ROMANIA

Reimbursable Advisory Services Agreement on Supporting the Ministry of European Investments and Projects in Assessing the Use of European Structural and Investment Funds (ESIF) in the Energy Sector in Romania (P174407)

Output 2

Interim evaluation report of selected fully implemented ESIF funded projects, and recommendations on the implementation of the 2014-2020 and design of the 2021-2027 LIOP programming periods

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MINISTERUL INVESTIŢIILOR ŞI PROIECTELOR EUROPENE

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Abbreviations

ANRE	National Energy Regulator
bcm	billion cubic meters
CBA	cost-benefit analysis
CHP	combined heat and power
DH	district heating
DSO	distribution system operator
ESIF	European Structural and Investment Funds
ERDF	European Regional Development Fund
EC	European Commission
EE	energy efficiency
EQ	evaluation question
ESCO	energy service company
EU	European Union
GHG	greenhouse gas
IHP	independent heat producer
INS	National Institute of Statistics
kgoe	kilograms of oil equivalent
LIOP	Large Infrastructure Operational Program
LNG	liquefied natural gas
MA	Managing Authority
MDPWA	Ministry of Development, Public Works and Administration
MEWF	Ministry of Environment, Waters and Forests
MIEP	Ministry of Investments and European Projects
MoE	Ministry of Energy
MW	megawatt
MWe	megawatt electric
MWh	megawatt-hour
MWt	megawatt thermal
mtoe	million tonnes of oil equivalent
NECP	National Energy and Climate Plan
NRRP	National Recovery and Resilience Plan
NTS	National Transmission System
ohl	overhead line
OP	Operational Program
PA	Priority Axis
PCI	Project of Common Interest (EU)
PEST	Political, Economic, Sociological, Technological
PM_{10}	particulate matter less than 10 micrometers in diameter
PV	photovoltaic

RES	renewable energy sources
ROP	Regional Operational Program
RID	Regional Infrastructure Directorate
SAIDI	System Average Interruption Duration Index
SMART	specific, measurable, achievable, relevant, and timebound
SO	Specific Objective
SOE	state-owned enterprises
SOP	Sectoral Operational Program
SWOT	strengths, weaknesses, opportunities, and threats
TBP	Trans-Balkan Pipeline
tCO2e	tonnes CO_2 equivalent
ToC	theory of change
TSO	transmission system operator

Executive Summary

1. The evaluation report covers the energy components of the Large Infrastructure Operational Program (LIOP) for 2014–20 (Axes 6, 7 and 8). An overview of the OP's development and implementation by February 2021 in the broader context indicated the following:

- Though the types of interventions are similar to other OPs in Central and Eastern European (CEE) countries, the main difference consists of the place of the OP within the broader national strategic framework for the energy sector. Poland and Lithuania use the Infrastructure OPs as instruments to support the goals of national policies, fully embedding European Union (EU) financial assistance into national policy and budgeting processes and leveraging EU funds to assist the governments in reaching national targets on climate, renewables, energy efficiency and interconnectivity. By contrast, Romania's LIOP compensates for the absence of national strategies by providing the broad directions for several policies and interventions to reach Romania's committed targets on the same policy goals. The conceptual difference is fundamental and leads to key differences in the level of progress in implementation (outputs) and sustainability (outcomes); the latter can be observed at this stage mainly in the capacity to leverage EU funds and scale up EU-funded interventions to achieve much broader impact with the limited funding. It also affects the capacity to prepare, monitor and report the key output and outcome indicators for the program, which is crucially limited by available data. If there is no national policy (e.g. energy strategy, district heating strategy and action plans), there are no mechanisms set in place to collect data and report indicators measuring the efficiency and efficacy of policy instruments by various institutions, such as the energy regulator (ANRE), the Ministry of Energy (MoE), the National Statistics Institute, etc. Institutional fragmentation (e.g. multiple entities at the central and local levels dealing with district heating, or different ministries dealing with energy vs energy efficiency in buildings) also affects the capacity to optimize programming. Thus, while the Polish and Lithuanian OPs couple energy efficiency in buildings with district heating and measures targeting renewable energy sources (RES) in the same OP (which facilitates the application and prioritization of projects by the beneficiaries), in Romania the measures are split into two different OPs, LIOP and the Regional Operational Program (ROP), with little coordination.
- For the energy components of Romania's LIOP, the level of implementation is low, with few projects finalized so far (mainly 15 smaller-scale measures such as industrial smart metering on SO 6.2 and one project on SO 7.1). This was also the experience in the previous financial cycle (2007–13), where implementation was concentrated in the last 2-3 years of funding eligibility. While some lessons were learned from the previous set of OPs and led to improvements, other factors observed in the previous cycle continue to affect the preparation and implementation of projects, as summarized in Chapter 1. Thus, interventions in LIOP refined the measures in Sectoral Operational Program (SOP) Competitiveness 2007–13 (e.g. refocusing support for increased RES in narrowed-down areas that were less attractive under SOP Competitiveness or other forms of state aid schemes, such as green certificates, smart metering for households, industrial cogeneration, and interconnectivity); and continued interventions in SOP Environment

(district heating support in seven cities, extended also to Bucharest). The implementation structure was also strengthened in the legal framework for the LIOP, with beneficiaries consistently acknowledging the smoother day-to-day relationship with counterparts in the management of the OP. However, some long-term issues continue to lead to significant delays in contracting and implementation. These consist of: low evaluation capacity at MA; low capacity on the interpretation of state aid (Competition Council) for the preparation of support schemes for each SO, including for large-scale infrastructure projects managed by local authorities or state-owned companies in natural monopoly sectors; and lack of unitary interpretations concerning expropriations and construction permits. Given the current status of the energy LIOP (with most projects under evaluation or contracting), we cannot assess the possible risks associated with project implementation, mostly procurement and monitoring / supervision of works.

- While the smaller projects covered by PA 6 are likely to be finalized by end-2023, the larger infrastructure projects on PAs 7 and 8 may exceed the deadline. One project (SO 7.2 – Bucharest DH) will probably have to be "phased" (some works finalized by 2023, after which financing would be sought in the 2021–27 financing cycle for the works remaining). SO 8.1 – Transelectrica's line and stations – may also be at risk for "phasing": currently, the procurement is ongoing and works are expected to take place over two years. Unexpected procurement issues that may arise (e.g. contestations) or works implementation delays could push the finalization of the project beyond the 2023 deadline. While "phasing" is a mechanism that avoids ineligibility of the expenditure on EU funds in the current cycle, it is a suboptimal use of available resources, as funds would have to be earmarked from the next budget for the finalization of projects from the current cycle. This limits the remaining available EU funds to be allocated for new projects.

2. The evaluation, which at this stage is mainly formative, is structured around 12 questions addressing the program's effectiveness, coherence, efficiency, impact, and sustainability. The same methodology will be used in the next evaluation. Due to the stage of implementation of LIOP energy as of February 2021, the extent to which some of the evaluation questions have been addressed (most importantly, cost-efficiency, impact, and sustainability) is limited, focusing mostly on expectations of what will happen by 2023. The current stage of the program is summarized in the following table. The evaluation covers the 36 projects for which a financing contract was signed by February 2021. Nine projects were selected for case studies which are presented in Annex D. They cover each SO – for SOs 6.1-6.4 and 7.1, the project closest to finalization or a representative project have been selected. Because SOs 7.2, 8.1 and 8.2 each consist of one project, these were analyzed as case studies.

Table ES 1. Current Status of the Large Infrastructure Operational Program in Romania

	Project title	***Beneficiary***	***MySmis Code***	***Status of physical implementation***	***Case study***
SO 6.1 – Increasing production of energy from renewable and less-exploited sources (biomass, biogas, geothermal)					
1.	Upgrading of the 20 kV overhead line (ohl) Axis Mofleşti - Melineşti and the 20 kV branch axis Fratostita and Pojaru, Dolj County to increase the distribution capacity for taking over the power delivered by the PV Power Plants	Distribuție Energie Oltenia S.A.	122825	partly implemented	
2.	Upgrading of the 20kV ohl Axis Parangu - Sadu 2B - Novaci and 20kV ohl Axis Carbunesti - Novaci, in order to increase the distribution capacity for taking over the power delivered by the Low Power Hydroelectric Power Plants in the N-E area of Gorj County	Distribuție Energie Oltenia S.A.	127410	recently started	
3.	Upgrading of transformer stations under the management of Delgaz Grid in order to take over the electricity produced from renewable sources in safe conditions of operation at SEN - Huși, Stănilești, Vetrișoaia, Fălciu, Murgeni stations	Delgaz Grid	127686	recently started	
4.	Upgrading of transformer stations of E.ON Distributie Romania S.A. - Strengthening works of the electrical network upstream of the connection point of the additional production capacities in order to take over the electricity produced from renewable resources in safe conditions of S.E.N. - Unit 110 / 20kV Hirlau, Unit 110 / 20kV Pascani, Unit 110 / 20kV Gorban	Delgaz Grid	105731	almost finalized	Yes
5.	Utilization of geothermal energy combined with heating pumps, to produce thermal agent for heating and hot water for Nufarul I Area, Oradea	Oradea Municipality	115839	recently started	Yes
6.	Increasing the production of thermal energy based on geothermal water in Beiuș	Beius Municipality	127641	recently started	
7.	Construction of the biomass thermal energy production unit and the thermal energy distribution network in Maieru	Maieru Village	119846	recently started	
8.	Increasing the production of energy from less exploited renewable resources obtained in the Salonta geothermal perimeter	Salonta Municipality	125691	recently started	
SO 6.2 – Reducing the energy consumption of industrial consumers					
9.	Implementation of a monitoring system of energy consumption (electricity, heat, compressed air) at the level of SC SORTILEMN SA	SORTILEMN SA	105740	finalized	
10.	Intelligent energy consumption monitoring system within Yazaki Component Technology Romania	Yazaki Component Technology S.R.L.	106581	finalized	
11.	Smart metering application for utility consumption and production	Vel Pitar S.A.	106965	finalized	Yes
12.	Intelligent energy consumption monitoring system within Antibiotice SA	Antibiotice S.A.	109717	finalized	

	Project title	Beneficiary	MySmis Code	Status of physical implementation	Case study
13.	Reducing energy consumption at the level of SC Zoppas SRL by implementing a high-performance monitoring system	Zoppas S.R.L.	111829	finalized	
14.	Implementation of an energy consumption monitoring system at AZUR S.A.	AZUR S.A.	116222	finalized	
15.	Smart Metering utility consumption application	COMELF S.A.	117803	finalized	
16.	Intelligent energy consumption monitoring system within CIECH Soda Romania S.A.	CIECH Soda Romania S.A.	117977	finalized	
17.	Development of energy consumption monitoring system at Hammerer Aluminum Industries Santana S.R.L.	Hammerer Aluminum Industries Santana	118591	finalized	
18.	Technical Solution Study - Energy Consumption Monitoring System	Infopress	118973	finalized	
19.	Implementation of advanced metering system with on-line monitoring to reduce energy consumption at Takata Romania SRL	Takata Romania SRL	120195	finalized	
20.	Intelligent energy consumption monitoring system within CEMACON SA	CEMACON SA	127985	finalized	
21.	Advanced metering system for reducing energy consumption at CELCO SA - Lime Factory	CELCO S.A.	128259	finalized	
22.	Implementation of energy consumption monitoring systems for industrial consumers	Heineken S.A.	128334	finalized	
23.	Energy consumption monitoring system within S.C. Meat Industrialization KOSAROM S.A.	KOSAROM S.A.	130415	finalized	
SO 6.3 – Reducing the average power consumption of households					
24.	Implementation of intelligent measurement system in Craiova, central area - partially and Sărari - approx. 10,000 consumers from Craiova	Distribuție Oltenia	114790	partly implemented	Yes
25.	Implementation of an intelligent distribution monitoring system in a homogeneous area of predominantly household electricity consumers	DELGAZ	117855	partly implemented	
SO 6.4 – Increasing savings of the consumption of primary energy produced by high-efficiency co-generation systems					
26.	Increasing the operational energy efficiency at SC AMBRO S.A. Suceava by implementing a high efficiency cogeneration installation	AMBRO S.A.	115900	finalized	Yes
27.	Optimization of primary energy consumption within CEMACON S.A. by installing a high efficiency cogeneration plant	CEMACON S.A.	119391	partly implemented	
SO 7.1 – Increasing the energy efficiency of DH systems in selected cities					
28.	Rehabilitation of the district heating system in Oradea for the period 2009-2028, to comply with environmental legislation and increase energy efficiency - Stage II	Oradea Municipality	108460	finalized	Yes
29.	Rehabilitation of the district heating system in Focșani Municipality for the period 2009 - 2028 to comply with environmental legislation and increase energy efficiency - Stage II	Focșani Municipality	114845	almost finalized	

	Project title	Beneficiary	MySmis Code	Status of physical implementation	Case study
30.	Rehabilitation of the district heating system in Iași Municipality to comply with the environmental standards on emissions and to increase the energy efficiency in the urban heat supply. Stage II	Iași Municipality	115253	almost finalized	
31.	Rehabilitation of the district heating system at the level of Râmnicu Vâlcea Municipality for the period 2009-2028 to comply with environmental legislation and increase energy efficiency - stage II	Râmnicu Vâlcea Municipality	118892	recently started	
32.	Rehabilitation of the district heating system in Oradea for the period 2009 - 2028 to comply with environmental legislation and increase energy efficiency - Stage III	Oradea Municipality	123600	recently signed	
33.	Re-engineering of the centralized district heating system in the Municipality of Timișoara to comply with environmental protection regulations on air pollutant emissions and to increase efficiency in urban heat supply Stage II	Timișoara Municipality	127006	partly implemented	
SO 7.2 – Increasing the energy efficiency of the district heating system in Bucharest					
34.	Rehabilitation of the heating system of Bucharest Municipality	Bucharest Municipality	138142	recently signed	Yes
SO 8.1 – Increasing the capacity of the national energy system to use energy produced from renewable resources					
35.	LEA 400 KV d.c. Gutinas-Smardan	Transelectrica	129245	recently started	Yes
SO 8.2 – Increasing the interconnection capacity of the National Transmission System of natural as with other neighboring countries					
36.	Developments of NTS in the North-East area of Romania to improve the natural gas supply of the area as well as to ensure the transmission capacities to the Republic of Moldova	Transgaz	122972	partly implemented	Yes

Key Findings and Recommendations

3. The key findings and recommendations from the evaluation, structured by evaluation criteria, are summarized below.

Effectiveness

Conclusion:

4. The LIOP interventions are expected to lead to the desired change by end-2023. This is despite low implementation to date, which has resulted in the currently low levels of output indicators (and in consequence also low levels of outcomes). In general, the LIOP interventions were more progressive and ambitious than other support schemes in order to further Romania’s committed targets on energy efficiency, RES, modernization of grids (electricity, gas, DH) and interconnectivity; they also provided a better structure for such interventions in the absence of an energy strategy. However, the DH

interventions may have been sub-optimally designed, focusing on generation in 2007-2013 and on transport and distribution grids in the current LIOP, without proper correlation with demand (no interventions such as energy efficiency in buildings). Broader economic, demographic, and legislative factors affect the expected results of the interventions, e.g. legislative changes which limit the appetite of investors to scale up with commercial funding interventions supported by the LIOP or the changing patterns of energy supply and demand.

Recommendation:

5. The interventions may be continued in the next cycle provided they are 1) stronger embedded in national policy and budget processes (including clarification of responsible authorities for each policy, energy, DH, energy efficiency); and 2) at more ambitious technical standards, to match technological developments. Implementation delays for large projects, such as those caused by diverging interpretations of permitting or expropriation legislation for infrastructure (requiring multiple approvals from different jurisdictions), could be overcome by meetings/roundtables with all the authorities in charge with such authorizations for each project.

Coherence

Conclusion:

6. LIOP interventions substituted to a certain extent for the absence of an energy strategy, "stabilizing" longer-term policy measures to meet targets on energy efficiency, RES, interconnectivity, and emissions to which Romania committed to the EU. However, this is not a viable solution. The lack of a strategic vision (and hence of political will backing public sector investments and general reforms in the energy sector) is one of the structural causes for delays in implementation, poor selection of outcome indicators, and limited scale-up of smaller interventions with a demonstrative role (SOs 6.1-6.4). The Polish and Lithuanian examples illustrate how the OP should be integrated within the country's own policy and budgeting processes as a financing instrument supporting national policies and leveraging EU funds with national budgets and commercial funding.

Recommendation:

7. Strategic planning must be strengthened in the Ministry of Energy to ensure that the OP is an instrument to support the implementation of the strategy. This requires a full streamlining of the OP in the national strategy and budgeting processes.

Efficiency

Conclusion:

8. The LIOP administrative structure has improved compared to the 2007-2013 cycle, though several weaknesses remain: poor project evaluation capacity, limited understanding of EU state aid rules, and, possibly, public procurement and works supervision for large works (which would become visible only when large infrastructure projects such as electricity lines, gas pipelines and compressors, and DH grid projects begin physical implementation). For some SOs (e.g. SOs 6.1, 6.2, 6.3, 7.1), the capacity and appetite of beneficiaries may be limited.

Recommendation:

9. The major bottlenecks could be overcome through training in weak areas (evaluation; public procurement by public sector beneficiaries); and knowledge sharing between current and prospective beneficiaries.

Impact

Conclusion:

10. There are two separate matters of importance concerning the program's impact (which at this point can only be estimated for 2023, given the current implementation level): First, some of the outcome indicators (notably energy savings from smart metering for households and losses in DH systems) are poorly designed, given the lack of data for more adequate indicators to capture the effect of the interventions. Second, as highlighted above, the impact will be much more limited because there is no integration of the OP within broader national strategies and budgets. In particular, the SOs 6.1-6.4 consist of small pilots or demonstrative projects that, while having limited direct impact, are needed to identify the costs, benefits and scale-up potential for measures such as smart metering (industrial and households), RES, and small-scale industrial cogeneration. The absence of correlation between interventions in DH, RES and energy efficiency in buildings does not stimulate integrated projects to optimize interventions.

Recommendation:

11. Improving the impact cannot be decoupled from enhanced strategic planning in the Ministry of Energy to ensure that the OP is an instrument to support the implementation of the strategy. This requires a full streamlining of the OP in the national strategy and budgeting processes.

Sustainability

Conclusion:

12. Currently, with few projects finalized, the sustainability can only be assessed in terms of beneficiaries' expectations and provisions for maintenance for the investments after they are put in operation. For all infrastructure projects, maintenance will be recovered from regulated tariffs for electricity, gas and DH grids. The major challenge will be to ensure sustainability for projects at risk of slipping beyond the 2023 deadline (7.2, possibly 8.1). In particular in DH, there is no commitment for the support of the sector at government level, given the institutional fragmentation. Thus, there is a risk that significant funds are allocated to DH systems which might not remain viable in the future (e.g. disconnections continue beyond a tipping point from which the DH system can no longer be efficient; disconnections are more likely to accelerate in projects that are delayed and the quality of the service continues to degrade, e.g. Bucharest DH). This potential is also acknowledged by the EC (e.g. it required an institutional assessment done by Jaspers to ensure that Bucharest DH can remain viable, and the report remained inconclusive given frequent policy changes in the Bucharest municipality).

Recommendation:

13. When analyzing whether funding should be continued in the next cycle, a clear policy commitment should be in place – ideally accompanied by strong strategies with clear action plans. As above, the sustainability can be ensured only if the OP is constructed as an instrument to implement the broader energy strategy of Romania.

14. The report is structured as follows. The first chapter covers the broader context of the evaluation, including lessons learned from the previous cycle (2007-2013) and summarizes the object of evaluation and the theory of change on which the evaluation is based. Chapter 2 provides an overview of the methodology of the evaluation. Chapter 3 covers the main analysis undertaken on the 36 projects covered by this report, structured around the 12 evaluation questions. Chapter 4 summarizes the lessons learned from the relevant infrastructure OPs in Poland and Lithuania. Conclusions and recommendations are detailed in Chapter 5.

1. Evaluation Context

1.1. Object of the evaluation: overview of LIOP Energy

15. The three energy axes of LIOP (6, 7, 8) cover four categories of interventions, each with reference to one or more Specific Objectives (SOs):

   a. **Energy efficiency** through smart metering of energy consumption at the industrial level (SO 6.2), smart metering in households (SO 6.3), and small industrial co-generation systems (6.4);
   b. **Lower emissions** through less-exploited renewable sources (SO 6.1), which covers production of RES (geothermal) and investments in distribution grids;
   c. **Energy efficiency** at the level of district heating systems of selected cities (SOs 7.1 and 7.2); and
   d. **Smart and sustainable transmission grids** for electricity (SO 8.1) and natural gas (SO 8.2).

16. Table 1.1 summarizes the implementation status as of January 31, 2021.

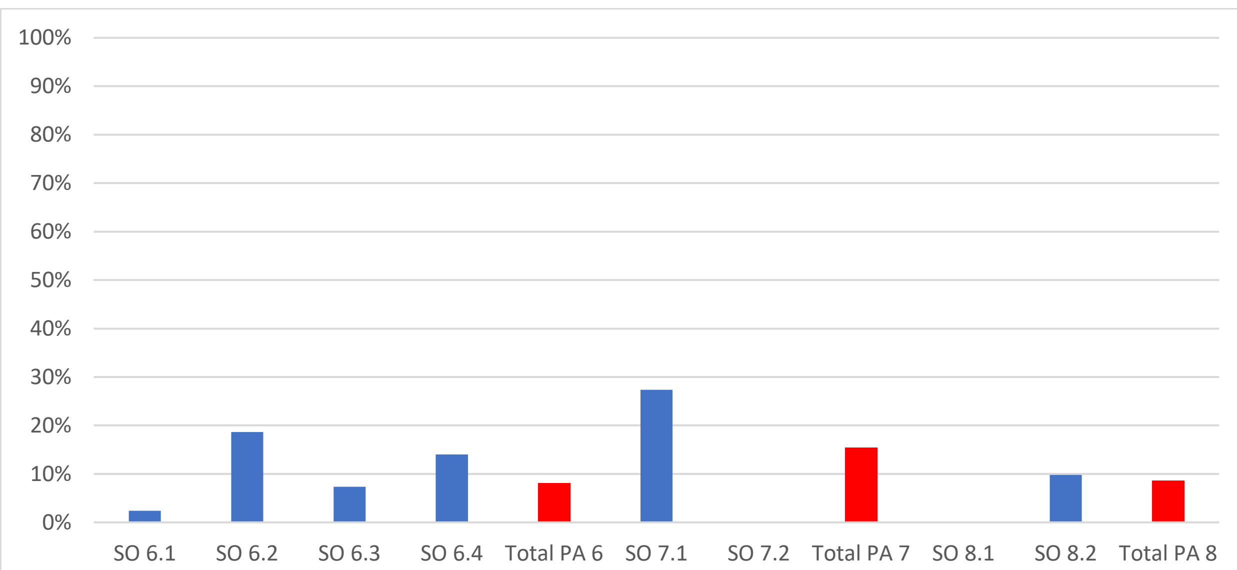
Table 1.1. LIOP implementation status as of January 31, 2021

		Implementation details (cutoff date January 31, 2021)					
Specific Objective	*Latest allocation (€ mn)*	*Projects submitted*	*Rejected*	*Under evaluation*	*Approved*	*Contracted*	*Implementation status*
• Priority Axis 6: Clean energy and energy efficiency in order to support a low-carbon economy • 88.3% contracting rate (1); 4.42% finalization rate (2)							
SO 6.1: Increasing production of energy from renewable and less-exploited (biomass, biogas, geothermal)	27.6 (EU 23.5)	Projects for renewable energy sources (RES) capacities: 45 (high competition, over 7.7 times the allocated amount)	11	28	6	4	4 under implementation, 93% contracting rate
	18.4 (EU 15.6)	Projects for distribution to integrate RES capacities: 17 (2.2 times the total allocation)	2	11	4	4	4 under implementation; 62% contracting rate
SO 6.2: Reducing energy consumption at industrial consumers	11.8 (EU 10)	66 (equals total allocation)	10	36	20	15	12 finalized, 3 under implementation; 23% contracting rate; 79% finalization rate
SO 6.3: Reducing the average power consumption of households	38.1 (EU 32.4)	16 (competitive, 3.9 times allocated amount)	1	13	2	2	1 finalized, 1 under implementation; 25% contracting rate
SO 6.4: Increasing savings of the consumption of primary energy produced by high efficiency co-generation systems	28.2 (EU 24)	15 (1.6 times total allocation)	0	12	3	2	2 under implementation; 21% contracting rate

• Priority Axis 7: Energy efficiency at system level centralized heating in selected cities • 43% contracting rate (1); 0% finalization rate (2)							
SO 7.1: Increasing energy efficiency for DH systems in selected cities	151.3 (EU 128.6)	11 (not competitive, 7 cities defined at programming stage; one city submitted 2 projects); equals total allocation	2	3	6	6	1 finalized; 5 in implementation. 18% finalization rate; 76% contracting rate
SO 7.2. Increasing energy efficiency of district heating system in Bucharest	117.6 (EU 100)	1 (not competitive); 189% of total allocation	0	0	1	1	231% contracting rate
Priority Axis 8: Intelligent and sustainable transmission systems for electricity and natural gas 39.25% contracting rate (1); 0% finalization rate (2)							
SO 8.1: Increasing the capacity of the national energy system to use energy produced from renewable resources	23.5 (EU 20)	1 (not competitive); 123% of total allocation	0	0	1	1	1 in implementation; 133% contracting rate
SO 8.2. Increasing interconnection capacity of National Transmission System of natural gas with other neighboring countries	169.3 (EU 143.9)	250, o/w 1 non-competitive and 249 competitive, extension of distribution networks; 2x total allocation	14	10	1	1	1 in implementation; 26% contracting rate

Note: (1) *contracting rate*: value of contracts signed / total allocation; (2) *finalization rate*: value of contracts completed / value of contracts signed.

Figure 1. Effective absorption rate, February 2021 (reimbursements / allocation)



Source: MA internal reporting

17. The energy-related LIOP projects covered by this evaluation are presented in Table 1.2.

Table 1.2. Energy-related LIOP projects

	Project title	*Beneficiary*	*SMIS*
SO 6.1 – Increasing production of energy from renewable and less-exploited sources (biomass, biogas, geothermal)			
1.	Upgrading of the 20 kV overhead line (OHL) Mofleşti – Melineşti and the 20 kV branch axis Fratostita and Pojaru, Dolj County to increase the distribution capacity for taking over the power delivered by the photovoltaic power plants	Distribuție Energie Oltenia S.A.	122825
2.	Upgrading of the 20kV OHL Axes Parangu – Sadu and 2B – Novaci and of the 20kV OHL Axis Carbunesti – Novaci, in order to increase the distribution capacity for taking over the power delivered by the Low Power Hydroelectric Power Plants in the N-E area of Gorj County	Distribuție Energie Oltenia S.A.	127410
3.	Upgrading of transformer stations under the management of Delgaz Grid in order to take over the electricity produced from renewable sources in safe conditions of operation at SEN – Huși, Stănilești, Vetrișoaia, Fălciu, Murgeni stations	Delgaz Grid	127686
4.	Upgrading of transformer stations of E.ON Distributie Romania S.A. – building additional capacity into the electrical network upstream of the connection point so it can handle the electricity produced from renewable resources in safe conditions of S.E.N. – Unit 110 / 20kV Hirlau, Unit 110 / 20kV Pascani, Unit 110 / 20kV Gorban	Delgaz Grid	105731
5.	Combining geothermal energy with heating pumps to produce thermal agent for heating and hot water for Nufarul I Area, Oradea	Oradea Municipality	115839
6.	Increasing the production of thermal energy based on geothermal water in Beiuș	Beius Municipality	127641
7.	Construction of the biomass thermal energy production unit and the thermal energy distribution network in Maieru	Maieru Village	119846
8.	Increasing the production of energy from less exploited renewable resources obtained in the Salonta geothermal perimeter	Salonta Municipality	125691
SO 6.2 – Reducing energy consumption at industrial consumers			
9.	Implementation of a system for monitoring energy consumption (electricity, heat, compressed air) at the level of SC Sortilemn SA	SORTILEMN SA	105740
10.	Intelligent energy consumption monitoring system within Yazaki Component Technology Romania	Yazaki Component Technology S.R.L.	106581
11.	Smart metering application for utility consumption and production	Vel Pitar S.A.	106965
12.	Intelligent energy consumption monitoring system within Antibiotice SA	Antibiotice S.A.	109717
13.	Reducing energy consumption at the level of SC Zoppas SRL by implementing a high-performance monitoring system	Zoppas S.R.L.	111829
14.	Implementation of an energy consumption monitoring system at AZUR S.A.	AZUR S.A.	116222
15.	Smart metering utility consumption application	COMELF S.A.	117803
16.	Intelligent energy consumption monitoring system within CIECH Soda Romania S.A.	CIECH Soda Romania S.A.	117977
17.	Development of the energy consumption monitoring system at Hammerer Aluminum Industries Santana S.R.L.	Hammerer Aluminum Industries Santana S.R.L.	118591
18.	Technical solution study – energy consumption monitoring system	Infopress	118973
19.	Implementation of advanced metering system with on-line monitoring to reduce energy consumption at Takata Romania SRL	Takata Romania SRL	120195
20.	Intelligent energy consumption monitoring system within CEMACON SA	CEMACON SA	127985
21.	Advanced metering system for reducing energy consumption at CELCO SA – Lime Factory	CELCO S.A.	128259
22.	Implementation of energy consumption monitoring systems for industrial consumers	Heineken S.A.	128334

23.	Energy consumption monitoring system within S.C. Meat Industrialization KOSAROM S.A.	KOSAROM S.A.	130415
SO 6.3 – Reducing average power consumption of households			
24.	Implementation of intelligent measurement system in Craiova, central area (partially) and Sărari (approx. 10,000 consumers from Craiova)	Distribuție Oltenia	114790
25.	Implementation of an intelligent distribution monitoring system in a homogeneous area of predominantly household electricity consumers	DELGAZ	117855
SO 6.4 – Increasing savings of the consumption of primary energy produced by high-efficiency co-generation systems			
26.	Increasing the operational energy efficiency at SC AMBRO S.A. Suceava by implementing a high efficiency cogeneration installation	AMBRO S.A.	115900
27.	Optimization of primary energy consumption within CEMACON S.A. by installing a high efficiency cogeneration plant	CEMACON S.A.	119391
SO 7.1 – Increasing energy efficiency for DH systems in selected cities			
28.	Rehabilitation of the district heating system in Oradea for the period 2009-2028, to comply with environmental legislation and increase energy efficiency – Stage II	Oradea Municipality	108460
29.	Rehabilitation of the district heating system in Focșani Municipality for the period 2009–28 to comply with environmental legislation and increase energy efficiency – Stage II	Focșani Municipality	114845
30.	Rehabilitation of the district heating system in Iași Municipality to comply with environmental standards regarding the emissions in the atmosphere and to increase the energy efficiency in the urban heat supply – Stage II	Iași Municipality	115253
31.	Rehabilitation of the district heating system at the level of Râmnicu Vâlcea Municipality for the period 2009-28 to comply with environmental legislation and increase energy efficiency – Stage II	Râmnicu Vâlcea Municipality	118892
32.	Rehabilitation of the district heating system in Oradea for the period 2009–28 to comply with environmental legislation and increase energy efficiency – Stage III	Oradea Municipality	123600
33.	Re-engineering of the centralized district heating system in the Municipality of Timișoara to comply with environmental protection regulations on air pollutant emissions and to increase efficiency in urban heat supply – Stage II	Timișoara Municipality	127006
SO 7.2 – Increasing energy efficiency of district heating system in Bucharest			
34.	Rehabilitation of the heating system of Bucharest Municipality	Bucharest Municipality	138142
SO 8.1 – Increasing the capacity of the national energy system to use energy produced from renewable resources			
35.	LEA 400 KV d.c. Gutinas-Smardan	Transelectrica	129245
SO 8.2 – Increasing interconnection capacity of National Transmission System of natural gas (NTS) with other neighboring countries			
36.	Developments of NTS in the North-East area of Romania to improve the natural gas supply of the area as well as to ensure the transmission capacities to the Republic of Moldova	Transgaz	122972

1.2. Context: background to the LIOP energy interventions

18. Romania's energy policy has in recent years lacked a clear direction, with numerous ad hoc changes and frequent legal and regulatory amendments. The latest approved strategy is from 2007, though there were numerous attempts to formulate a new strategy, in particular from 2016 onwards. Changes in government and in institutional setup (such as ministries' structure and responsibilities), as

well as the absence of a political majority in the electoral year 2020 (overlapping with the pandemic), have led to substantial amendments to the draft strategy.

19. This has contributed to uncertainties for investments in the energy sector, affecting both private and public companies. There have been virtually no finalized investments in electricity generation capacities since late 2016, when new investments became ineligible for support schemes adopted previously (RES green certificates scheme of 2009–12; cogeneration bonus of 2009–11). At the same time, large coal-fired plants (CE Oltenia, CE Hunedoara) committed to an accelerated phase-out of significant capacities by 2026–30 (at least 2500 MW) and replacement with cleaner generation (renewables and gas as a transition fuel). If these plans – which have been submitted to the European Commission (EC) – are not implemented and new investments fail to compensate for the closure of obsolete, environmentally damaging capacities, Romania may soon face an electricity generation shortfall.

20. Profitable state-owned companies have been required to contribute 90 percent of their profits as dividends – which were much needed to cover fiscal deficits, but also limited the profits that could have been reinvested. Major investment projects in the 10-year network development plans of Transelectrica and Transgaz were delayed, as well as investments in state-owned generation (Romgaz' new 430 MW gas-fired capacity at Iernut). However, the finalization in late 2020 of new gas and electricity cross-border interconnection capacities may signal a recent improvement in the capacity to operationalize large investments and a new sense of urgency.

21. There is insufficient ownership of district heating aspects within the Government, where responsibilities are unclearly split between the MoE, the Ministry of Development, Public Works and Administration (MDPWA), the energy regulator (ANRE), and local authorities. Major constraints affecting development of energy capacities exist in the areas of project planning, preparation of technical documentation, expropriations, permitting (central and local), procurement, and execution of works or availability of supplies. The legal framework in the energy sector (electricity, gas, heating) needs alignment with the latest European Union (EU) energy directives and regulations to ensure maximization of benefits from liberalization; to facilitate trading of gas, electricity and heating, and to create a sound regulatory environment for market-driven energy-efficiency measures (including services such as industrial and residential energy service companies or ESCOs).

22. Access to energy for vulnerable consumers remains a challenge. The legal framework supporting identification of types, location and number of vulnerable consumers, as well as the operationalization for targeted financial and non-financial assistance, is not yet in place.

23. These shortcomings and challenges in the Romanian energy sector feature prominently in European Union policy documents and recommendations; as well as in Romania's commitments and strategic documents prepared in response to the EU's concerns.

- The EC's latest (2020) Council Recommendation for Romania[1] highlights several priorities including basic household access to energy; the urgent need to relaunch public infrastructure works, including energy; and clean production and use of energy. These need to be addressed in Romania's National Energy and Climate Plan (NECP), though the latest draft (January 2021) still does not address some of the EC recommendations. Also, investments in clean and efficient production and use of energy and environmental infrastructure, including in the coal regions, are highlighted as priorities for 2020 and 2021. These are in line with previous Council Recommendations.
- The 2020 National Reform Program[2] contains extensive recommendations to (i) improve the functioning of energy markets (including by full adoption of EU rules); (ii) reform state-owned energy companies (corporate governance); (iii) restructure district heating through a government-financed program that complements existing funding (including EU); and (iv) support energy-storage projects with research. The Program also summarizes existing initiatives that are funded from the central budget (e.g. the Environment Fund and state budget).
- The draft NECP proposes more-ambitious 2030 targets than previously envisaged for renewables, energy efficiency (industrial and households), and energy access. In the absence of an approved energy strategy and given the new Commission's focus on the European Green Deal[3], the NECP will be the overarching strategic document to guide energy sector priorities for 2020–30.
- Romania has also recently prepared a National Recovery and Resilience Plan (NRRP) in the context of the EU's NextGenerationEU plan to emerge stronger and greener after the pandemic. The preliminary version will be negotiated in May 2021 in Brussels. The draft energy chapter includes reforms concerning the finalization and adoption of the NECP, the legal transposition of EU Directive 944 and Regulation 943 (electricity market), and the consolidation of the legal framework to facilitate investments and (partial) coal phase-out. Investments include electricity storage (batteries), hydrogen, renewables (particularly decentralized capacities for underserved regions), digitalization, and greening investments in the coal regions. The revised energy chapter does not, however, address some of the criticisms from national stakeholders, such as a clear target for coal phase-out or support for modernized heating/cooling systems integrating renewables. Some of the projects proposed for investments might well exceed the 2026 deadline since they are not mature enough (e.g. smart grids), while others would face significant challenges to meet EU's legal criteria for state aid.

24. In this context, Romania's energy policy is de facto driven mainly by EU commitments; and OPs in 2007–13 and 2014–20 contributed to steering some interventions towards more ambitious decarbonization and modernization, ahead of the national policies and strategies. OPs also "stabilized"

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[1] European Commission, *Council Recommendation on the 2020 National Reform Program of Romania, with a Council opinion on the 2020 Convergence Program of Romania*, May 20, 2020: https://ec.europa.eu/info/sites/info/files/2020-european-semester-csr-comm-recommendation-romania_en.pdf.

[2] Government of Romania, *National Reform Program 2020*, https://sgg.gov.ro/new/wp-content/uploads/2020/05/ANEXA-5.pdf.

[3] https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en

certain measures as part of the EU's 7-year cycles despite the frequent changes in legal and regulatory framework. SOP Competitiveness 2007–2013[4] covered interventions in renewable capacities and energy efficiency and SOP Environment supported investment prioritization in DH, while the Large Infrastructure Operational Program (LIOP) 2014–20 enhanced the interventions supported in the previous cycle with increased technical standards for interventions. Thus, SOP Competitiveness supported investments in renewable energy sources (RES); cross-border interconnections of electricity and gas grids; support for energy efficiency equipment for industry; modernization of transport and distribution grids; and desulphuration of energy generation. SOP Environment 2007–13 supported the DH sector in 7 cities. The correspondence between the interventions in the previous programming period and LIOP interventions is summarized in the table below. Several lessons learned from the previous cycle informed the programming of LIOP; whereas other issues causing delays in implementation persist:

- During the programming of the two OPs for 2007–13 and 2014-20, the SOs were more broadly defined to include more possible areas of support, e.g. investments in any part of the grid infrastructure provided it contributed to energy efficiency, increased RES capacity, or interconnectivity. This allowed for more flexibility and identification of areas which lag behind for support in the current cycle under LIOP. For example, if the energy efficiency in industry intervention in Operational Program (OP) Competitiveness highlighted companies' lack of interest in projects with energy efficiency as the primary benefit (preferring productive investments), LIOP concentrates on the need to raise awareness and interest among beneficiaries for the optimization of their energy consumption (supporting smart metering). Some areas supported in OP Competitiveness indicated the beneficiaries' reluctance to invest in projects that face more administrative constraints (e.g. permitting and expropriation); in response, LIOP Axes 7 and 8 focus on a set of predetermined projects, with a view to allowing them time to prepare and plan better to overcome such difficulties over the program period (though the success is only partial, e.g. the same delays are observed in SO 8.1)
- The implementation of Sectoral Operational Programs (SOPs) Competitiveness and Environment also incurred delays and was concentrated in the latter part of the programming period – with some projects "phased", other not finished, and even some cancellations. Most delays happened because of difficulties in interpreting state aid; procurement problems; and changes in the legal framework that affected the viability of some of the projects or the motivation of the beneficiaries (e.g. changes to the support for renewables in the green certificates scheme caused projects to arbitrate between the forms of state aid, seeking the more advantageous option). These constraints have not been resolved and will continue to affect LIOP, where the implementation is again concentrated in the last three years of the program, 2021–23.
- Interventions supported in 2007–13 continued to be relevant in the current programming period; however, the standards were increased, focusing on targeted and rather ambitious measures –

[4] Available in Romanian at https://www.fonduri-ue.ro/images/files/programe/COMPETITIVITATE/POSCCE/2018/Raport_Final_de_Implementare_POS_CCE_2007-2013-revizuit_1.pdf.

with substantial benefits expected in terms of contributions to energy efficiency, RES, and interconnectivity that could then be scaled up.

Table 1.4. Comparison between OP 2007-13 and OP 2014-20

2007–13 OP	*2007–13 measures*	*Results*	*LIOP 2014–20 SO*	*Lessons learned in previous OP*
Competitive-ness	4.1.1. EE in industry	Good progress, 83% finalization, 67 projects	6.2, 6.4 - continued investments, narrowed to smart metering and small cogeneration	Little interest for EE, preference for productive investments; needed measures to raise awareness of EE benefits
	4.1.2. Modernization of energy grids	Relatively broad coverage (transport, distribution, gas, electricity), 92.5% finalization, 37 projects	6.1, 6.3, 8.1, 8.2 - narrowed down interventions on more specific areas	Beneficiary preference for stations (because of land expropriation issues), both for distribution and transport; SCADA for gas transport; extension of gas distribution networks. State aid interpretations
	4.1.3. Desulphuration energy capacities	One project, 100% finalized (12 projects submitted)	No longer supported	Desulphuration interventions completed; no need for further support (other generation support is difficult for state aid reasons)
	4.2.1. RES capacity	472 projects submitted, 89 contracted, 53 finalized (59% finalization rate)	6.1 - generation limited to geothermal; distribution	Many contracts cancelled because of changes in green certificates scheme; delays in procurement, difficulties in cofinancing
	4.3.1. Interconnections electricity & gas	Competitive projects for Transelectrica and Transgaz. One project contracted and then cancelled.	8.1, 8.2 - predetermined projects	Delays caused by change of state aid rules; the approach in 2014–20 with preselected projects focused preparation on mature projects
Environment	Axis 3. Support for DH in 7 cities	Good progress - preparation of TORs and technical specifications, investments to reduce emissions (generation, transport)	7.1 - investments based on DH technical documentation prepared in SOP Environment; 7.2 extended to Bucharest	Work contracts signed only in 2014 (prior to 2014, only consultancies and TA). Delays in absorption caused by procurement, approval of tariff increases, and insolvent contractors. A major finding is that losses in networks are substantial and need investments.

1.3. LIOP Theory of Change

25. The Large Infrastructure Operational Program (LIOP) theory of change (ToC), illustrated in Annex A, was reconstructed based on the analysis carried out for evaluation. Table 1.3 summarizes the three main elements of the ToC as identified in the Inception Report: challenges, needs, and strategy.

Table 1.3. The LIOP Theory of Change

Challenges The main features of the national context and the main challenges concerning LIOP interventions in energy	The following challenges were identified in the LIOP programming phase: • Absence of an up-to-date energy strategy, which constrains the capacity to prioritize actions to reach EU 2020 targets on energy and climate (the target most at risk is on energy efficiency). • Limited appetite for the development of renewable capacities or energy-efficient generation in certain technologies (e.g., biomass and industrial co-generation), based on existing support mechanisms. • Limited capacity of the electricity transmission and distribution networks to integrate renewable sources and allow for adjustments in demand (such as may occur through smart distribution); limited rollout of smart metering for household electricity. • Delays in implementing well-functioning energy markets and interconnectivity of the gas system. • Poor performance of DH systems (high network losses). Most of these challenges remain relevant to date. Additional challenges that are increasingly prominent in recent energy policy debates include: • Vulnerable consumers (poor and/or substantially affected by energy-supply unavailability) and access to energy supply (e.g., household access to gas in rural areas); • Prosumers (households that can produce and deliver renewable electricity to the grid)—requiring the acceleration of smart metering and smart grids and accelerated modernization of electricity distribution; • Electromobility—requiring modernization of electricity distribution in cities. Furthermore, the EU Energy Package and the more ambitious new European Green Deal will require accelerated efforts for decarbonization in Romania – for example, conversion from coal to gas; new renewable energy sources (RES) such as offshore wind; hydrogen development; and faster integration of RES in electricity grids.
Needs The main structural reform needs highlighted in the context of the LIOP in relation with the energy interventions	The following key structural reform needs were identified; they appear to remain relevant to varying degrees: • Strengthened corporate governance of energy SOEs (the National Reform Programs of 2014–2020 indicate weaknesses in implementing the relevant legislation, including for energy SOEs) and increased independence and capacity of the energy regulator ANRE. While some advancements were made in this sense (especially for some SOEs and ANRE), corporate governance reforms remain necessary for certain SOEs (e.g. Oltenia, DH companies) to ensure adequate performances to meet the country's envisaged objectives. • Continued energy market liberalization, particularly for gas and electricity, as highlighted in the LIOP ex-ante evaluation. This remains relevant to date, despite progress: delays in implementation of successive EU Energy Packages (Third and Clean Energy packages) limit the appetite for market-driven investments in RES, co-generation, etc. It also hampers development of energy-efficiency measures at the consumer level. Prioritization of investments in infrastructure

	(transmission and distribution networks for electricity, gas, and heating) is needed to ensure adequate access to the energy markets to producers and consumers. • Adoption of an energy strategy correlated with a climate strategy. When the LIOP was being prepared, the two strategies needed only to be consistent. But in 2020, new EU rules introduced a more stringent condition to prepare an integrated National Energy and Climate Plan (NECP). Romania submitted the final version of the NECP to the European Commission in January 2021 and it is currently under review.
Strategy The strategic approach proposed by LIOP for energy interventions in terms of SOs, eligible activities, eligible beneficiaries, target groups, and target areas	The energy interventions in LIOP focused on areas where support mechanisms and energy markets existing at the program design stage proved insufficient to foster investments (for example, less-developed RES, energy efficiency, industrial co-generation, smart metering, and so on). Although a strategy to develop these areas was not well defined, their inclusion in the LIOP compensated to a certain extent by providing a strategic framework for intervention. But the effect instead has been LIOP financing spread too thin—small amounts distributed across multiple intervention areas, mainly for pilots and demonstration projects for OS 6.1-6.4; projects which cover only portions of total investment plans of DH networks in SO 7.1-7.2.
Factors which influenced the LIOP energy interventions	• *Economic*: Economic growth after 2013 has increased demands for energy, both for households and industry, making energy a priority sector. Since the market and business environments were not yet sufficiently developed to stimulate investments in the energy sector, targeted state interventions were still required. • *Demographic and geographic*: Changes in energy-demand patterns (heating for households; electricity and gas consumption in industry) were not matched by current supply patterns (and to a certain extent, they are still not today). The electricity, gas, and heating networks are obsolete, while fossil-fueled generation has not kept pace with regional shifts in demand or with changes in electricity consumption for new uses (e.g., electromobility; increased electricity demand for households for new appliances, etc.). • *Legislative framework*: Frequent amendments to the Energy Law (covering gas and electricity) and uncertainties concerning the Heating Law, as well as secondary legislation and regulations, are likely to have reduced the interest of beneficiaries in accessing LIOP available funds. • *Availability of complementary resources*: Electricity generation is a competitive sector, while energy efficiency is also market-driven; both can and should draw resources from the private sector, focusing public support for accelerating trends and adopting innovative technologies. Investments in infrastructure (transmission and distribution networks for gas, electricity, and heating), as well as maintenance, should be covered by regulated tariffs collected from end-consumers. The availability of private funding sources, however, depends on the functioning of the market and regulatory environment, while public-sector support requires compliance with state aid principles.
Assumptions behind the LIOP interventions	The assumptions used during the programming stage linked the challenges, needs, and the existing strategy and policy measures in place at the time (2013) • SO 6.1: Certain renewable technologies (biomass, geothermal, etc.) have potential, but existing market conditions and support schemes are insufficient to attract investments. • SO 6.2: While energy market prices were liberalized for industrial consumers before 2014, additional efforts are needed to increase awareness (metering) and support acceleration of energy efficiency efforts.

	• SO 6.3: Smart metering rollout (initially targeted at 80 percent by 2020), introduced in the Energy Law 123/2012, requires additional support to take off, in the form of pilot/demonstration projects to indicate the costs and benefits. • SO 6.4: Industrial co-generation that is not covered by support schemes (such as the co-generation bonus) requires initial support, at least for demonstration purposes. • SOs 7.1 and 7.2: DH networks in eight cities where environmental benefit is demonstrated (in SOP Environment, 2007–2013) incur large losses and need financial support to boost efficiency and avoid consumer disconnections for poor quality. • SO 8.1: The electricity transmission grid requires additional investments to integrate rapidly developing RES (avoiding a potential bottleneck for RES development). • SO 8.2: Interconnections with Moldova (part of EU's internal energy market) enhance regional energy security but require public funding.
Outputs, outcomes, results	The target values for both outputs and outcomes are rather limited for SOs 6.1–6.4, and their contribution to Romania's Europe 2020 targets is marginal. Certain proposed measures (under SOs 6.1-6.4) involved seed funding for pilot and demonstration projects to provide information (real costs and benefits) for later scale-ups, along with other sources of funding. Output and outcome indicators for PAs 6, 7, and 8 required an assessment of the capacity of relevant entities to effectively monitor the achievements.

2. Evaluation Design and Methodology

2.1. Objectives of the Evaluation

26. The ***general objective*** of this evaluation is twofold. First, it aims to support the Ministry of Investments and European Projects (MIEP) in assessing the program's effectiveness, cost-efficiency, and impact (2014 to 2020) in its use of European Structural and Investment Funds (ESIF) in the energy sector. Second, it seeks to draw key lessons from this period so they may be considered for the 2021–2027 programming period.

27. In line with its general objective, the evaluation has the following ***specific objectives***:

   a. to support the MIEP in assessing energy sector programs and projects financed under ESIF in 2014–2020 according to the agreed evaluation framework;
   b. to identify the factors contributing to the success or failure of designed program intervention, as well as to the long-term sustainability of funded actions; and
   c. to produce knowledge that could be transferred to relevant managing authorities to inform the remaining projects for the current or next LIOP programming period and also be used when evaluating the Partnership Agreement.

28. The ***evaluation scope*** is to cover the LIOP energy-related programs and projects as follows:

   a. energy efficiency through smart metering of energy consumption and co-generation systems (SOs 6.2–6.4);
   b. lower emissions through less exploited renewable sources (SO 6.1);
   c. energy efficiency in the district heating (DH) systems of selected cities (SOs 7.1 and 7.2); and
   d. smart and sustainable transmission grids for electricity and natural gas (SOs 8.1 and 8.2).

29. The report also aims to support MIEP for the 2014–2020 programming period by providing evidence and lessons to inform the preparation and implementation of the next cycle. The evaluation covers the projects approved and committed by December 2020 and expected to be executed by December 2023.

30. The ***evaluation use*** was planned for the following three groups of stakeholders:

   a. Evaluation users: Policymakers (MIEP, MoE Ministry of Environment, Water and Forests (MEWF), and other relevant national agencies), entities implementing ESIF-funded energy sector activities (national companies such as Transelectrica and Transgaz, selected municipalities, etc.) and other sector stakeholders and partners using the evaluation to inform policy making, including EU officials;
   b. Stakeholders in charge of managing and carrying out evaluations—namely, evaluation managers, steering and scientific committees, data providers, and evaluators; and
   c. *General public and civil society*.

2.2. Overall Evaluation Framework

31. The original terms of reference included eight evaluation questions focused mostly on impact and sustainability. Based on the information reviewed and given the status of the implementation of the LIOP in the energy sector, in the inception phase some revisions to the original set of evaluation questions were proposed and agreed. These revisions aimed to capture the dimensions of effectiveness, coherence, and efficiency as well as impact and sustainability; and the number of evaluation questions was increased to 12 as presented below.

Effectiveness

1. To what extent are the LIOP energy interventions carried out in accordance with the expectations, and do they produce the desired change (Specific Objectives)?

2. What factors influence the results of the LIOP energy interventions?

Coherence

3. To what extent are the LIOP energy interventions coherent with national strategies, plans, and programs?

4. To what extent are the LIOP energy interventions coherent with EU strategies and programs (EU Clean Energy Package and other energy and climate strategies, as applicable)?

Efficiency

5. To what extent is the implementation system of the LIOP energy interventions functional and operating efficiently against performance indicators?

6. To what extent are the LIOP energy interventions cost-efficient?

Impact

7. In meeting the program/project stated objectives in targeted sectors, territories, and groups, what progress is discernible (namely, what are the gross effects) since the interventions were adopted?

8. To what extent may the observed progress be attributable to the funded interventions (that is, what is the net effect)?

9. What is the existing estimated network effect of the funded interventions?

10. To what extent could the effects occur beyond the targeted territory, sectors, or groups (estimated spillover effects)?

Sustainability

11. To what extent are the interventions' effects expected to be sustainable over a longer period of time (that is, can interventions be integrated into national sustainable development plans)?

12. To what extent should the LIOP energy interventions be further funded—for example, to maintain their relevance for the next programming period?

32. The detailed Evaluation Matrix is presented in Annex B.

33. Due to the slow pace of the projects' contracting and implementation, in the current evaluation report (Output 2) only 9 out of the 12 evaluation questions (EQs) could be addressed as initially planned: 1–7 and 11–12. The EQs planned to address LIOP projects' net effect, network effect, and spillover effects (EQs 8–10) will be covered in the next evaluation report (Output 3), as they assess current expectations in terms of potential impact that can be achieved by the end of the program.

2.3. Methodology

2.3.1. Methodological approach

34. The evaluation methodological approach was based on a non-experimental design. Data collection was accomplished according to a methodology focused mostly on qualitative methods, which were applied so the evaluation could validate, invalidate, or further explain the hypothesis and preliminary findings resulting from desk review. The selection of projects, data collection and guidelines for interviews and focus groups are presented in Annex C.

35. Most of the data were collected in a first phase of the evaluation; however, the evaluation team came up with new iterations/requests for additional data from relevant key informants to deepen the analysis and further develop the preliminary evaluation results.

36. A variety of data sources (see Annex C) were used to gain access to already existing data regarding the monitoring of the LIOP energy-related interventions, as well as to collect new data and information needed throughout the evaluation process.

37. The collected data covered the entire cycle of implementation of the LIOP energy interventions, including their sustainability phases. Therefore, the entire period, January 2014–December 2020, was taken into account.

38. This evaluation used several methods of analysis, such as: SWOT (strengths, weaknesses, opportunities, and threats), primary and secondary data analysis, indicators' analysis, and theory-based analysis.

39. The **SWOT analysis** assessed the strengths, weaknesses, opportunities, and threats of the energy-related LIOP interventions to identify:

- Positive internal factors (strengths) present in the implementation of interventions supported by LIOP energy interventions;
- Negative internal factors (weaknesses) present in implementation of the interventions supported by LIOP energy interventions;
- Opportunities (external factors that could or did influence the quality of energy services: socioeconomic, demographic, legislative, environmental factors, etc.) regarding the implementation of the interventions supported by LIOP energy interventions;
- Threats (external factors that could or did negatively influenced the implementation and/or had unintended consequences) regarding the implementation of the interventions supported by LIOP energy interventions.

40. The highlighted strengths and opportunities led to the identification and evaluation of alternatives for intervention, and weaknesses and threats form the basis of risk-strategy planning (by using the strengths). The SWOT analysis helped identify the internal and external factors facilitating or hindering the production of intended effects in the wake of intervention implementation.

41. The **primary and secondary data analysis** covered the following aspects: the number of approved/contracted/completed projects, the financial results, the use of funds at the project/operation/SO, etc. Both data from the responsible authorities for project management and implementation (managing authority, beneficiaries) and data collected from other public institutions and relevant organizations were analyzed, as presented in the desk review.

42. The **analysis of indicators** assessed the degree to which the indicators were met at the project level according to intervention type. The results were assessed in accordance with the targets of the projects and with results achieved during a similar intervention (according to the results found in the comparative analysis of similar projects in Poland's and Lithuania's OPs described in Chapter 4). Data were correlated with the results of qualitative analyses with a view to identifying the factors that facilitated or hindered the achievement of results. The results of the analyses were correlated with the financial information at the SO level of the project or operation to highlight aspects connected to the efficiency of the intervention and the identification of unitary costs in areas where this was possible (for comparative analyses and good practices or lessons learned).

43. **Theory of change:** The causal chain of results was considered, followed by an analysis of relevant aspects for each intervention. The hypothesis considered the way the proposed strategy led to obtaining the results especially in the socio-economic context and coherent with the complementary actions (e.g. actions for the marketplace, in the social sphere. etc.).

2.3.2. Data Collection

44. **1. A Desk review** (including secondary data sources) was used to obtain a clear and detailed picture of the program-intervention logic of the results and impacts of PA 6, 7, and 8. The desk review informed the analysis and complemented the primary data collection.

The main documents covered during the desk review (see Annex E) were the following:

- Romanian energy strategic documents (draft versions of the energy strategy, which, though not formally approved, indicate policy priorities since 2014; the NECP for 2020–2030)
- Main legislation and regulations (energy law, heating law, ANRE orders), which entail the rules of the energy market, but also complementary support schemes for technologies and projects similar to those in the LIOP (Green Certificates scheme, co-generation bonus, EU programs supporting other gas infrastructure, etc.)
- Program documents for LIOP (preliminary and final versions; implementation framework documents; annual implementation reports; ex-ante LIOP evaluation; other relevant documents and presentations from the Monitoring Committee of the LIOP)
- Project-related documents (for projects included in case studies—project applications, ex ante cost-benefit analysis (CBA), progress or final implementation reports monitoring results); 10-year network development plans for Transelectrica and Transgaz (for SOs 8.1 and 8.2)

- Relevant statistics from INS and ANRE (e.g., annual reports on energy efficiency and renewables, market reports)
- Other EU programs relevant to the topic (final implementation report of SOP Competitiveness 2007–2013 for previous projects on energy efficiency and renewables; SOP Environment 2007–2013 for prioritization of DH projects in LIOP – latest implementation report of 2014; current Regional Operational Program (ROP) 2014–2020 for complementary measures on energy efficiency in buildings).

45. **2. Semi-structured interviews** were used to gain a better understanding of the program design, history of program implementation, bottlenecks, lessons learned from the preparation of guidelines, calls for project proposals, evaluations, contracting, procurement under the funded projects, institutional challenges, and so forth. Interviews were based on guidelines prepared in the Inception Report. ***Eight interviews*** carried out for this evaluation output, of which four were individual interviews and four were group interviews (with an average of three participants per group interview). The interviews included Managing Authority representatives and stakeholders from both the Monitoring Committee (key beneficiaries and public institutions) and the Technical Committee. Interviews will be the main instrument for gathering information directly from stakeholders in SOs 7.2, 8.1, and 8.2, which each consist of one large and specific project. Interviews were also used to inform the case studies.

46. **3. Focus groups** were used to collect information from a pool of projects, particularly under PA 6 and PA 7, that have competitive selection processes and multiple beneficiaries. ***Two focus groups*** were organized (with an average of six participants in each group) so data could be collected from a broader range of stakeholders where organizing individual interviews would have been less efficient, for SOs 6.2 and 7.1. The focus groups included beneficiaries and implementing actors (service providers and consultants). Focus groups were established based on guidelines prepared in the Inception Report.

47. **4. Case studies** were used to provide more in-depth analysis of projects implemented under LIOP. The criteria for case studies selection were the following:

- The most representative (final or close to finalization) for SOs 6.1–6.4 and SO 7.1 (to be updated in the second evaluation)
- The two projects in SOs 7.2 and 8.1
- Interconnection project – Transgaz SO 8.2
- Sample of gas distribution projects from SO 8.2 (in second evaluation)

48. The nine projects selected to be the subject of case studies are presented in Table 2.1.

49. The ***nine case studies*** are detailed in Annex F.

Table 2.1. List of Case Studies

	Project title	*Beneficiary*	*MySmis Code*
SO 6.1 – Increasing production of energy from renewable and less-exploited sources (biomass, biogas, geothermal)			

1.	Upgrading of transformer stations of E.ON Distributie Romania S.A. – Strengthening works of the electrical network upstream of the connection point of the additional production capacities in order to take over the electricity produced from renewable resources in safe conditions of S.E.N. – Unit 110 / 20kV Hirlau, Unit 110 / 20kV Pascani, Unit 110 / 20kV Gorban	Delgaz Grid	105731
2.	Utilization of geothermal energy combined with heating pumps, to produce thermal agent for heating and hot water for Nufarul I Area, Oradea	Oradea Municipality	115839
SO 6.2 – Reducing energy consumption at industrial consumers			
3.	Intelligent energy consumption monitoring system within Antibiotice SA	Antibiotice S.A.	109717
SO 6.3 – Reducing average power consumption of households			
4.	Implementation of intelligent measurement system in Craiova, central area (partially) and Sărari (approx. 10,000 consumers from Craiova)	Distribuție Oltenia	114790
SO 6.4 – Increasing savings of the consumption of primary energy produced by high-efficiency co-generation systems			
5.	Increasing the operational energy efficiency at SC AMBRO S.A. Suceava by implementing a high efficiency cogeneration installation	AMBRO S.A.	115900
SO 7.1 – Increasing energy efficiency for DH systems in selected cities			
6.	Rehabilitation of the district heating system in Oradea for the period 2009-2028, to comply with environmental legislation and increase energy efficiency – Stage II	Oradea Municipality	108460
SO 7.2 – Increasing energy efficiency of district heating system in Bucharest			
7.	Rehabilitation of the heating system of Bucharest Municipality	Bucharest Municipality	138142
SO 8.1 – Increasing the capacity of the national energy system to use energy produced from renewable resources			
8.	LEA 400 KV d.c. Gutinas-Smardan	Transelectrica	129245
SO 8.2 – Increasing interconnection capacity of National Transmission System of natural gas with other neighboring countries			
9.	Developments of NTS in the North-East area of Romania to improve the natural gas supply of the area as well as to ensure the transmission capacities to the Republic of Moldova	Transgaz	122972

2.3.3. Limitations

50. The evaluation identified a few key risks and methodological limitations for which mitigation measures were found, as shown in Table 2.2.

Table 2.2. Methodological Limitations

Limitation	Comments
Inaccurate monitoring reports and data	The desk review revealed certain limitations of monitoring data – in particular, indicators showing final output and outcome data for projects still under implementation, but not finalized, and indicators which were sub-optimally designed. To address this constraint, the evaluation team included monitoring topics in as many interviews as possible to reconstruct additional data of a monitoring nature.
Delays in implementation	Most of the interventions started recently or are delayed in implementation. Capturing effects of interventions in early phases of implementation is challenging, especially at the level of outcomes and impact. The evaluation team tried to provide projections of the likely effects of interventions.
Limited engagement of a few key actors	The evaluators had limited opportunities to access and engage with a few key actors from the LIOP managing authority. Close cooperation with the Evaluation Central Unit facilitated access of the evaluation team to most of the key informants.
Limitation of data collection due to COVID-19 pandemic	The evaluation was conducted without traveling and face-to-face meetings, which involved certain challenges in the primary data collection process. The group meetings were carried out online and, in spite of the initial tendency of being less interactive, in the end they proved to be informative to a satisfactory level.

3. Analysis and Interpretation

3.1. Effectiveness

EQ 1: To what extent are the LIOP energy interventions carried out according to expectations and produce the desired change (SOs)?

51. The progress in achieving program outputs and outcomes is summarized in Table 3.1.

Table 3.1. Summary of Progress in Achieving Program Outputs and Outcomes

SO	*Indicator*	*Type*	*Baseline 2013*	*Actual value 2020 or 2018*	*Target 2023*
6.1	No. distribution stations modernized / new	Output	0	12	4
	Additional RES capacity installed (MW)	Output	0	26.905	26
	CO_2 emission reduction (tCO2e)	Output	0	15805.55	20972
6.1	Gross primary energy production less used RES	Outcome	76.38	104.5	455.96
6.2	No. of companies supported	Output	0	15	60
6.2	Energy intensity in industry (kgoe/€1000)	Outcome	183	140.9	121.5
6.3	No. of households connected to smart metering	Output	0	20016	80000
6.3	Average household (hh) consumption (MWh/hh/year)	Outcome	1.42	1.35	1.2
6.4	Installed high-efficiency cogeneration capacity (MW)	Output	0	18.339	20
	No. of companies supported	Output	0	2	5
	CO_2 emission reduction (tCO2e)	Output	0	11112.35	28000
6.4	Primary energy savings 1000 toe/year	Outcome	178	209	232
7.1	Network modernized (km)	Output	0	295.62	210
7.1	Network losses (%)	Outcome	26.76	28.54	15
7.2	Network modernized (km)	Output	0	0	133
7.2	Network losses (%)	Outcome	26.76	28.54	15
8.1	Km of modernized electricity line	Output	0	140	140
8.1	Increased RES integration capacity (MW)	Outcome	2200	3200	3200
8.2	Km of modernized gas pipeline - transport	Output	0	0	160
	Technological level of smart gas grid	Outcome	0	0	2
8.2	Interconnection capacity (bcm/year)	Outcome	14.35	15.85	20

Sources for current values (2020): SMIS database (2020 data) for SOs 6.1, 6.2, 6.3, 6.4, 7.1; latest Annual Implementation Report (2019) for SOs 7.2, 8.1, 8.2. Indicators for 6.1, 6.3, 6.4, 7.1, 8.1 are in fact reported for projects that are under implementation (construction is not finalized). This is a major shortcoming as it produces an overreporting of the achievements so far under LIOP.

SO 6.1: Increasing energy production of less-exploited renewable resources (biomass, biogas, geothermal)

52. The measures included in this SO have been split in two priorities: (i) support for electricity distribution to better integrate renewable energy (strengthening of electricity distribution lines and

construction of substations) and (ii) production of renewable energy – i.e. the use of geothermal resources for integration into DH systems. No project has been finalized to date to assess the final contribution to the targets. However, during interviews, the beneficiaries of support in electricity distribution are confident that their projects would indeed enhance their capacity to integrate newly-built renewable capacities into their region, once the implementation is finalized. Beneficiaries of support for geothermal energy are also positive that the projects would increase the share of renewable heat in district heating, contributing to the committed targets – though they highlight significant implementation risks as the viability of the projects (and thus eligibility of costs) would be clear only after the finalization of the construction.

SO 6.2: Reducing the energy consumption of industrial consumers

53. Projects covered by SO 6.2 include installation of smart metering systems to monitor consumption of electricity, gas, heat, and water for industrial consumers. 14 projects have been finalized. The introduction of smart metering does not *per se* lead to reduced energy consumption, but rather provides adequate and detailed information on consumption, allowing the companies to optimize production processes and invest in energy-efficient equipment in priority areas. Since most of the projects have just been finalized in 2019-20, the follow-up measures to reduce energy consumption are still to be implemented, though beneficiaries state the smart metering investments have indeed produced valuable information for the optimization of the industrial processes that would be forthcoming. Despite the SO having the best results in terms of finalization of projects among the SOs of the energy component of LIOP (with 14 projects finalized), it must be noted that to date only 15 projects out of the envisaged 60 to be supported (23 percent of the total financial allocation) are under implementation or finalized.

SO 6.3: Reducing the average power consumption of households

54. Only one project (consisting of the installation of smart metering for electricity distribution in an area in Craiova city with about 10,000 households) has been partly implemented to date. Of the envisaged eight projects, two (or 25 percent of the financial allocation) have been contracted. Since the baseline data considered in the LIOP is the electricity consumption in households as of 2014, the electricity consumption in households has in fact increased, and the attainment of the target indicator by the end of the LIOP is unlikely, as household electricity consumption is expected to increase (more appliances, electromobility, electric-based heating and cooling etc.). This issue is, however, more related to the selection of the target indicators at the programming stage than to a failure to achieve desired objectives, which should ideally consist of a lower electricity consumption in 2023 compared to a baseline for the same year 2023 in the absence of the measures (though consumption for 2023 could not be properly estimated at the programming stage in 2014).

SO 6.4: Increasing savings of the consumption of primary energy produced by high-efficiency co-generation systems

55. As of the date of this report, two projects have received support under this SO and one has been physically finalized (a small cogeneration unit at AMBRO), though it is in the final testing phase and

not yet operational. The two projects cover just 18 percent of the financial allocation. While the beneficiary of the finalized project is optimistic about the efficiency of the investment, the cogeneration unit is not yet under operation to measure the actual savings. The intervention might be suboptimal, however: given the restrictions for the project's eligibility (a maximum capacity of 20 MWt and 6.5 MWe), the beneficiary whose project has been finalized installed a smaller capacity than would have been optimal for its industrial process.

SO 7.1 Increasing the energy efficiency of DH systems in selected cities

56. Projects supported by this SO currently cover five of the seven cities originally envisaged; only one project (in Oradea) has been finalized, and the city has applied for a follow-up project. The baseline data considered in the LIOP consists of losses in DH networks in 2014; currently the DH network losses registered have in fact increased, given delays in investments overall in the DH sector. Thus, it is unlikely that the final target of loss reduction overall in DH networks at the national level will be achieved, though this is reflective of the limitation of the indicator chosen to measure outcomes at the end of the program (losses as of 2014 baseline instead of expected losses as of 2023 without interventions) rather than of the performance of the SO. It must be noted, however, that for the finalized project in Oradea the beneficiary reported in the final implementation report a decrease in losses of 26.7 percent.

SO 7.2: Increasing the energy efficiency of DH systems in Bucharest

57. The implementation of the project has not started (for exogenous reasons examined in EQ2). The expectation is that the project could be "phased" to achieve partial implementation in the current cycle and continue under the 2021-2027 program.

SO 8.1: Increasing the capacity of the national energy system to use energy produced from renewable resources

58. The project (a 400-kV double-circuit overhead line between Gurdinas and Smardan substations, with modernization of such substations) is currently under implementation, after many delays caused by: unclear interpretation of state aid notification requirements and amendments to the applicant's guidelines; a lengthy authorizations process (particularly concerning construction at the local level); an expropriations process for the construction of the electricity line (particularly from other state-owned landowners); amendments to total costs caused by legislative changes; and preparation of terms of reference (TORs).

59. Currently, the project is at the stage of procurement of works, so its contribution to the stated objectives (enhanced capacity for integrating renewables into the electricity system) is still estimated only ex ante (what is expected once the project is finalized). However, the project continues to be a major priority for Transelectrica as it is expected to strengthen the network, thereby increasing the grid's capacity to integrate electricity produced into the renewables-rich Dobrogea area and the interconnection with Bulgaria. It will become even more relevant if Romania develops offshore wind, a new direction in the energy policy highlighted also in the NECP.

SO 8.2: Increasing interconnection capacity of National Transmission System of natural gas with other neighboring countries

60. The SO consists of one major project – a pipeline and two compressor stations at Transgaz that would ensure interconnection with the Republic of Moldova; plus, in September 2020, a new call was launched covering extensions of distribution networks for gas to enhance household access. After significant delays, the Transgaz project is now expected to be finalized by mid-2021.

61. As the project connects Romania's network to that of the Republic of Moldova, one of the risks during the programming consisted of potential delays or cancellation of the corresponding infrastructure in the Republic of Moldova (a pipeline connecting the border to the main consumer area of Chisinau). However, in 2020 the infrastructure on the Moldovan side (also purchased by Transgaz) was finalized, eliminating this risk. At the same time, Russian gas supplies via Ukraine are gradually phasing out, rendering the LIOP-financed project even more relevant. However, the actual viability and use of the project will be demonstrable only after construction is completed. Gas supplies to Moldova via the pipeline supported under LIOP will depend on gas market conditions in the Republic of Moldova and competing pipelines.

62. In 2020, additional financing amounting to €235 million was reallocated to SO 8.2 to support gas distribution networks. One call for project applications was launched (in August) for projects to be submitted by December 2020; 250 proposals were submitted. Currently, the projects are under evaluation and no financing contract has been signed as of February 2021. These projects will be covered in the next evaluation report.

EQ 2: What factors influence the results of the LIOP energy interventions?

SO 6.1: Increasing energy production of less-exploited renewable resources (biomass, biogas, geothermal)

Economic factors

63. The strengthening of distribution grids to enhance integration of renewables connected directly to distribution networks is influenced by increased electricity demand, particularly from households. Additional challenges, such as the emergence of prosumers (households that can produce and deliver renewable electricity to the grid), require attention to ensure optimal balance and better management of demand and supply. It must be noted that the two beneficiaries of 6.1 (both distribution system operators, or DSOs) are also the two beneficiaries of 6.3, smart metering for households: Delgaz Grid and Distributie Oltenia, representing two out of eight regional electricity DSOs in Romania. This indicates that beneficiary DSOs see the need to couple the two measures: strengthening distribution lines and substations is required to integrate (i) corporate producers of renewable electricity connected to distribution (PV and wind) and (ii) households that are both producers (e.g. rooftop PV panels) and consumers at different times of the day (prosumers). Detailed metering for intermittent renewables and real-time consumption is essential to facilitate prosumers.

64. Economic factors are less important for the production of geothermal energy for district heating, as this is designed to replace existing (fossil) energy source for a largely constant heat demand for residential use, which is therefore not influenced by economic factors.

Demographic and geographic factors

65. Not significant for this SO.

Legislative framework

66. Two main legal and regulatory issues caused delays:

- Emergency decree 114/2018 increased costs for construction, rendering some costs ineligible as they exceeded the approved financing (for which beneficiaries needed to find complementary resources)
- Lack of clarity concerning state aid schemes (consisting mostly of interpretations by the Competition Council of EU state aid legislation) – e.g. interpretation as to whether or not renewable energy sources for local authorities should fall under the state aid regulations.

Availability of complementary resources

67. The availability of complementary resources is very relevant – in particular for SO 6.1, production of renewable energy, where funding is allocated to the drilling of geothermal wells so the hot water can be used in heating systems. While the geothermal potential is known only generally before the well is drilled, the economic potential (whether the actual temperature and pressure of the water allows its economic use for DH) is only fully discovered after the well is finalized. Thus, there is a high risk for beneficiaries to access EU funds and discover at the end that the entire investment is ineligible because the economic potential is not realized. For this reason, only municipalities which have the financial resources to take the risk of ineligibility applied for the available EU financing under this SO; this also renders the scale-up problematic.

SO 6.2: Reducing the energy consumption of industrial consumers

Economic factors

68. The measures supported under this SO consist of smart metering for consumption of electricity, gas, water, and steam. In this context, two factors have had a positive impact on the projects: (i) energy prices, which were liberalized after the beginning of the 2014–20 programming period; and (ii) changes in the markets for products aimed at industrial consumers (requiring changes in equipment). Follow-up measures (e.g. improvements of production equipment, changes in business processes) are needed to realize the energy efficiency potential.

Demographic and geographic factors

69. Not applicable to this SO.

Legislative framework

70. Other potential beneficiaries might have not applied because of the state aid scheme used for the measures included in the SO. The state aid scheme was *de minimis* – which minimizes the

approvals, but caps maximum support at € 200,000, which could be low for this type of project. At the same time, some beneficiaries considered the de minimis cap as too low for the amount of paperwork and bureaucratic workload involved in preparing a project for EU funding.

Availability of complementary resources

71. SO 6.2 supports smart metering for industrial consumers; in general, large industrial consumers who fully understand the need for optimization of energy consumption are large businesses for which financial support of up to €200,000 is a small amount. The absorption could be accelerated through a promotional campaign targeting SMEs and meetings organized by the MA between current and prospective beneficiaries, who could learn from the experience of beneficiaries who have finalized projects supported under this SO.

SO 6.3: Reducing the average power consumption of households

Economic factors

72. Electricity consumption in households has increased and is expected to increase further (e.g. the baseline for 2014 is 1.35 MWh/household/year, whereas the 2018 actual consumption is 1.42 MWh/household/year, according to the LIOP annual implementation report of 2019). The increase is caused by higher usage and diversification of household appliances, electricity use for heating, electromobility, etc.; as electricity is a cleaner source of energy than fossil fuels for heating (gas) and transport (gasoline), household demand will increasingly be stimulated by both normal economic development and decarbonization policies. While the results indicators selected for SO 6.3 might thus be suboptimal for capturing the energy efficiency gains from smart metering in electricity distribution, the expected increase in electricity consumption in fact renders more urgent the modernization of electricity distribution and the roll-out of smart metering (which supports the optimization of grid operations and the generation of granular, real-time data on consumption and production by prosumers).

Demographic and geographic factors

73. Projects supported under LIOP focus on smart metering infrastructure (meters, data concentrators, software, etc.) in small urban neighborhoods (covering about 10,000 households each) where the population is not expected to decline.

Legislative framework

74. The regulatory framework (Energy Law 123/2012 with amendments) contains provisions for the roll-out of smart metering in distribution. In the original version of the law, the roll-out program was to have been 80 percent completed by 2020 (as required in the EU's Third Energy Package of 2009). This suggested a clear and ambitious schedule for the roll-out to be implemented by ANRE, with investments to be recovered from increased distribution tariffs. As costs were only roughly estimated (in a study done by AT Kearney in 2012), ANRE promoted several small pilot projects to identify the best technical solutions and appraise the total financial burden for the consumers associated with a full roll-out (minimum 80 percent of consumers). The pilots were inconclusive, with wide

disparities across distribution companies, and ANRE delayed the approval of a full roll-out schedule because of uncertainties on the impact on the increase of the distribution tariff.

75. As a result, the energy law was subsequently amended and the roll-out deadline was postponed to 2028 (though beneficiaries expect that even by 2028 the roll-out could be as low as 50 percent, since the law allows significant room for ANRE to decide even beyond that date). This amendment affects SO 6.3 because there is a risk that all smart metering projects implemented in recent years (from LIOP and several pilot projects promoted by ANRE) might not be compatible with the equipment that would be installed by the time of the full roll-out in 2028 or well beyond, as technology changes.

Availability of complementary resources

76. Romania must ensure a full roll-out of smart metering, with investments to be recovered in distribution tariffs, as long as the roll-out is demonstrated as economically feasible. Thus, both ANRE pilots and LIOP demonstrative projects were supposed to collect information for an accurate CBA for the roll-out. As highlighted above, the main risk would be the possible incompatibility of current technology with the full roll-out (which would also render SO 6.3 measures inefficient) if the roll-out is delayed for too long. Beneficiaries are however optimistic that the equipment procured under SO 6.3 is currently up to date and will be still operational for several years beyond 2028.

SO 6.4: Increasing savings of the consumption of primary energy produced by high-efficiency co-generation systems

Economic factors

77. The two beneficiaries of support under 6.4 are a paper producer and a producer of construction materials; 12 other projects are under evaluation. Economic factors that could influence the results concern the general economic conditions affecting the markets in which beneficiaries operate (potentially including the pandemic). However, the cogeneration capacities covered by the project are rather small and beneficiaries are expected to be from various industries, which reduces the risk of negative economic conditions negatively affecting the results of the entire SO.

Demographic and geographic factors

78. Not applicable to SO 6.4.

Legislative framework

79. SO 6.4 covered support for cogeneration that was not covered from other sources (e.g. the cogeneration bonus covered higher capacities and required that electricity be sold to third parties on the market). It was thus unaffected by changes in the legislation concerning cogeneration.

Availability of complementary resources

80. Industrial cogeneration supported from SO 6.4 could probably have been implemented without the support from LIOP by using ESCOs, own resources, or commercial loans, but the investment recovery period would have been much longer.

SO 7.1 Increasing the energy efficiency of DH systems in selected cities

Economic factors

81. Heat demand for households is insensitive to economic growth. A major constraint highlighted by beneficiaries is the availability of critical supplies, in particular pipes for the DH networks (the major producers of pipes have exited the market in recent years because of low demand from the DH sector).

Demographic and geographic factors

82. The main challenge to DH systems consists of the major shifts in demand that have not been matched by adjustments in the DH generation and network. DH systems were initially intended to supply mainly electricity and industrial heat for industrial platforms, with residential heat as a by-product, concentrated in large neighborhoods with multi-family apartment buildings. Following the closure of industrial platforms at the periphery of the cities, generation remained oversized, with capacities far from residential areas, which increases inefficiencies and network losses, apart from the poor condition of the infrastructure. Support for DH systems, including that funded by the EU in the previous cycle (2007–13, in OP Environment), covered the reduction of pollution and inefficiencies in generation while retaining the original generation capacity, and was rather decoupled from the changes in demand that took place during this time. As a result, the systems remain oversized compared to current demand – which is lower because of disconnections, climate change, and measures taken to improve energy efficiency in buildings (i.e. insulation of multi-family apartment buildings, which is quite advanced in several cities). The poor quality of the heating service also discouraged new connections, though in large cities new neighborhoods of multi-family apartment buildings have been built (mostly after 2000); these are generally heated by individual or (at best) building-level gas boilers.

Legislative framework

83. The main changes causing delays consist of:

- amendments to the state aid support scheme after the initial publication of the applicants' guidelines, which affected the eligible costs and required that operators amend their initial projects; and
- uncertainties concerning the main law on district heating (Law 325/2006, amendments to which are currently being considered in Parliament). The law has important provisions concerning the responsibilities of various institutions (MoE); MDPWA; ANRE; local authorities) and operational details, such as unitary heat zones and disconnections.

Availability of complementary resources

84. Financing for DH systems is available from other programs, in particular the Termoficare program managed by the MDPWA. The Termoficare program started in 2006 and was extended successively until 2020; in 2021, the Ministry prepared a new, multi-annual program. In general, works financed by the Termoficare program have been small and absorption low (about 20 percent by 2020), in particular because it was an annual program which could support only small works (i.e. interventions that could be completed in just several months following budget approval, preparation of tenders, and

selection of construction companies). Additional resources for generation are available from other EU instruments (such as the Modernization Fund from the proceeds of emission trading system (ETS) trading under Article 10d of the EU ETS directive[5]); commercial loans (in particular where the DH companies are financially viable and/or operated by private companies, such as Oradea, Ploiesti or Iasi).

85. However, none of the existing funding, including EU programs, correlates demand-side measures (energy efficiency in buildings) with the support for restructuring DH to match the fundamental changes in demand patterns. While there is funding available in the Regional Operational Program (ROP) for thermal insulation of buildings, as well as programs financed from national and local budgets, there is no clear linkage (apart from one criterion in the application for funding in ROP that gives additional points to projects for buildings still connected to DH).

SO 7.2: Increasing the energy efficiency of DH systems in Bucharest

Economic factors

86. As mentioned earlier under SO 7.1, a major constraint could be the supply of pipes for the DH networks. In addition, the availability of gas as an alternative to heating in Bucharest (unlike in the city of Oradea) and the very high level of average incomes in the city (above EU average, comparable to Berlin) is likely to accelerate disconnections. While the level of official disconnections of existing consumers is low (below 10 percent since 1990, unlike 30-50 percent in other cities which still have DH systems), it is quite possible that unofficial disconnections are much higher; in the past five years the reduction of heat demand has been about 25 percent, which can only in part be explained by energy efficiency in buildings and milder winters. Increased losses on the network (especially after 2015) and extended interruptions of heat and hot water (particularly in areas in northeast of Bucharest, where two CHPs were shut down in 2009 and 2014), are likely to have prompted consumers to install boilers for hot water, air conditioning with heating, or other heat improvisations without disconnecting officially, thus avoiding the paperwork and bureaucratic difficulties.

87. At the same time, electricity produced in CHPs providing heat for Bucharest also contributes 80 percent of the peak demand for electricity consumed in the city; if the DH system fails, there would be insufficient supply to cover Bucharest's demand, given congestion in the electricity transmission grid around the city.

Demographic and geographic factors

88. The issues identified earlier for SO 7.1 (mismatch of supply and demand patterns, oversized system) are valid for Bucharest DH at a much larger scale, as the city's DH system is roughly 10 times larger than systems in the other Romanian cities (such as those supported under SO 7.1) and represents 50 percent of the total DH sector in Romania.

[5] Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a system for greenhouse gas emission allowance trading within the Union and amending Council Directive 96/61/EC.

Legislative framework

89. The main changes causing delays, apart from those mentioned for SO 7.1, include the changes of institutional setup and the lengthy insolvency/bankruptcy process of the DH company RADET. Even though the beneficiary of the EU financing in SO 7.2 is the city hall, the insolvency, bankruptcy and continued financial distress of the DH system (caused by locally-approved tariffs that cover less than a third of costs, and arrears in payments of a local subsidy) mean there is a significant perceived risk that the DH system might no longer be a going concern. The issue was recognized during the preparation of the project, with Jaspers undertaking a detailed assessment and providing options to overcome the financial and institutional crisis of the Bucharest DH. While the new local administration may be more interested in solving the fundamental problems of the DH system, concrete steps are yet to be taken.

Availability of complementary resources

90. Bucharest is eligible for the same sources of financing for generation and DH networks as cities in SO 7.1. Both the city's heat generators (ELCEN, which is owned by the MoE), and private firm Vestenergo) are also currently recipients of the cogeneration bonus. ELCEN may no longer be eligible for a cogeneration bonus after the extension of the current scheme until 2023, as it would apply only to financially viable companies (ELCEN is currently undergoing an insolvency procedure).

91. In terms of complementary measures for demand-side energy efficiency, most multi-family buildings in Bucharest have been or will be thermally insulated in the next 2-3 years, mostly with local funding from Bucharest city districts and European Investment Bank (EIB) loans. The disconnect between DH restructuring and demand developments is also visible in Bucharest. (However, interventions under SO 7.2 will support investments in smaller-diameter pipes to match the reduced demand).

SO 8.1: Increasing the capacity of the national energy system to use energy produced from renewable resources

Economic factors

92. While electricity demand is expected to rise, Romania faces an electricity generation shortage, following lack of investments in new capacities after 2016 and the probable closure of a large share of coal-fired generation in CE Hunedoara and CE Oltenia in the next few years. Urgent investments in electricity transportation infrastructure will be required to integrate new, intermittent sources of renewable energy.

Demographic and geographic factors

93. Most electricity generation, including intermittent renewables, is concentrated in the Southeast region of the country / Dobrogea area, whereas demand is concentrated in the west and in Bucharest; in these regions, demand is expected to increase (according to Transelectrica's projections). The line and stations to be financed in SO 8.1 would help reduce the congestion in the Dobrogea area and better integrate renewables, avoiding limitations to installing new capacities.

94. Romania also has offshore wind potential in the Black Sea, which would also require a stronger connection from Dobrogea to other regions of the country (as well as to Moldova, where there are few generation capacities, and Transylvania).

Legislative framework

95. Unclear interpretations of state aid rules applicable to the project (Transelectrica being a natural monopoly) caused some delays and amendments to the applicant's guidelines. Other bottlenecks consisted of various legal interpretations of local authorities concerning construction permits; and the conflict between provisions of the Forestry Code and law on expropriations for causes of national interest which still affects the expropriation of some land plots belonging to Romsilva (a state-owned enterprise that oversees publicly owned forests). Emergency Decree 114/2018, which increased construction costs for many projects in LIOP energy, did not affect Transelectrica's project because the application and cost updates were submitted to the MA after the decree entered into force.

Availability of complementary resources

96. Transelectrica collects ANRE-regulated tariffs for its electricity transmission services; the tariffs are calculated based on the regulatory asset base and would cover maintenance, Transelectrica's own financing, and ineligible expenses. The company is also seeking additional funding from EU sources, in particular for measures such as storage and digitalization under the NRRP.

SO 8.2: Increasing the interconnection capacity of the National Transmission System of natural gas with other neighboring countries

Economic factors

97. Increased gas demand in the Republic of Moldova following the reduction of gas supplies from Gazprom transited via Ukraine may contribute to a higher use of the interconnection with Romania after the finalization of the Onesti-Gheraiesti-Letcani pipeline and compressors. The gas project is also designed to increase the transport capacity in Moldova, strengthening an old pipeline; this would allow possible extensions of gas supply to households in the area for heating.

Demographic and geographic factors

98. Currently, Romania and Moldova are transited by a gas pipeline (the Trans Balkan Pipeline, or TBP), which until 2020 was the main route for Russian gas to southeast Europe and which, though belonging to Transgaz in Romanian territory, was neither physically nor commercially available for exports of Romanian gas to Bulgaria, Moldova, or Ukraine. Though more expensive than direct access to the TBP, the Onesti-Gheraiesti-Letcani-Iasi-Ungheni-Chisinau route was supported by the EC from 2013 onwards, because the TBP was not accessible for gas exports from Romania to Moldova and Ukraine. This was caused both by physical constraints (the pipeline was not connected to the rest of Transgaz' network) and non-compliance with EU law (no information on available capacity was made public, while Gazprom claims regarding differences in regulatory regimes complicated the applicability of the EU network codes at the border, effectively blocking third-party access to the pipe for Romanian gas suppliers).

99. Since the construction of TurkStream (an export gas pipeline stretching from Russia to Turkey across the Black Sea), Gazprom has no longer needed the pipeline to supply Greece or Bulgaria, though it might still use it in reverse flow to supply gas to Moldova from the opposite direction (in fact it began doing so in 2021). Because there remains no regulatory pretext to block reverse flows (the transit country for Gazprom gas supplies upstream from Romania would be another EU member state bound by EU network codes) and the physical interconnection with the rest of Transgaz network requires investments which have been partly finalized in 2020 with EU support, Romania could use the Isaccea route for supplies to Moldova as an alternative to the project on SO 8.1, the pipeline also being closer to the Black Sea deposits. This might affect the economics of the project.

100. The main rationale for the project was from the beginning energy security (capacity to supply gas in case of interruptions of Gazprom deliveries) rather than economic viability. But if the pipeline is used under capacity, it could affect the recovery of maintenance costs from transport tariffs.

101. The availability of the TBP under EU rules might also optimize the use of the Iasi-Ungheni route (while the theoretical maximum capacity is 1.5 bcm per year, the pipeline can be used at this level only during winter, as Moldova does not have gas storage; using the TBP with Romania and Ukraine it can access storage in Ukraine). The use of the pipeline will depend on the capacity of the regulatory framework in the Republic of Moldova to enable a level playing field for both Romanian gas suppliers and incumbents.

Legislative framework

102. Changes in energy legislation – in particular the law on offshore gas and the energy law, which discouraged investments in the Black Sea deposits – pose risks for the availability of enough gas in Romania for exports in coming years.

Availability of complementary resources

103. See above on concerns for maintenance.

3.2. Coherence

EQ 3: To what extent are the LIOP energy interventions coherent with national strategies, plans and programs?

SO 6.1: Increasing energy production of less-exploited renewable resources (biomass, biogas, geothermal)

104. Interventions in SO 6.1 were designed to cover renewables for which the forms of support existing at the time of the programming of LIOP (mainly, the green certificates scheme for electricity generation) were not sufficient to stimulate investments. The SO covers investments in heat from renewable sources (geothermal) and in electricity distribution grids. The interventions remained aligned with the latest draft of the NECP, which has more ambitious targets for renewables for 2030 (30.7 percent of final energy consumption).

SO 6.2: Reducing the energy consumption of industrial consumers

105. Smart metering for industrial consumers contributes indirectly to the reduction of energy consumption by providing reliable, granular information on consumption by equipment and processes. Energy efficiency targets in the latest NECP draft of January 2021 are increasingly ambitious (savings of 45.1 percent of primary energy consumption and 40.4 percent of final energy consumption by 2030).

SO 6.3: Reducing the average power consumption of households

106. This SO contributes to the overall NECP energy efficiency targets. In addition, the NECP presents a roll-out schedule for smart metering by 2028, corresponding to ANRE Decision 778/2019. Interventions in SO 6.3 are demonstrative projects designed to help distribution companies gain experience in the installation and operation of smart metering, which can be then scaled up.

SO 6.4: Increasing savings of the consumption of primary energy produced by high-efficiency co-generation systems

107. SO 6.4 interventions are designed to contribute to the NECP energy efficiency targets and cover support for cogeneration that is not supported by other policy measures (in particular the cogeneration bonus). While the NECP draft does not specifically mention industrial cogeneration as a policy priority (it focuses on cogeneration for DH), it has been criticized by COGEN Europe for this shortcoming and the final version will likely include a reference to industrial cogeneration. The government has also been discussing a new cogeneration bonus scheme targeted at greenfield investments including industrial cogeneration, though there is no draft policy yet. It is very likely that, if approved, the new scheme would cover only those cogeneration capacities that would put at least a part of their electricity production up for sale on the market to third parties. This SO remains complementary, as it covers small cogeneration for industrial consumers for own use of heat and electricity.

SO 7.1: Increasing the energy efficiency of DH systems in selected cities

SO 7.2: Increasing the energy efficiency of DH systems in Bucharest

108. The NECP refers to DH and the need to improve efficiency along the entire chain (production, transport, distribution, consumption). Given the comments from COGEN Europe, the DH component will likely need to be strengthened, though it is unclear whether there is a "DH champion" (an institution that would lead a DH strategy and action plan) in the government. This SO aligns with other measures, in particular Termoficare 2006-2020 and the new Termoficare program that started in 2021.

109. Until the final approval of Law 325/2006, on which amendments are currently being discussed in Parliament, DH policy in Romania will remain fragmented because of unclear institutional responsibilities among the two relevant ministries (Energy vs. Development), the regulator (ANRE), and local authorities. There is little connection to complementary policies (notably, energy efficiency in buildings, for which a strategy – the Long-Term Renovation Strategy (LTRS), another EU condition – has been approved in November 2020 by the MDPWA).

SO 8.1: Increasing the capacity of the national energy system to use energy produced from renewable resources

110. The project supported under this SO is explicitly mentioned in the NECP and in Transelectrica's 10-year network development plans (latest version 2020-29). It is also closely linked to a project of common interest (PCI) for the EU covering further upgrading of the same stations and electricity line because it too contributes to increasing Romania's interconnectivity (target 15.4 percent by 2020) in the Black Sea Corridor.

111. While the project, like other interconnection and network strengthening projects, has been delayed in successive network development plans of Transelectrica prepared in the last five years, it will likely be accelerated in view of the high risk of decommissioning of coal-fired capacities in CE Hunedoara and CE Oltenia. (In late 2020 the same sense of urgency also triggered the finalization and putting into operation of Transelectrica's connection Oradea Sud – Bekescsaba to Hungary, which had also been delayed for several years).

SO 8.2: Increasing the interconnection capacity of the National Transmission System of natural gas with other neighboring countries

112. The project included under this SO is mentioned in the NECP as critical for the interconnection with the Republic of Moldova and for the improvement of the gas supply in the northeast Romanian northeast region, with the deadline 2021.

EQ 4: To what extent are the LIOP energy interventions coherent with strategies at the European level (EU energy and climate strategies)?

Alignment of LIOP interventions to Romania's European commitments

113. LIOP energy interventions remain aligned with the strategic directions of the final draft NECP, which aligns Romania's energy and climate targets with the EU's revised targets for 2030. In the absence of an energy strategy, Romania's energy policy has been in part de facto anchored by the availability of EU financing instruments (OPs, but also mechanisms such as 10d – Modernization Fund), and strategic documents required by the EU (NECP, LTRS for energy efficiency in buildings, National Resilience and Renovation Plan), although implementation remains a challenge. It must be noted that the LIOP was designed from the beginning to cover multiple areas of intervention, with rather limited funding for each measure. Axis 6 in particular comprises a set of demonstrative instruments, well ahead of the energy policy in 2013-14, and complementing support instruments for (i) decarbonization in force at the time of the programming, (ii) energy efficiency in industry and household electricity consumption, and (iii) renewables in areas considered more difficult for market forces to work in and not well covered by existing policies. Thus, the LIOP has been more progressive than national strategies in terms of alignment with EU's ambitious objectives for energy efficiency, RES, decarbonization and digitalization. The next programming cycle would need to step up the ambition to match the new Green Deal and to contribute to reforms and investments proposed in the draft NRRP.

3.3. Efficiency

EQ 5: To what extent is the implementation system of the LIOP energy interventions functional and operating efficiently?

114. The LIOP energy interventions are administered by the Managing Authority (MA), which is organized as a General Directorate in the Ministry of Investments and European Projects. The MA is broadly responsible for the efficient management and implementation of the OP: developing the program itself, selecting projects that would benefit EU financing, ordering payments to be made to beneficiaries and verifying the regularity of expenditures, monitoring the implementation progress and assessing the level of achievement of relevant objectives, as well as reporting annually the implementation to the EC.

115. The MA is composed of seven departments, each charged with specific tasks and phases of the program and of the projects. The department responsible for the administration of the program has sub-departments for programming, evaluation and contracting, and technical assistance. The project authorization department is mainly responsible for ensuring regularity of expenditures during the implementation, including conformity with procedures, e.g. procurement. The monitoring department has subdepartments for each component of the LIOP (transport, environment, energy); it is in charge of both monitoring during implementation and structuring the information to be submitted by beneficiaries to ensure adequate monitoring; it can also organize visits to projects under implementation. The accounting and payment department is broadly responsible for the efficient financial management of the OP. There are also eight regional departments (Regional Infrastructure Directorates, or RIDs), which monitor implementation through on-site visits and the periodic implementation reports provided by the beneficiaries; they are also in charge of the initial review of requests for pre-financing, payments and reimbursements. The monitoring activity is coordinated by the monitoring department at central level within the MA.

116. All beneficiaries on Axes 6-8 mentioned a good relationship with the RIDs and with the MA and have a highly positive opinion of their responsiveness, in particular in the processing of payment requests or clarifications over the entire project cycle. However, a major weakness remains the project evaluation capacity, where the lengthy procurement of evaluators (consultancy for the MA) has caused substantial delays, from project submission through to contracting. On projects under implementation, RID staff frequently organize site visits and keep in close contact with beneficiaries with regard to monitoring/reporting and processing of payment requests.

117. Some beneficiaries already had experience with the previous programming cycle: SOP Competitiveness 2007–13 included energy projects with beneficiaries who further applied to Axis 6 of LIOP, and beneficiaries of Axis 7 had accessed EU funds under SOP Environment 2007–13. They generally note an improvement in the relationship with the current managing structure of the LIOP energy compared to their experience with MAs and Intermediate Bodies (IBs) in the previous cycle. (At the same time, such beneficiaries have also themselves gained more experience in EU project preparation and implementation over two cycles of EU projects, which may also contribute to a smoother process.)

118. On Axis 6 in particular (and to a lesser extent in Axis 7), the main administrative obstacles in implementation were as follows:

- *Project appraisal process:* The project appraisal process is perceived by beneficiaries on Axes 6 and 7 as too lengthy, and changes of the rules between the time of application and contracting could cause difficulties in implementation or lead to ineligibility of expenses. This was the case on SO 7.1, where the introduction of a new criterion (heat load/km) required some beneficiaries to revise rather substantially the projects before the final submission, thus excluding a part of the network that no longer met the new criterion to avoid ineligible expenses. The issue of delays in evaluation is mentioned also by beneficiaries in other SOs; the general unpredictability of the legal framework during the long evaluation period may also lead to increased costs – e.g. the adoption of Governmental Emergency Ordinance (GEO) 114/2018, which increased construction costs; or ANRE Order 183/2021, which requires distribution companies to connect new consumers free of charge, thereby increasing costs, including under the projects submitted for EU financing for SO 6.1).
- *State aid issues:* variations in the interpretation of state aid rules by the Competition Council, which in part follow recent amendments and clarifications of state aid rules in Brussels (e.g. legal state aid for natural monopolies both state and private; and for local authorities as energy producers and owners of heating grids). These triggered amendments to the applicants' guidelines and adjustments to projects that beneficiaries had prepared in expectation of the calls or had already submitted and were under evaluation. On SO 6.2, a de minimis scheme was preferred to avoid state aid complications, but the small value of financial support (up to €200,000) discouraged some potential beneficiaries from applying, as these are mostly rather large industrial consumers.
- *Bureaucracy:* Some beneficiaries mentioned duplication in reporting to the MA and regional directorates (either same data in different formats, or same data requested by different counterparts because of staff turnover at MA/RID and loss of institutional memory), as well as the excessive documentation needed for relatively small projects (in particular SO 6.2). Changes in reporting formats during the implementation may also be an obstacle for beneficiaries, while potentially creating difficulties for the MA in terms of comparative evaluation or benchmarking. However, the issue concerning bureaucratic overload / red tape during implementation did not emerge as a particular concern in the discussions with beneficiaries. In general, beneficiaries of EU funds also have an understanding on the complexities of the management of the OPs and the paperwork involved, while the responsiveness of MA and RID to any requests from beneficiaries contributed to a good relationship.
- *Knowledge-sharing and training needs:* Given the relative complexity of project preparation and management of EU funding requirements, beneficiaries (particularly in Axes 7 and 8, local authorities and state-owned companies) consider capacity building essential to increase absorption. Support from facilities such as TA, the EIB's Joint Assistance to Support Projects in European Regions (JASPERS), and the EIB's Project Advisory Support Service Agreement (PASSA) for the preparation of projects, interpretation of EU rules (such as state aid), and institutional assessment (such as Bucharest DH) have been crucial to overcoming major bottlenecks in absorption. On Axis 6, where beneficiaries are mostly private companies with

relatively stronger capacity in project management, the need for training stood out less, but they welcomed the opportunity to meet other beneficiaries from the same SO to share lessons learned from the projects.

EQ 6: To what extent are the LIOP energy interventions cost-efficient?

119. For projects contracted under LIOP energy, beneficiaries submitted ex ante cost-benefit analyses (CBAs) during the project application process; a summary of the key elements is presented in the table below, where we illustrate one project per SO. The main findings from the CBA analysis, and also from discussions with beneficiaries, are as follows:

- Financial and capital internal rates of return (IRRs) indicate that projects supported by LIOP would not have taken place without the EU financing, nor would beneficiaries have made profits without the grants. Financial sustainability is ensured by regulated tariffs covering maintenance (6.1, 6.3, 7.1, 7.2, 8.1, 8.2). For SO 6.2 (smart metering in industry), where benefits cannot be realized without additional investments, the project is justified in terms of future benefits from changing equipment with more energy-efficient solutions. The findings are confirmed from discussions with beneficiaries, who highlight that without EU funding they would most likely not have undertaken the projects (all SOs except 6.2 and 6.4) or that they would have possibly made the investments but the repayment period would have been much longer, with additional risks. It must be noted, however, that the CBA results depend also on other factors, such as the availability of other support mechanisms or market conditions or the extent to which the regulatory and legal framework encourages investments.
- Despite negative IRR figures, the intervention and support is justified in terms of non-financial benefits which are correlated with results indicators (energy savings, reduction of losses, share of RES in the energy mix etc.).
- Depending on the amount of the support, projects calculate the CBA for at least two scenarios (without / with EU funding) or, for large projects, several scenarios (e.g., alternative technical solutions to achieve the same result). The "without EU funding" is an ex ante contrafactual analysis. For all projects, the ex ante CBA demonstrates that the EU funding is justified. Also, for projects above €10 million a sensitivity analysis is performed.

120. Table 3.2 summarizes the ex ante CBAs for the projects selected for evaluation.

Table 3.2. Ex ante CBA results

SO / SMIS project code	*6.1 - 105731*		*6.2 - 109617*		*6.3 - 114790*		*6.4 - 115900*	
Reference period (years)		20		17		19		20
Financial discount rate (%)		4		4		4		4
Main components	Net value	NPV	Net value	NPV	Net value	NPV	Net value	NPV
Total investment costs	13,144,684	12,000,356	1,076,268	1,048,657	29,659,197	27,885,376	36,794,749	33,811,628
Residual value	316,689	144,533	-	-	1,895,633	899,748	1,214,228	554,158
Revenues		59,441		190		619,690		134,465,109
Operational & replacement costs		813,154		332,162		5,032,311		84,120,620
Net revenue		1,017,127		332,352		4,752,253		50,898,647
Total investment costs - net revenue		10,983,229		716,305		-32,637,629		-17,087,020
Pro rata NPV (%)		0.92		0.68		1.17		-0.51
	No EU support	With EU support	No EU support	With EU support	No EU support	With EU support	No EU support	With EU support
Financial IRR (%)	-13.75	-4.46	-9.7	5.65		24.7	3.84	5.3
NPV (€)	-10,983,229	-1,871,451	-716,365	32,126	6,306,878	3,246,644	-101,683	743,553
Financial IRR	<4%, needs EU financing		<4%, needs EU financing		<4%, needs EU financing		<4%, needs EU financing	
Capital IRR	<4%, cannot repay		<4%, cannot repay		<4%, cannot repay		<4%, cannot repay	

SO / SMIS project code	*7.1 - 108460*		*7.2 - 138142*		*8.1 - 129245*		*8.2 - 122972*	
Reference period (years)		20		25		25		26
Financial discount rate (%)		4		4		4		4
Main components	Net value	NPV	Net value	NPV	Net value	NPV	Net value	NPV
Total investment costs	21,741,808	20,905,584	254,218,272	236,993,270	56,759,192	55,459,134	152,721,464	150,075,873
Residual value	1,038,777	474,084	92,467,927	36,073,724	12,656,618	4,937,618	67,760,944	29,735,779
Revenues		63,455,859		417,607,838		465,212,946		125,338,101
Operational & replacement costs		63,455,859		424,450,723		448,096,307		53,821,864
Net revenue		474,084		29,230,839		22,054,257		101,252,016
Total investment costs - net revenue		20,431,500		207,762,431		33,404,877		48,823,857
Pro rata NPV (%)		0.98		0.88		0.6		0.33
	No EU support	With EU support	No EU support	With EU support	No EU support	With EU support	No EU support	With EU support
Financial IRR (%)	-11.6	-5.8	-4.8	2.75	-2.08	2.97	1.27	3.66
NPV (€)	-19,957,416	-2,661,754	-207,762,432	-10,198,471	-33,404,877	-3,620,448	-48,823,857	-4,251,368
Financial IRR	<4%, needs EU financing		<4%, needs EU financing		<4%, needs EU financing		<4%, needs EU financing	
Capital IRR	<4%, cannot repay		<4%, cannot repay		<4%, cannot repay		<4%, cannot repay	

121. Given the implementation status, the cost efficiency of the projects cannot be properly assessed at this stage, requiring an analysis after the implementation, i.e., after the effective costs are incurred and actual benefits of finalized projects start to accrue. This will be possible in subsequent evaluations, most likely in the final evaluation in 2023. Such analysis would consider several possible options for assessing the cost efficiency of the interventions, e.g. benchmarking of finalized projects (cost per unit of result achieved) from the same SO. This may be possible for some of the projects on SO 6.1-6.4, where projects are selected competitively for financing, e.g. such an analysis may be able to provide information for better targeting of financial support in the next cycle (such as prioritization of eligibility criteria in the applicants' guidelines) for interventions that will continue after 2023.

122. Other types of benchmarking (e.g. comparison of cost per output / result with similar interventions with EU funding from other countries) could be feasible, though the interventions may be too specific and dependent on various factors (such as local conditions) to allow direct benchmarking. For example, the cost per km of DH pipeline or cost per energy saved could differ substantially among projects in various cities in Romania and other European cities.

3.4. Impact

EQ 7: What is the emerging progress in meeting the program/project SO in targeted sectors, territories, and groups since the adoption of the interventions?

123. The progress measured in outcome indicators is summarized in Table 3.3. Overall, we expect that the program, after a slow start, is on a good track to have the expected impact by 2023 for most of the SOs (except SO 7.2 – Bucharest DH, which will not be finalized by 2023 and will likely be moved to the next programming cycle). SOs 7.1 and 8.1 are also at potential risk that project implementation could exceed 2023. For two SOs (6.3 and 7.1) the outcome indicators will not be achieved. This is not caused by lack of impact, however, but by issues in defining indicators that can both be monitored (data collection) and captured effectively.

Table 3.3. Progress in Meeting the Program SO in Targeted Sectors, Territories, and Groups

SO	*Indicator*	*Baseline 2013*	*Actual value 2020 or 2018*	*Target 2023*
6.1	Gross primary energy production less used RES	76.38	104.5	455.96
6.2	Energy intensity in industry (kgoe/ €1000)	183	140.9	121.5
6.3	Average household consumption (MWh/hh/year)	1.42	1.35	1.2
6.4	Primary energy savings (1000 toe/year)	178	209	232
7.1	Network losses (%)	26.76	28.54	15
7.2	Network losses (%)	26.76	28.54	15
8.1	Increased RES integration capacity (MW)	2200	3200	3200
	Technological level of smart gas grid	0	0	2
8.2	Interconnection capacity (bcm/year)	14.35	15.85	20

Source: Data from SMIS database (2020) for SOs 6.1-7.2 and from Annual Implementation Report (latest available - 2019) for SOs 8.1, 8.2. It must be noted that data on output indicators reported in SMIS generally refers to outputs expected after the finalization of the contracts under implementation; whereas data in the annual implementation reports are usually estimates for the actual level of implementation. The difference is significant for large projects on Axes 7 and 8. The SMIS data is overoptimistic to the extent there is a risk that some of the projects on Axes 7 and 8 might not be finalized, requiring “phasing” (i.e. moving the non-finished works to the next programming cycle).

SO 6.1: Increasing energy production of less-exploited renewable resources (biomass, biogas, geothermal)

124. The SO interventions were fine-tuned during the implementation of the LIOP, focusing on specific project types based on the interest expressed by project applicants; currently the allocation is split between investments in distribution (60 percent, with a 93 percent contracting rate) and geothermal heating (40 percent, with a 62 percent contracting rate). Projects that are currently under implementation will be finalized before 2023, and two of the output indicators – the number of modernized electricity distribution stations and the installed capacity (in MW) – will likely be achieved by the end of the program with just the ongoing projects, assuming they are duly finalized; in this case, the outcome (increase of primary RES production) could also be realized. This is very likely, as they are generally smaller projects and the ongoing projects were put on hold just temporarily for a few months because of the pandemic, when works were more difficult; works have resumed in recent months.

125. As of February 2021, there were another 39 project applications under evaluation and 2 additional projects approved for financing on distribution, but not yet contracted. Additional projects will be needed to achieve the third output indicator (reduction of CO_2 emissions). We expect that new projects (more likely on the distribution component) will be concluded in the next few months covering the entire allocation and that the output indicators will be achievable by 2023.

126. The outcome indicator cannot be measured because there is no completed and fully operational project. In terms of estimated impact, according to beneficiaries with more-developed projects on distribution networks, the finalized projects will likely contribute to the better integration of RES in the electricity network. Currently, without automation, the distribution needs to cut off renewables from supplying the grid for longer periods than will be the case after projects are finalized. Also, the two beneficiaries have projects under SO 6.3, which will reinforce the integration of renewables, including from prosumers.

SO 6.2: Reducing the energy consumption of industrial consumers

127. So far, 15 companies (representing roughly 23 percent of total allocation and a quarter of the target of 60 supported companies) have been supported under SO 6.2, of which 12 were finalized in 2019-2020; the other 3 are close to completion or are in the final tests before being put into operation. As of February 2021, there were 36 additional projects under evaluation, 5 of which have had been approved for financing, though the contracts had not yet been signed. There are thus good prospects that the financial allocation will be fully absorbed by 2023.

128. The installation of smart metering systems at industrial consumers is expected to provide information to the management that will support further investments in more energy-efficient equipment (thus a part of energy savings could be realized after additional investments that

beneficiaries would make after obtaining the information on consumption from the smart metering). However, the smart metering systems also inform existing business processes; for example, some beneficiaries with well-advanced or finalized projects indicated they have already made changes in the operation of the existing equipment, such as avoiding idle production time or disconnecting equipment from energy supply when not in operation; this has visibly reduced consumption of certain energy supplies such as electricity, compressed air, and steam. Given the energy intensity reported for 2019 in the annual implementation report (the latest data) and current trends, it is very probable that the energy efficiency target will be overachieved by 2023.

SO 6.3: Reducing the average power consumption of households

129. Two projects are ongoing under SO 6.3 and 13 more are under evaluation; we expect that about six more projects can be implemented by end-2023, which would cover the full allocation and reach the output indicator of 80,000 households connected to smart metering in electricity distribution.

130. The outcome indicator (showing electricity consumption per household, with the baseline 2014 and target for 2023) is unlikely to be achieved, mostly because there are other factors apart from energy efficiency which influence the consumption. These include the substitution of electricity for other energy sources (e.g. change of heating source, electromobility) and increased usage of household appliances.

131. In terms of expected impact, the highest concern is the delay in implementing the demonstrative projects under LIOP, pilot projects supported by ANRE regulations, and the full roll-out for smart metering. Demonstrative projects in LIOP and pilots were designed to inform the full roll-out by revealing the true costs of smart metering and developing the capacity of electricity distribution operators to install the system. This is because, prior to the pilots and demonstrative projects under LIOP, there were only very broad estimates of the costs for the entire roll-out; these were presented in 2012 in a study done by AT Kearney for ANRE, which indicated that the roll-out (by 2020) would be economically feasible.

132. However, delays in the demonstrative projects, wide-ranging cost estimates noted by distribution operators during the pilots, as well as delays in ANRE's preparation of a calendar for the roll-out (confirmed in primary legislation) led to an increased risk that, by the time the LIOP projects are finalized, the technology used in these projects might be outdated for a roll-out expected by 2028. It is worth noting that among distribution companies, only ENEL was fully supportive of an accelerated roll-out (as it already had substantial prior experience in Italy with 99 percent rollout of smart metering and already implementing the second generation of equipment); whereas the other distributors, including the two beneficiaries under SO 6.3, were rather reluctant to commit to an ambitious roll-out. (An important contribution of SO 6.3 was to mitigate the concerns of DSOs with less experience in smart metering.)

SO 6.4: Increasing savings of the consumption of primary energy produced by high-efficiency co-generation systems

133. 12 projects are under evaluation and another project has been approved, apart from the two projects under implementation, which gives assurance that the output indicators (number of companies supported, installed capacity, and CO_2 emissions reduction) will be achieved by end-2023. It should be noted that the estimated reduction in CO_2 emissions is based on the characteristics of the equipment, not actually measured, which means the indicator will be automatically reported as achieved once the capacity is installed. The reduction of primary energy consumption is likely to be achieved by 2023, given the current trend and considering the finalization of the other projects. However, the conditions for financing (coupled with the lack of support for larger capacities of industrial cogeneration) may cause some of the beneficiaries to invest in smaller than optimal capacity.

SO 7.1: Increasing the energy efficiency of DH systems in selected cities
SO 7.2: Increasing the energy efficiency of DH systems in Bucharest

134. The projects for DH networks in five cities are ongoing except for Oradea's first project, which was recently completed; Iasi and Focsani are also at about 90 percent completion rate. To increase absorption, in September 2020 the program was amended to accept applications from other cities apart from the pre-selected seven cities under SO 7.1. As of February 2021, three more projects are under evaluation.

135. The total network length modernized under the contracted projects will exceed the target output by 2023 (295 km vs 210 km) if the implementation does not incur significant delays. There is a risk that procurement of certain equipment (pipes in particular) will be constrained by availability in the market. Also, the capacity of municipalities to implement works may face constraints (with the exception of Oradea and possibly Iasi and Focsani, which were the most advanced in preparing, submitting, contracting and organizing the procurement and works).

136. Since projects supported under LIOP focus on large DH transport infrastructure (as opposed to distribution networks), which crosses major roads, the acceleration of works toward the end of the period is likely to cause more disruptions in the city (traffic, noise, etc.); in some cases this could prompt the municipality to postpone some of the works to minimize urban disruptions, which would lead to additional delays. (This could be the case, for example, in Timisoara, which is the European capital of culture for calendar year 2021.) In case of delays that push the completion date beyond 2023, there is an expectation that the projects could be "phased" (i.e. split into segments, covering the works executed by 2023 under the Operational Program for Large Infrastructure (POIM) and seeking financing in the next cycle). While "phasing" minimizes decommissioning of funds for works started but not completed, it leads to foregone EU funds in the current cycle (for the portion not finished) and consumes amounts from the budget in the next cycle that could have been put to better use. One project for which "phasing" is almost certain is Bucharest DH. This is also visible from the current allocation under SO 7.2, for which the amount of the approved project is double the allocation.

137. However, the projected impact (reduction of total losses on the networks compared to the baseline year 2014) is unlikely to be achieved by 2023. It must be noted that the indicator selected for

the monitoring of impact covers overall losses in the entire DH networks in the country (not just for the projects supported under LIOP). Since the beginning of the LIOP, the situation of the DH sector in Romania has deteriorated, following increased disconnections, backlogs in maintenance, and below-cost tariffs, including in the cities that are supported under the program. Two cities (Bacau and Botosani) that were preselected for financing at the programming stage do not have financing contracts.

Figure 2. DH disconnections in cities supported by LIOP, 2019 vs 2013

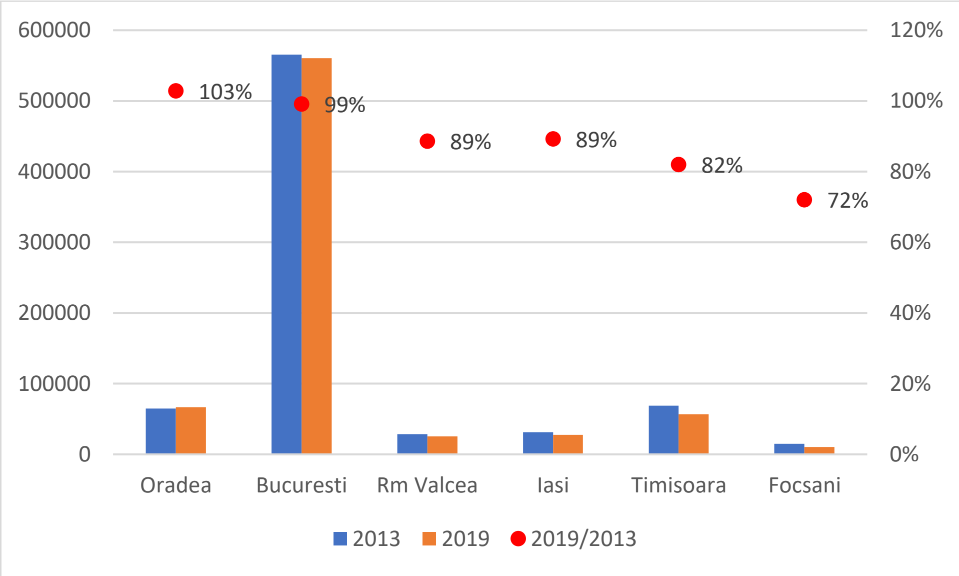
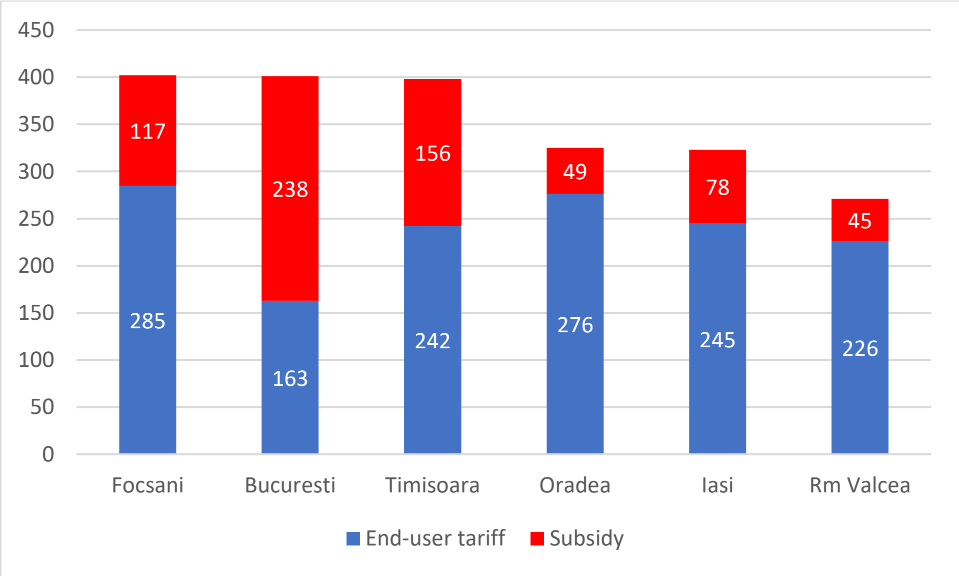


Figure 3. Tariffs vs subsidy for DH in cities supported by LIOP, 2018



Source: ANRE, ANRSC

SO 8.1: Increasing the capacity of the national energy system to use energy produced from renewable resources

138. Procurement for the works under SO 8.1 is currently ongoing and Transelectrica expects the project to be finalized and operational two years after the contracts are signed. The output and outcome indicators (km of modernized line and additional RES capacity integrated into the system) are reported as realized both in the Annual Implementation Report and in the SMIS database, although construction has not started. It can be expected that, if built, the project would indeed remove critical bottlenecks in the transmission of RES energy from Dobrogea to the rest of the country and enhance the capacity for RES installation in the region in the future.

139. Currently, RES investors looking for opportunities in wind or solar in the region face issues and additional costs in obtaining the connection approvals. However, there is a risk that the implementation could slip beyond 2023. (It must be noted that Transelectrica's successive 10-year network development plans indicate major delays in all investments. About 80 percent of the projects to modernize the network in general and almost 100 percent of the projects critical to integrating new RES have delays of 1-3 years, some even up to 10-15 years (WB/IFC InfraSAP report on RES, 2020[6]).

140. The delays so far on SO 8.1. resulted from land expropriations, construction permit obtention delays, and adjustments of costs compared to the initial project application (caused by reassessment of state aid rules, but also inflation since 2014). These are common issues in building infrastructure in Romania. Other frequent issues, however, which could further delay the project from this point forward are bidding contestations or delays in the actual works; such delays could push the finalization beyond 2023.

SO 8.2: Increasing the interconnection capacity of the National Transmission System of natural gas with other neighboring countries

141. The construction of pipelines and compressor stations for the interconnection with Moldova is ongoing. As mentioned earlier under EQ 2, there are several factors which could influence the longer-term impact of the project, mostly whether offshore gas in the Black Sea becomes available in the market; whether the alternative route via Isaccea becomes accessible for exports to Moldova (and Ukraine); future developments concerning Gazprom's gas supply to the region following the construction of Turkstream; and the functioning of gas market institutions in Moldova, which would allow Romanian suppliers to compete on a level playing field.

EQ 8. To what extent may the observed progress be attributable to the funded interventions (that is, what is the net effect)?

142. The energy-related axes of LIOP differ substantially in scope. Axis 6 covers "niche" areas in which there is relatively limited progress supported by other policy instruments, where the market has not led to investments, and which represent small interventions rather with demonstrative purposes for

[6] InfraSAP Report, Romania, 2019–20, focusing on District Heating and Renewables; Regulatory Impact Assessment for smart metering in electricity, 2016–2017; Assessment of the Co-generation Bonus, 2015.

potential future scale-up; in these areas the impact (contribution to Romania's global targets for energy efficiency, RES share, emission reductions) is minor. By contrast, Axes 7 and 8 cover parts of infrastructure where other instruments (investments from public budgets, other EU funds, etc.) have complementary interventions under LIOP.

143. For SO 6.1., 6.2 and 6.4, there were no similar initiatives or programs; given the current level of implementation (as of February 2021), the interventions are not mature enough to inform either companies (to continue similar investments using other sources of funding) or public policies (to scale up similar support).

144. For SO 6.3, in parallel with the LIOP, distribution companies implemented pilot projects for smart metering in 2014-18 and, based on data obtained from the pilots, submitted to ANRE proposals on prioritization of roll-out by 2026-28 (see Table 3.4). It must be noted that there was a very large disparity among distribution companies in terms of capacity for smart-metering implementation in 2012-14, with ENEL (Muntenia S, Banat, Dobrogea) well ahead of the others having prior experience with a 99 percent roll-out in Italy. Oltenia (Distributie Oltenia, formerly CEZ) and Moldova (Delgaz Grid, owned by E.ON) did not have experience and were rather reluctant on the roll-out; they were more interested in testing the feasibility and possibly undertaking such investments than Electrica (which remains de facto state-managed, at 49 percent state ownership – Muntenia N, Transilvania N, Transilvania S). While ENEL, unlike other DSOs, could estimate well the potential costs based on prior experience in installing such equipment, all companies had major difficulties in estimating the benefits for the smart metering in Romania (most importantly, there was no granular data on consumption beyond the transformers, and only rough estimates of commercial vs. technical losses, energy thefts, etc.). Distributie Oltenia and Delgaz Grid used LIOP to complement the information from the pilots, though the projects are still not completed and so cannot provide real-life information. The lack of data continues to delay the national roll-out of the smart metering in distribution (which was recently pushed to 2028 by amendment of the Law 123/2012).

Table 3.4. Pilot projects for smart metering

DSO	*Prioritization of roll-out from ANRE pilots*	*LIOP*
Muntenia S	Areas with obsolete metering; high losses; meter reading problems	Not yet supported
Banat	Areas with obsolete metering; high losses; meter reading problems	Not yet supported
Dobrogea	Areas with obsolete metering; high losses; meter reading problems	Not yet supported
Oltenia	Best CBA results; high losses; optimization of transformers and data collection	Identification of areas with of highest losses; reduction of interruptions
Moldova	Areas included in 2014-2018 pilots with delays in implementation; energy thefts; commercial losses above 0.08 MWh/year/consumer; minimization of reading costs	Reduction of losses; demand management; adequate consumption data collection
Muntenia Nord	Best CBA results; high technical and non-technical losses	Not yet supported
Transilvania N	Best CBA results; high technical and non-technical losses	Not yet supported
Transilvania S	Best CBA results; high technical and non-technical losses	Not yet supported

145. SO 7.1 and 7.2 – It must be noted that the results indicator selected consists of the overall reduction of losses in the DH grids at the national level; this is because the selected cities are among

the largest DH systems remaining in the country and high-priority investments in large transport networks would help reduce overall pipe losses. LIOP funding is the main source of financing for these networks; the other programs (Termoficare 2006-20 and the new Termoficare started in 2021) made rather minor contributions to the overall modernization of the DH networks, covering small works. Beneficiaries on LIOP also confirm that LIOP standards (project preparation, specifications for equipment, procurement, etc.) are much higher than for national financing, which leads to incomparable quality. Overall, there is little observed progress in the sector beyond LIOP intervention; and there is even a risk that some of the LIOP projects might not be completed by 2023 (in particular Bucharest DH – SO 7.2).

146. SO 8.1. – The project is closely linked to other projects that would enhance the connectivity of SE Romania (the area concentrating the largest wind capacities and with the highest potential, including for offshore wind) with the rest of the country. However, there is little progress beyond the LIOP intervention. Delays in investments in Transelectrica's priority projects to integrate RES have led to excessive costs for RES producers to connect to the grid (investors are required to pay a "network strengthening tariff" that can be prohibitive, amounting to 12-15 percent of the total investment cost, according to the 2020 InfraSAP Report). It should be noted that no large RES investments in electricity connected directly to the transmission grid have been put into operation after 2016, for multiple reasons (amendments to the Green Certificates scheme and impossibility of concluding PPAs, but also grid connection restrictions).

147. SO 8.2 – The project is the "missing link" in the interconnection of gas with the Republic of Moldova (which consists of the project under SO 8.2, Iasi-Ungheni, and Ungheni-Chisinau pipelines. The interconnection capacity increase will be fully attributable to the project, as without the Onesti-Gheraesti-Letcani pipeline and two compressors supported by SO 8.2, the gas capacity for physical exports is minimal (about 1 percent of the 1.5 bcm at the finalization of the project.)

EQ 9. What is the existing estimated network effect of the funded interventions?

EQ 10. To what extent could the effects occur beyond the targeted territory, sectors, or groups (estimated spillover effects)?

148. Given the current level of implementation, with very few projects finalized and operational, the evaluation team has grouped the two questions. There is no current network impact and it is too early to assess in detail the potential impact, including spillover effects after the finalization of the program. Based on discussions with beneficiaries, we expect the projects will indeed have spillover and network effects, highlighted in Table 3.5.

Table 3.5. Estimated Spillover Effects

Specific Objective	*Summary of interventions*	*Estimated network effects at end-of-program in 2023*
Priority Axis 6: Clean energy and energy efficiency in order to support a low-carbon economy		
SO 6.1: Increasing production of energy from renewable and less-exploited (biomass, biogas, geothermal)	Projects for renewable energy sources (RES) capacities - geothermal	Additional knowledge of costs and benefits of geothermal; identification of bottlenecks affecting investments in the sector (e.g. the risk that investments can turn out not to be economically feasible because the real geothermal potential is discovered only after the investment is made). Demonstrative effects for the modernization of DH systems and integration of RES in DH.
	Projects for distribution to integrate RES capacities	Raised confidence from RES investors and prosumers that distribution grids would be capable to better integrate RES
SO 6.2: Reducing the energy consumption of industrial consumers	Smart metering for industrial consumers	Increased demand for energy-efficient equipment by various types of industrial consumers (medicine; chemical; constructions; engines etc.)
SO 6.3: Reducing the average power consumption of households	Smart metering in distribution for households	Enhanced knowledge of real-life issues of the distribution networks; increased demand for smart metering solutions (equipment, software, data management processes)
SO 6.4: Increasing savings of the consumption of primary energy produced by high efficiency co-generation systems	Small industrial cogeneration units	Increased demand for equipment; better management of energy demand; reduced bottlenecks in the national infrastructure (e.g. less electricity demand from the grid, produced in house)
Priority Axis 7: Energy efficiency at system level centralized heating in selected cities		
SO 7.1: Increasing the energy efficiency of DH systems in selected cities	DH network investments	Potential turnaround of DH policy, largely neglected after 2000. Possible recovery of domestic production of supplies for the DH, which was shut down after years of neglect, if the DH investments take place as planned; possible development of prosumers in DH, if networks are modernized and digitalized, allowing the technical possibility of future integration of RES (not only geothermal, but also energy produced by PV at consumer level or heat recovered from industrial processes)
SO 7.2. Increasing the energy efficiency of district heating system in Bucharest	DH network investments	Potential turnaround of DH policy, largely neglected after 2000. Possible recovery of domestic production of supplies for the DH, which was shut down after years of neglect, if the DH investments take place as planned; possible development of prosumers in DH, if networks are modernized and digitalized, allowing the technical possibility of future integration of RES (not only geothermal, but also energy produced by PV at consumer level or heat recovered from industrial processes)
Priority Axis 8: Intelligent and sustainable transmission systems for electricity and natural gas		
SO 8.1: Increasing the capacity of the national energy system to use energy produced from renewable resources	Transelectrica line and stations	Acceleration of Transelectrica's investments in the grid. The project also contributes to reinforcing another investment project related to interconnectivity with the region (Bulgaria). Grid reinforcement on EU funds would diminish the "network strengthening tariff" now requested from RES investors to obtain connection permits and increase confidence of RES investors in the capacity to maximize usage hours of installed RES

SO 8.2. Increasing the interconnection capacity of the National Transmission System of natural gas with other neighboring countries	Transgaz pipeline to Moldova and compressors	Increased reliability of gas transport for connections to new distribution grids to underserved areas in Moldova

3.5. Sustainability

EQ 11: To what extent are the interventions' effects expected to be sustainable over a longer period of time?

149. Given the current level of implementation, the sustainability can be assessed at this stage mainly in terms of expectations of beneficiaries and the provisions they make for the adequate maintenance of the equipment funded through the interventions under LIOP. The projects financed under LIOP will be monitored for a period of five years after finalization and start of operation, which provides additional assurance on the sustainability. Projects at risk in terms of sustainability are the projects for which finalization could be extended after end-2023 ("phased" into the next budgetary cycle).

SO 6.1: Increasing energy production of less-exploited renewable resources (biomass, biogas, geothermal)

- Distribution: DSOs supported under LIOP expect that maintenance will be assured from distribution tariffs regulated by ANRE because investments would be included in the regulated assets base.
- Production: given the eligibility constraints, potential beneficiaries were extremely prudent in applying for the financing under LIOP. Investments will remain eligible only if geothermal wells prove economically viable; otherwise, the investment costs will be covered from local budgets at the end of the projects. The economic viability will be demonstrated by the integration of geothermal energy into the DH systems.

SO 6.2: Reducing the energy consumption of industrial consumers

150. Beneficiaries of projects that have been finalized or are close to finalization are confident that the installed smart metering systems will contribute to process optimization and inform future purchases of energy-efficient supplies.

SO 6.3: Reducing the average power consumption of households

151. For the two DSOs with ongoing projects under LIOP plan, ensuring the smooth integration of the demonstrative projects currently under the full roll-out will require that the equipment installed now (with LIOP funding) is compatible with the equipment used for the whole system. The sustainability will decrease if the full roll-out of smart metering is further delayed, because the

technological changes could limit the compatibility with technical solutions that could become mainstream by the full roll-out by 2028.

SO 6.4: Increasing savings of the consumption of primary energy produced by high-efficiency co-generation systems

152. It appears that the investments are sustainable because, although evidence from the LIOP beneficiaries indicates that the investments would have been possible in the absence of support, the investment payback period would have been much longer (7-8 years compared to 3-4 years with support). The potential risk consists of future changes in the business models of the supported companies (e.g. changes in the production markets in which the industrial beneficiaries operate).

SO 7.1 Increasing the energy efficiency of DH systems in selected cities

SO 7.2: Increasing the energy efficiency of DH systems in Bucharest

153. The major sustainability risks consist of the possibility that some of the projects are not completed by 2023 (in particular Bucharest DH), prompting the need for “phasing”. DH systems in all the cities (except Oradea) face additional sustainability problems, such as disconnections. Cities such as Ramnicu Valcea and (partly) Timisoara face an additional risk related to the coal phase-out: the DH generation is currently coal-fired and major investments are needed to replace the heating source.

154. The approach for the DH programs in SOP Environment and LIOP may have also been suboptimal, as the investments started from generation and then networks, instead of energy efficiency at the consumer level (thermal insulation of multi-apartment buildings). Currently, DH projects are only marginally linked with support for energy efficiency in buildings. For example, some cities support thermal insulation efforts for multi-family buildings connected to DH; but there is no initiative to modernize DH networks with priority for consumers who are already part of a program of thermal insulation supported from local, national or EU funds, or the other way around.

155. There is a risk that the DH capacities planned for upgrading will remain oversized compared to the final demand and the disconnections will continue even after modernization of the pipes. Thus, an oversized system would continue to be inefficient (e.g. pipelines whose diameter is too large for the final heat demand will have higher losses than smaller pipes adapted to the effective demand).

SO 8.1: Increasing the capacity of the national energy system to use energy produced from renewable resources

156. The investments in the electricity line and stations have now become more urgent than at the programming stage given the accelerated investments in RES in Southeast Romania in 2013-16 and the future expected investments in offshore wind, which are expected to take place in a few years. The investment would be introduced in the regulatory asset base, which ensures that maintenance will be recovered from the ANRE-regulated distribution tariffs.

SO 8.2: Increasing the interconnection capacity of the National Transmission System of natural gas with other neighboring countries

157. There is a risk that the gas pipeline interconnection with Moldova could be underutilized if the market conditions in Moldova discourage supplies from Romania and if the Isaccea border crossing point becomes accessible for gas exports to Moldova and Ukraine. However, the pipeline also strengthens the gas transport network in Northeast Romania, which would allow the extension of distribution to Romanian households in the region which are not yet connected to gas supplies (mainly in rural areas). The compressors (which represent the largest share of the investment) will also be needed to enhance Romania's gas export capacity to Moldova and Ukraine, regardless of the route (via Iasi-Ungheni or via Isaccea).

158. A critical issue for the sustainability of the investment is the fact that it is not "future-proof": that is, the gas infrastructure was not designed having in mind the transition from gas to "green gas" (such as hydrogen) and the equipment will possibly require new investments to ensure compatibility with such other types of gas. There is a risk that the investments could become "stranded assets" by 2050, as fossil fuels are phased out in the EU. This trend, which has been accelerated by the new directions in the European Green Deal, was not anticipated at the programming stage.

EQ 12: To what extent should the LIOP energy interventions be further funded?

159. The current level of absorption of EU funds on all the energy-related LIOP Priority Axes indicates that the causes for delays need to be urgently addressed before considering further funding of the LIOP energy interventions. As highlighted above, the main issues to be addressed prior to considering extending the financing are as follows:

- Increased capacity for legal interpretation of EU state aid rules, which have caused significant delays and amendments of the guidelines for applicants;
- Increased project appraisal capacity to reduce the time between submission of project applications for funding and contracting;
- Streamlining the legal and regulatory framework concerning expropriations and construction permits;
- Streamlining tender procedures (based on experience with other large infrastructure investments – especially for projects on Axes 7 and 8 – one can expect delays in organizing tenders, including the preparation of terms of reference and selection of contractors); and
- Monitoring the works to ensure good quality and timely finalization.

160. To the extent these issues are addressed, most of the priorities supported by LIOP in energy are still relevant today (or even more urgent than at the LIOP programming stage), as follows.

SO 6.1: Increasing energy production of less-exploited renewable resources (biomass, biogas, geothermal)

161. Accelerating investments to ensure integration of RES in distribution grids is critical. Also, investments in geothermal can have significant spillover effects into providing DH systems with low-

cost, clean and renewable energy. The measures can still be funded in the next programming cycle based on lessons learned in the current 2014–20 OP (mainly the state aid scheme). The next programming period, while maintaining continuity, could also introduce higher standards for the projects to accelerate modernization of infrastructure, e.g. additional eligibility for electricity storage projects, which could also contribute to better integration of RES (new capacities and optimized use of installed capacities).

SO 6.2: Reducing energy consumption of industrial consumers

162. This SO is relatively more successful in terms of project maturity. The limited appetite of the beneficiaries to apply for this SO stems from the choice of a suboptimal state aid scheme (de minimis, capping the maximum support for one project to €200,000).

163. Normally, smart metering for industrial consumers could be entirely market-driven, e.g. industrial consumers should find it easy to invest in such equipment using mechanisms such as ESCOs. In practice, the ESCO market in Romania is still insufficiently developed, including for industrial consumers, in part because the liberalization of the energy market has been slow and involved many uncertainties after 2014.

SO 6.3: Reducing the average power consumption of households

164. A full roll-out of smart metering is essential for distribution grid operation and also Romania's commitment to the EU; however, it has been delayed successively by the lack of reliable data on costs and benefits, and the new deadline is 2028. The SO could be extended to the new financing cycle, though possibly targeted specifically to ensure (i) participation of DSOs that have been relatively slow to implement pilots and LIOP-supported smart metering projects (in particular Electrica) and (ii) state-of-the-art technology to ensure equipment does not become obsolete and incompatible with the roll-out.

SO 6.4: Increasing savings of the consumption of primary energy produced by high-efficiency co-generation systems

165. Although Romania's policy has been to support high-efficiency cogeneration, current support covers only cogeneration for DH. A new scheme may be introduced to support industrial cogeneration, with the condition that a certain share of the electricity is delivered to the market (i.e. not only for self-consumption). Since the benefit of energy savings is achieved in any cogeneration process, regardless of whether the energy is consumed "in house" or sold to the market, EU financing could continue to support high-efficiency cogeneration not covered by other schemes, to avoid market distortions as much as possible. The level of ambition could be increased (e.g. support for tri-generation, advanced technology).

SO 7.1: Increasing the energy efficiency of DH systems in selected cities

SO 7.2: Increasing the energy efficiency of DH systems in Bucharest

166. Some of the projects (in particular DH Bucharest) will likely have to be "phased" if the implementation is delayed post-2023. While DH is a top priority in the EU, there is no political leadership on the subject in Romania and no clearly defined responsibilities for the ministries involved, the energy regulator, or the local authorities. Also, the approach to DH in the two financing cycles so far has been not very efficient: OP Environment 2007–13 supported environmental cleanup of CHPs and the current LIOP supported investments in pipelines, with little regard to the link with consumers (e.g. coordination with thermal insulation of buildings and disconnections, official and informal, caused by the poor quality of service). This is likely to have caused excessive investments in infrastructure, which remains oversized to the current demand (which is lower because of factors like disconnections, shorter winters, and better insulated apartments). It must be noted that the newly drafted NRRP does not include DH as it is de facto not a policy priority and no ministry (Energy or Development) intends to take policy and funding ownership. The responsibilities are pending for clarification by Law 325/2006, which has been in Parliament for amendments for four years.

167. If the law is not finally approved to clarify policy ownership and a clear path forward set before the 2021-27 OPs are submitted officially to the EC, the rationale for further supporting DH in the next cycle substantially decreases. EU funding alone will not be sufficient to modernize (overhaul) the DH sector, and there will be little willingness to allocate budget funding if there is no ministerial responsibility and also little willingness from local authorities. At the same time, local authorities that are keen to modernize their DH systems (e.g. Oradea) will be able to attract funding on a commercial basis from banks or private investors, as DH is viable in large cities provided it is well-governed and planned for the long term.

168. Bucharest is the largest DH system in Romania and represents 50 percent of the sector; CHPs of ELCEN are critical for the electricity production and cover about 80 percent of peak demand in Bucharest, and about 50 percent of the company's revenues depend on DH. Discontinuing DH in Bucharest would thus be a significant challenge beyond providing heat for the 560,000 households still connected. However, the first works under SO 7.2. will likely start in 2022, which leaves just two working seasons before the end of the program in 2023. Bucharest city hall will almost certainly need to "phase" the project into the next cycle, completing just a fraction (at best 15-20 percent) of the entire project in the current cycle. The project also represents just the top 20 percent priority of a network that is obsolete and oversized.

SO 8.1: Increasing the capacity of the national energy system to use energy produced from renewable resources

169. Projects supporting the integration of RES into the transport grid continue to remain relevant in the next cycle, as RES potential in Romania is disproportionately concentrated in some areas of the country (Southeast for wind, Southwest for solar), while demand is concentrated in other regions (Northwest, Bucharest). The 2021-27 cycle should focus on higher technical standards and ambitious projects for which tariff recovery may lead to significantly higher electricity prices, such as

digitalization and electricity storage. These would optimize the management of the network and allow for increased integration of intermittent RES. The draft NRRP also mentions similar investment priorities.

SO 8.2: Increasing the interconnection capacity of the National Transmission System of natural gas with other neighboring countries

170. Gas grid investments are critical, as the current network is oversized and obsolete. For example, pressures in Romania's transmission grids are 10-15 bar, whereas neighboring countries have pressures of 40-45 bar. This is the result of obsolescence – old pipes and network structured around gas deposits that have been depleted over the past several decades.

171. In addition, savings from other SOs and from the performance reserve will be invested in the development of distribution grids under SO 8.2. However, gas will be phased out gradually in the EU between 2030 and 2050, and grid developments need 20-30 years for investment recovery. It must be ensured that grid investments will not become stranded assets (infrastructure abandoned before the end of the recovery period).

4. Lessons learned from Poland and Lithuania OPs

172. For the present evaluation, the analysis used experience with similar programs in other EU member states to identify lessons learned and practices that can be useful to accelerate the implementation of the LIOP and enhance its results. The most relevant programs are Lithuania's *Operational Program for the European Union Funds' Investments in 2014–20* and Poland's *Operational Program for smart, sustainable and inclusive growth and the achievement of economic, social and territorial cohesion 2014-20*, both of which are similar to the program being evaluated in this report and have recently performed mid-term evaluation assessments[7]. We analyzed qualitatively the design and implementation experiences on SOs that cover similar interventions with LIOP and on how Poland and Lithuania addressed the issues identified in the LIOP evaluation as major barriers for implementation (e.g. permitting, state aid etc.). Taking into account that the evaluation reports for each program do not cover the same period (up to March 2019 for Lithuania, up to September 2018 for Poland), the following can be inferred from the information available:

- Despite very similar objectives and investment priorities, results indicators (and definition of outcomes versus outputs) vary widely from one program to the other, which makes it difficult to compare results.
- The implementation pace of OPs in Lithuania and Poland seems to have been faster than in Romania.
- Despite differences, a few common issues have been identified at this stage – notably the capacity of the implementation system, lack of clarity of and/or lengthy procedures to access funding, and access to land for construction of power lines.

173. Table 4.1 provides an overview of the three programs.

Table 4.1. Overview of OPs in Romania, Lithuania, and Poland

	Romania	*Lithuania*	*Poland*
Operational Program	Large Infrastructure Operational Program (LIOP)	OP for European Funds' Investments 2014-20	OP for smart, sustainable and inclusive growth and the achievement of economic, social and territorial cohesion
Budget	€498 million	App. €1.21 billion (including investments in transport)	€2.8 billion

[7] Lithuania: https://www.visionary.lt/wp-content/uploads/2019/05/3-mid-term-evaluation-synthesis-report.pdf; Poland: https://www.ewaluacja.gov.pl/media/75771/01_RK_Midterm_POIiS2014-2020_I_VII.pdf.

Priority axis (PA) and thematic objective(s)	• PA 6 (Clean energy and energy efficiency for a low carbon economy) and PA 7 (Energy efficiency at system level centralized heating in selected cities) • Thematic objectives 4 (Supporting the transition shift to a low-carbon economy in all sectors) and 7 (Promoting sustainable transmission systems and removing bottlenecks in key network infrastructures)	• PA 4: Promoting energy efficiency and production and use of renewable energy, with thematic objective 4 (Supporting the shift towards a low-carbon economy in all sectors); and PA 6 (Developing sustainable transport and key network infrastructures) with thematic objective 6 (Promoting sustainable transport and removing bottlenecks on key network infrastructures)	• PA 1 (Low emission economy) and PA 7 (Improving energy security). Thematic objectives 4 (Supporting the shift towards a low-carbon economy in all sectors) and 7 (Promoting sustainable transport and removing bottlenecks in key network infrastructures).
Results (outcome) indicators	• Additional renewable energy • Reduction in industrial energy intensity • Reduction of average electricity consumption per household • Energy savings by high efficiency co-generation • Reduction of heat losses from transmission and distribution networks at national level • Increase capacity to integrate RES into national transmission grid • Transmission capacity at interconnection points	• Share of RE in the final energy balance • Energy intensity in industrial enterprises • Final energy consumption in the service and household sectors • Energy consumption by households (not connected to DH networks) • Transportation and distribution losses in heating networks • Higher quality of electricity supply (SAIDI) • Herfindahl-Hirschman index for energy imports in Lithuanian electricity market and in the natural gas market • Performance level of the N-1 criterion[8] in the natural gas sector	• Share of energy from renewable sources in final gross energy consumption • Primary energy consumption and gross inland consumption divided by GDP • Share of customers using smart meters • Primary energy consumption, GHG emissions, efficiency of energy transfer in heating companies, urban exposed to PM_{10} concentrations • Primary energy consumption and share of combined power generation in the total electricity production • Diversification for the gas sector (Herfindahl-Hirschman index) • Amount of electricity not delivered by the electricity transmission system

[8] The N-1 criterion measures the capacity of the system to face failure or outage of a single system component.

Implementation progress	As of January 31, 2021: • 88% contracting rate for PA 6, 43 percent for PA 7, 39 percent for PA 8 • Indicators likely to be only partially achieved because of the slow implementation of the program	As of March 2019: • 82% of funds contracted • Most indicators are expected to be achieved, despite some underachievement regarding output indicators	As of end September 2018: • 53% of Axis 1 funds contracted • 80% of Axis 7 funds contracted • Most targets expected to be achieved by program end, except for RE, smart meters, PM_{10} concentration and electricity production indicators
Issues identified	• Administrative issues (state aid interpretation, lengthy evaluations, permitting, procurement) • Project planning and preparation, in particular for large public infrastructure projects • Exogenous factors (e.g. changes of legal framework) affecting project viability or beneficiary motivation	• Administrative issues (process of obtaining construction permits, access to land, etc.) • Payback period of investments • Cofinancing requirements and eligibility of costs	• Evaluation method of projects under PA 1 (addressed) • Issues with functionality of the payment claims handling system and capacity of implementing unit • Significant increase in the prices of construction services • Land access (electricity lines)

174. The following section analyses in depth relevant lessons for the LIOP learned from the Lithuanian and Polish Operational Programs, based on their detailed mid-term evaluation reports.

SO 6.1: Increasing production of energy from renewable and less-exploited (biomass, biogas, geothermal) energy

175. Similar to the Romanian LIOP, the main contribution in the Lithuanian program was towards the development of capacity from the renewable energy sources (RES) in the heat sector, as electricity generation from RES is already supported through a mandatory support mechanism for RES producers (including a special fixed fee included in electricity tariff). The Lithuanian government has made a strategic choice to support biomass as the main RES for heat, to support green heating and reduce dependency on (expensive) imported fossil fuels (Romania focused on geothermal energy instead, also given prior mixed experience with the green certificates support for biomass in cogeneration). The share of RES during implementation of the OP in the final energy balance has been growing and the 2020 target value (23 percent) has already been achieved.

176. In the case of Lithuania, there was high demand for the measure on "Renewable energy resources for industry", with companies particularly interested in the opportunity to reduce their operating costs. During the remainder of the OP implementation period, this SO will also support the replacement of polluting biofuel boilers with new ones or more efficient technologies using RES.

177. The Polish approach to supporting renewables is closer to the Romanian model, focusing both on RES generation (e.g. biomass for heat) and on support for connection to electricity distribution networks. The Polish infrastructure OP is a very good example of successful "blending" of available

sources of funding, which ensures leveraging of EU grants for more ambitious results. For example, the program intervention similar to SO 6.1 supported the establishment of a small biomass plant to replace a coal-fired plant in the town of Olsztyn. The same city is planning to build a waste-to-energy plant financed with EU funds from the same Infrastructure OP and with a private investor in a PPP contract (EU grants cover only 21 percent of the total investment cost); the measure is also linked to the SO 1.5 covering energy efficiency in buildings.

178. The other component concerning electricity grid investments is similar to the Romanian SO 6.1 (modernization of substations and lines to integrate renewables).

SO 6.2: Reducing the energy consumption of industrial consumers

179. The Lithuanian OP covers interventions aimed at increasing energy the efficiency of the industrial sector: beneficiaries are asked to undertake an energy audit (which can be financed from the OP) and can then apply for support to implement the recommended measures. Little progress had been achieved under this SO due to lack of uptake from companies. This risk was already identified in 2015[9] as the long payback period (7-8 years) largely seems to exceed what the companies see as acceptable (3 years). This issue was very similar in Romania's SOP Competitiveness 2007–13, which is why the new approach in the LIOP was to focus only on smart metering equipment (though an additional reason was easier state aid rules for small projects, under a de minimis scheme that capped the maximum support for one project at €200,000).

180. In Poland there is no exact equivalent measure; however, the interventions similar to SO 6.4 are much broader in scope (see below).

SO 6.3: Reducing the average power consumption of households

181. There is no direct comparison between Romania's LIOP and OPs in Poland and Lithuania. However, two measures in these OPs are of particular relevance: (i) smart distribution grids and (ii) a focus on energy efficiency for households, targeted at heat demand.

Smart distribution grids

182. Romania's LIOP focuses on a very delayed implementation of demonstrative projects for smart metering, and the next step – development of smart grids – still remains a distant objective, both for transmission and distribution (envisaged for the next cycle and the NRRP). In contrast, in Lithuania, OP 2014–20 specific objective "Implementation of Intelligent Low and Medium Voltage Distribution Systems and Development" aims to invest in advanced electricity distribution network management technologies that enable the development of new services for users and their active participation in the electricity market (distributed generation, demand management, energy storage, etc.). This investment priority is implemented by the measure "To test the implementation of smart grid technologies".

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[9] UAB Ekotermija (2015), *Potential for energy efficiency in industrial enterprises and measures to promote it effectively consumption of different types of energy*, pp. 100-102.

183. The ex-ante evaluation, which identified ways and means of developing a smart grid, has generated substantial discussion at both the Lithuanian and EU levels. At the time of the interim evaluation, three projects were under implementation, with no information on the progress in achieving indicators to renovate the industrial electricity distribution network installed more than 20-30 years ago – through the installation of new power substations, transformer substations, and power lines and the upgrade of transformer substations and distribution points, as well as connection of new users to smart grids.

184. Poland OP also has a specific SO targeted at smart distribution grids – about 23 percent of all households are to be connected by the end of the program. Smart grids contribute to better decentralized balancing of intermittent renewables and the benefits on energy efficiency and integration of RES is leveraged.

Focus on energy efficiency for households targeted towards heat demand

185. Lithuania and Poland included in their Infrastructure OPs measures targeted at energy efficiency in buildings. Romania took a different route, opting to include such measures in the Regional Operational Program, given the split responsibilities for energy and buildings as well as the lack of ownership for district heating. Poland also has a very large program component on energy efficiency in buildings (public and residential), focusing on insulation but also on installation of RES for electricity and heat.

186. With regard to smart meters (which Romania included under this SO), both Lithuania and Poland are much ahead in terms of digitalization and smart metering (e.g. Lithuania is preparing a full roll-out of smart metering for all energy utilities which may be finalized by 2023). Poland incurred initially similar problems as Romania, but a large-scale rollout of smart metering in electricity is now expected by 2026.

SO 6.4: Increasing savings of the consumption of primary energy produced by high efficiency co-generation systems

187. While the Romanian LIOP focuses on industrial cogeneration (the DH cogeneration being supported by a cogeneration bonus scheme), the Lithuanian OP targets larger cogeneration projects which provide heating in the DH system. Thus, the measure "Promotion of high efficiency cogeneration in Vilnius" is supporting the construction of a combined heat and power (CHP) plant with a power capacity of about 100 MW and thermal capacity of about 240 MW, which is about to start operating. The project implementation faced many delays due to a lengthy process for preparation, state aid notification and justification for large-scale infrastructure projects, and coordination with the European Commission. The project has highlighted a wider issue regarding recycling of municipal waste. Lithuania is committed to recycling 50 percent of its municipal waste by 2020; however, additional waste-to-energy cogeneration capacities are being built in Vilnius and Kaunas. The Polish OP is more similar to the Romanian approach, which also targets the support of cogeneration capacities for industrial consumers. The level of technical ambition is high, encouraging also trigeneration (electricity, heat, cold).

SO 7.1: Increasing energy efficiency for DH systems in cities

188. Lithuania has extensive DH systems in nearly all its urban centers. Similar to the Romanian approach, which supported DH in two cycles, Lithuania's OP 2014-20 aimed to build on infrastructure investments made during 2007–13 to replace deteriorated thermal energy pipelines, with a focus on reducing losses and improving the reliability of the centralized heat delivery network. By the end of 2017, 51 percent of the heat loss reduction target had been reached.

189. The conversion from fossil fuels to biofuels in Lithuania's district heating system enabled the introduction of various efficiency measures in heat generation facilities, leading to a reduction in CO_2 emissions by as much as 60 percent over the period of 20 years. However, despite all successful steps taken during the conversion from fossil fuels to efficient and environmentally friendly biofuel combustion technologies, an important aspect in the modernization of the energy sector in Lithuania will be the diversification of this sector, to mitigate over-dependency on biofuels. Also, some mechanisms applied to municipal heat supply companies and independent heat producers have undermined competition and efficiency for DHs.

190. The Polish OP also supports the modernization of DH networks, and the level of interest from the municipalities was high; the program is supporting the modernization of 5-8 percent of the entire DH network in the country. It must be noted that the Polish OP has two dedicated SOs targeting energy efficiency in buildings and modernization of DH in one voivodship (province): Silesia. About 16 percent of the DH network in the region will be modernized by the end of the program. The program not only finances existing infrastructure, but also encourages connections to new consumers as well as centralized heating and cooling.

SO 8.1. Increasing the capacity of the national energy system to use energy produced from renewable resources

191. Lithuania's OP supports a project to reconstruct/construct 178 km of power transmission lines. This accounts for 36 percent of the initially set output indicator for the "Length of new and/or reconstructed power transmission lines" (500 km). The MoE reduced the scope of investments under this measure to 330 km, and other sources of funding would be needed to modernize at least 152 km of electricity transmission lines. The transmission system operator (TSO) Litgrid faces particular challenges as it needs to synchronize its system with the EU's. The Polish transmission system operator PSE and Litgrid signed an agreement to build an undersea cable – financed as a Project of Common Interest (PCI) from EU funds – that would link Poland and Latvia and synchronize the Baltic states' power system with that of Europe. In addition, Litgrid needs investments to prepare its network for the synchronization.

192. In general, Poland has an ambitious plan to modernize both electricity transmission and distribution, leveraging EU funds with commercial loans. For example, from 2019 to 2027, PSE plans to spend €3 billion to expand and modernize the Polish grid, with over €1 billion of support taken from the EU Operational Program Infrastructure and Environment. Network expansion and modernization is envisaged also because PSE plans to introduce 8 GW of power from offshore wind farms into the system by 2027 and to prepare for construction of power lines for a nuclear power plant (Romania also

intends to develop offshore wind in the Black Sea and possibly connect its third and fourth nuclear reactors after 2030). PSE's investment plans include building about 4,300 km of new 400-kV lines; upgrading another 800 km of 400-kV lines, along with 1,400 km of new or upgraded 220-kV lines; building nine new transformer stations; and modernizing 23 existing stations – all while "blending" funding from the EU and other sources.

SO 8.2: Increasing the interconnection capacity of the National Transmission System of natural gas with other neighboring countries

193. In the early 2000s, Lithuania experienced a major transition from oil to gas in the largest consumption sector: district heating (DH). Following the gas crises in 2008–09 and stricter environmental conditions, it experienced another transition from gas to renewables (biomass, biofuels) in DH, with 80 percent of DH supply sources now consisting of RES and waste-to-energy. The investments in gas infrastructure followed the same trends; the major works took place in the 2007–13 cycle (reinforcement of the grid – a new Jurbarkas-Klaipeda pipeline to build a ring in the gas transmission and connect to the LNG terminal in Klaipeda).

194. The Klaipeda liquefied natural gas (LNG) terminal was also built with other EU funds as it is a regional energy security priority project. For the period 2014–20, investment priorities were established in alignment with objectives set by the National Energy Independence and Security Strategy to ensure integration into the European electricity and gas grid systems. During the interim evaluation, the assessed progress of the implementation was low (15 percent). The slower implementation was influenced by the delay in the preparation and coordination of the National Strategy, as well as strained capacity of project promoters engaged in simultaneous large-scale modernization projects for transmission networks, funded by EU funds and Connecting Europe Facility (CEF) funds.

195. However, the target value of indicator "capacity of the state gas network to meet the total gas demand on a day of exceptionally high gas demand (which, according to statistical probability, occurs once every 20 years) has been already exceeded.

196. Poland also implements gas projects similar to Romania's LIOP under the SO "Development of intelligent storage, transmission and distribution systems" and the country has an ambitious plan to build interconnections with the Baltics, the Czech Republic, Denmark, Slovakia, and Ukraine, thereby building a very liquid regional gas market. Most importantly, under the OP, it will (i) extend the LNG terminal in Świnoujście, ensuring an interconnection capacity of 7.5 bcm/year, and (ii) cofinance about 773 km of gas pipeline sections connecting the LNG terminal and reinforcing the North-South gas corridor – with connections to the Czech Republic, Denmark, Latvia, Slovakia, and Ukraine (Baltic pipeline), in line with the latest energy strategy. The measures are accompanied by gas market reforms to facilitate regional trading. Projects are on track and will be finalized by 2023. The total interconnection capacity will increase to 36.4 bcm and will ensure total independence from Russian gas, as well as supporting the coal phase-out efforts in the long run.

Lessons Learned

197. Key lessons learned can be drawn from the review of the two OPs:

Broad considerations on program principles

198. 1. Poland and Lithuania have strong strategic planning capacity in their energy sectors, with consistent strategies implemented over longer time horizons. OPs are viewed as only instruments to support the implementation of the strategies. Most notably, both Poland and Lithuania have established energy security goals and contributed as active members of the EU in the preparation and implementation of EU rules on internal energy market, viewing Brussels as a key ally in their efforts to reinforce their energy independence (in particular from Russian energy supplies). There is clear, long-term political commitment to integration into EU's gas and electricity systems. While Poland is not very supportive of the EU's fast-track decarbonation policy (including a coal phase-out), this is mainly due to concerns about energy independence; internally, measures to accelerate RES and transition from coal to other fuels (other than Russian gas) are consistently pursued as long as they do not conflict with energy security. Lithuania seeks rapid decoupling from the Russian electricity system and competitive alternatives to Russian gas. Infrastructure OPs are thus supporting the country's own broader objectives, not the other way around.

199. 2. The OPs in Lithuania and Poland are internally consistent: measures and interventions reinforce each other and support beneficiaries in optimizing complex projects and preparing them in an integrated manner. For example, energy efficiency (EE) measures in DH are closely linked to EE in buildings, while in Romania they are covered by different OPs. The Lithuanian and Polish approach provides substantial benefits, allowing beneficiaries (local authorities and their subordinated entities) to deal with just one set of rules and OP management systems, while also allowing the Managing Authority (MA) to prioritize interventions in buildings and DH systems that are well planned and integrated.

200. 3. Both Poland and Lithuania consider EU funds as fundamentally integrated into the country's own public budgets and not as parallel funding for projects with different rules. The approach is consistent with viewing the OPs as instruments for implementing national strategies. This ensures that procedures, processes and technical specifications for major infrastructure projects are standardized regardless of the source of funding, which also encourages leveraging.

Lessons relevant to removing key bottlenecks encountered in the Romanian LIOP (efficiency)

201. The review has also yielded relevant lessons on the following cross-sectoral topics:

1. Financing instrument

202. Regulatory and tax measures, in addition to support for investments, contribute to the development of energy from renewable sources, energy consumption savings, and reduction of GHG emissions. The impact assessment studies conducted by the European Commission show that regulatory/tax incentives (especially support schemes designed for electricity produced from renewable energy sources and obligations to producers and consumers) have a greater impact on the development of energy from renewable sources than grants for investments. Both Poland and Lithuania have undertaken consistent efforts to leverage EU funds with commercial or donor lending, private

investments. They have also made best use of other EU funding sources, such as for PCIs, using funding in the infrastructure OPs to maximize the use of such projects.

2. State aid

203. State aid aspects are relevant for the energy sector, as for the first time the Commission has presented its *Guidelines on State aid for environmental protection and energy 2014–2020*.[10] Prior to these guidelines, there were no specific state-aid requirements for the energy sector. Lithuania, for example, took specific measures during the 2014–20 period to improve the capacity of state-aid rules application among the institutions involved in EU structural and investment funds management and control systems. Detailed recommendations for state-aid rules application were elaborated with checklists and instructions to the management and control system bodies on how to control state aid rules. In addition, the Competition Council of Lithuania was given special mandate and functions to support the implementation of the Operational Program.[11]

3. Implementation agency capacity

204. The capacity of the institutions administering the EU funds is key. In both Lithuania and Poland, the professional development of the staff of the institutions administering the EU funds is strengthened through training in various competency areas and managerial competencies.

4. Co-financing (including eligible costs)

205. Co-financing can be a dealbreaker for investors. In Lithuania, the government has put into place a mechanism (funded out of the state budget) to help municipalities (i) access co-financing funds, when financing needs exceed the statutory appropriations, debt and borrowing limits; and (ii) fund ineligible costs for the implementation of the project. These co-financing mechanisms must be structured carefully to make them attractive to potential investors. Poland has implemented funds that pool resources (e.g. additional support from national or regional budgets) for investments supported in the OPs.

5. Land and construction permit issues

206. Reduced time and increased transparency in the process of obtaining construction permits are key drivers of EU funds absorption capacity of the EU member states. In 2016, the Lithuanian government launched electronic services (Infostatyba IS) for issuing territorial planning and construction permits, which allowed such permits to be processed through a portal (www.planuojustatyti.lt). Managed by the State Territorial Planning and Construction Inspectorate under the Ministry of Environment of Lithuania, the system also helps collect, process, store, systematize and use data about the status of national constructions and state supervision of

[10] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52014XC0628(01).

[11] The Competition Council advises the institutions administering the Operational Program and project promoters on competition policy and state aid application; provides state aid projects expertise; provides conclusions and recommendations to state aid providers; submits state aid notifications and other information related to state aid to the European Commission and other interested institutions; collects information on the granted state aid in the implementation of the operational program and provides it to the European Commission and other interested institutions; and carries out the prevention of anti-competitive agreements in project procurement.

construction. This process has resulted in a 60 percent reduction in the time necessary to obtain a construction permit and has proven very useful for the implementation of infrastructure projects, financed by EU structural funds in the energy and energy efficiency sectors, for the renovation of multi-apartment buildings.

6. Restructuring of DH system

207. Lithuania has restructured its DH systems by introducing independent heat producers (IHPs) by amending the Law on heat supply in 2010. Such changes helped drive an increased penetration of renewable energy in the production of heat, by encouraging municipalities to invest in more-competitive heat production capacities using RES (mostly biomass), thereby creating competition, with a corresponding reduction in prices. Municipal DH companies have an obligation to connect IHPs to the DH network according to the established regulation. The end-tariff for users is regulated in all 60 municipalities. The average heat price in Lithuania – about €0.05/kWh – has fallen by 35 percent in the last five years.[12] A similar approach (developing competitive markets and third-party access to DH grids) has been adopted by Poland.

7. Smart metering

208. The main bottleneck in LIOP's support for smart metering in electricity distribution and for the later roll-out is uncertainty with regard to equipment costs. Experience from European countries shows that the cost of smart meters is driven by technical solutions and the condition of the distribution network, as well as how distribution system operators organize tender processes. Market consultations and aggregation of the procurement volumes can be used as instruments to achieve better unit costs. Also, framework agreements may be considered for the longer-period contracts – which would be implemented in stages, with option to renew prices in the secondary competition through price reverse auctions. There are several ongoing initiatives in Lithuania, funded by state budget and development banks, financing smart-metering installation projects.[13] The energy regulator indicated that the introduction of smart metering will increase the distribution price by €0.05 cents per kilowatt hour (excluding VAT), but it will not exceed 2 percent of the final electricity tariff. As the cost of the smart-meter installations will be recovered through the tariff, users will not have to pay separately for installing a smart meter. Box 1 provides a comparison of prices of smart meters in Europe.

Box 1. The cost of smart meters in Europe

According to the European Commission,* in 2018, costs per smart meter ranged from €33 to €546. The average cost is estimated at €201, with a (relatively high) standard deviation of €127. The differences may be explained by the technology, choice of meter functionality, prices offered by installers, local labor market conditions, the extent of modernization of utility accounting and other country-specific factors. Because its market is smaller, costs in Lithuania is about €170. The main findings on costs of

[12] https://www.regula.lt/en/Pages/Activities/district-heating-sector.aspx

[13] The Lithuanian National Energy Regulatory Council in 2019 approved a €147 million project for the implementation of smart metering. The Council noted that the value of the project had decreased by 79 million (the value of the original project was €226 million for the joint implementation of smart and gas metering). Energy group Ignitis grupė will receive 110 million loan from the European Investment Bank (EIB) for implementation a smart metering project.

smart-metering installation of the 18 pilots conducted in 2015-2016 in Romania were described in the Routledge Studies in Energy Policy.** Study provides the unit investment costs for the implemented pilot projects based on the ANRE publicized reports. There are significant differences between the minimum investment unit costs of 350 Romanian lei (€72) per customer and the maximum, which is lei 1,233 (€252) per customer. This means that the maximum investment unit cost is 250 percent higher than the minimum. An AT Kearney 2012 study*** showed that the cost-benefit analysis was positive for an investment unit cost of €99 per customer, well below average unit cost at the national level of lei 587 (€120) per customer.

* European Commission (EC) and Tractebel, *Benchmarking smart metering deployment in the EU-28*, EC, December 2019, https://www.buildup.eu/sites/default/files/content/mj0220176enn.en_.pdf.

** Routledge Studies in Energy Policy, Appraising of the economics of smart meters. Costs and Benefits, Jacopo Torriti, 2020 https://www.routledge.com/

***https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwj4j8KmhpzwAhUSA2MBHahzApwQFjAAegQIBBAD&url=https%3A%2F%2Fwww.anre.ro%2Fdownload.php%3Ff%3DgKp%252Bhg%253D%253D%26t%3Dvdeyut7dlcecrLbbvbY%253D&usg=AOvVaw2oXXPCbxoL-eeikXIPOFTO.

5. Conclusions and recommendations

5.1 Effectiveness

1. To what extent are the LIOP energy interventions carried out in accordance with the expectations, and do they produce the desired change (Specific Objectives)?

209. *Conclusion*: The level of implementation as of February 2021 is low, which limits the evaluability of the program. There is evidence that the projects will lead to the desired change, despite the delays incurred so far in contracting and implementation. Demonstrative projects in Axis 6 have the potential to produce the information required to scale up the interventions using other sources of funding (e.g. commercial or regulated tariff-supported).

210. However, some of the DH projects are at risk of not producing the desired change (in particular Bucharest, which will face difficulties in implementing the project in time while keeping the system operational and a going concern). DH projects may have also been sub-optimally designed in two successive cycles, as investments focused on generation and transport without proper consideration of demand forecasts. In general, LIOP interventions were more progressive and ambitious than other support schemes to further policy objectives such as energy efficiency, RES, modernization of grids (electricity, gas, DH) and interconnectivity and provided a better structure for such interventions in the absence of an energy strategy.

211. *Recommendation*: The financing of the current priorities can be continued in the next cycle, conditioned by higher technical standards to stimulate investments in state-of-the-art technology not yet feasible under market conditions and stronger institutional reforms, such as clear responsibility for DH policy.

2. What factors influence the results of the LIOP energy interventions?

212. *Conclusion:* The main factors include:

- Economic: general economic development of the country, leading to increased energy demand; energy price increases following market liberalization; changes in markets for supplies needed to finalize the projects.
- Geographic/demographic: shifting patterns of demand versus supply, which require substantial restructuring of the infrastructure (gas, electricity, DH).
- Legislative and regulatory: changes in interpretations of state aid; increased construction costs following the increase of salaries for construction workers in emergency decree 114/2018; temporary return to regulated electricity and gas prices; tariffs and local policies for DH, as well as uncertainties surrounding the approval of amendments to the DH law; no unitary practices concerning expropriations and construction permits.
- The availability of complementary resources will depend on market conditions (in particular for Axis 6, where beneficiaries are private companies operating in competitive markets) and political ownership to accelerate investments in infrastructure.

213. *Recommendation*: These factors – as well as the difficulties caused by the pandemic, which could have longer-term effects – must be taken into account in the next cycle. The regulatory and legislative framework needs to be stabilized, e.g. by organizing a structured discussion with other authorities, including local, which are involved in permitting to ensure a unitary practice and legal interpretation; or analyzing the impact of ad hoc legislative changes (such as emergency decree 114/2018, which caused increased construction costs and a return to regulated electricity and gas markets). Some of the interventions (such as SO 6.2 and 6.4) could have been cheaper if the market conditions and regulatory framework were conducive to private investments or commercial lending from banks, ESCOs, etc. The preparation for the next cycle should include a revision of existing legal framework, as the results of interventions depend critically on such factors (e.g. Axis 7 depends on legal clarity of responsibilities on DH).

5.2 Coherence

3. To what extent are the LIOP energy interventions coherent with national strategies, plans, and programs?

214. *Conclusion*: To a certain extent, the LIOP interventions substituted for the absence of an approved updated energy strategy. They did this by providing a list of priority measures not supported by other instruments, with critical targets for energy efficiency, RES, emissions, and interconnectivity. The LIOP remains broadly consistent with the current draft NECP and with the draft NRRP, though the standards (technical, institutional) need to be raised in the next cycle to ensure investments keep pace with the latest technology.

215. In general, lack of strategic vision, absence of a political commitment to a strategy, and lack of clear responsibilities for relevant institutions (ministries, regulators) lead to delays in

implementation in major infrastructure projects in the public sector and will continue to lead to further delays in the next cycle (virtually all projects on Axes 7 and 8).

216. *Recommendation*: For the next programming cycle, the development of a strategic direction will become even more important in ensuring coherence of the interventions. OPs should be instruments for implementing a strategic direction, well integrated into the national policy and budgetary processes – not a substitution for their absence. Most critically, if a DH strategy is not adopted to provide a strategic vision for the sector that integrates heat supply and demand (including energy efficiency in buildings), continuing funding with EU support will not have the expected impact. More precisely, EU funds may finance DH systems that will remain unviable or inefficient, while disconnections will continue. Financing post-2023, including to finalize unfinished projects in the current cycle by "phasing", should be allocated only if the capacity of local authorities (Bucharest and the other cities) to design and implement a long-term viability strategy for the DH is secured – including tariff adjustments, infrastructure development and maintenance – regardless of the changes in political leadership.

4. To what extent are the LIOP energy interventions coherent with EU strategies and programs (EU Clean Energy Package and other energy and climate strategies, as applicable)?

217. *Conclusion:* LIOP is consistent with the NECP and NRRP drafts, which are largely designed to conform to the more ambitious targets of the Green Deal and post-pandemic accelerated modernization of the energy sector envisaged by the Resilience and Recovery plan.

218. *Recommendation:* Higher standards for interventions need to be enforced, such as ensuring infrastructure will be compatible with latest technology (smart metering, digitalization for the integration of RES) and ensuring the transition to greener energy (gas pipelines to be compatible with hydrogen, etc.).

5.3 Efficiency

5. To what extent is the implementation system of the LIOP energy interventions functional and operating efficiently against performance indicators?

219. *Conclusion:* Beneficiaries with prior experience in the previous cycle note improvements in the relationship with the MA and RID. Major constraints for absorption consist of: delays in evaluation (caused also by the long process of contracting evaluators); interpretation of state aid (mostly concerning the capacity of the Competition Council); and, to a lesser extent, duplications of documents requested from beneficiaries and reporting caused by staff turnover in MA/RID and loss of institutional memory.

220. *Recommendation:* Knowledge sharing among beneficiaries and between current beneficiaries and prospective applicants, e.g. by organizing meetings, may have large benefits in promoting the program and ensuring applications from beneficiaries in more varied sectors.

6. To what extent are the LIOP energy interventions cost-efficient?

221. *Conclusion:* Projects contracted under LIOP have ex ante CBAs; all projects would require EU funding, while benefits are correlated to impact indicators. Given the current level of implementation, with few projects completed, the cost efficiency cannot be assessed at this stage and will be addressed in the next evaluation.

222. *Recommendation:* Data from benchmarking after the finalization of projects, e.g. among types of projects on the same SO (particularly Axis 6), could be used to prioritize interventions in the next cycle, if the funding is extended for similar interventions.

5.4 Impact

7. In meeting the program/project stated objectives in targeted sectors, territories, and groups, what progress is discernible (namely, what are the gross effects) since the interventions were adopted?

223. *Conclusion:* After a slow start, LIOP energy is on a good track to have the expected impact by 2023 for most of the SOs (except SO 7.2 – Bucharest DH, which will not be finalized by 2023 and will likely be "phased" in the next programming cycle). SOs 7.1 and 8.1 are also at potential risk that project implementation could exceed 2023. For two SOs (6.3 and 7.1), the outcome indicators will not be achieved because of the selection of indicators that, while monitorable, do not capture the real impact – e.g. energy efficiency from smart metering will not lead to lower electricity consumption because the demand is driven by exogenous factors such as substitution of other fuels (electromobility, heating) and new household appliances. Also, losses in DH will increase overall, as the gains from the interventions under SOs 7.1 and 7.2 are well superseded by the deterioration of the sector in general.

224. Major improvements are needed in the preparation and monitoring capacity to establish indicators for outputs and outcomes that are both easy to measure and effective in capturing the impact. Some of the outcome indicators will not be realized because they were poorly designed during programming (e.g. electricity savings for households with smart metering, which will increase due to exogenous factors if compared to the 2014 baseline). Other indicators, such as reduction of losses in the DH networks, capture not only the (positive) results of the projects supported, but the (negative) general deterioration of the sector apart from LIOP interventions. Also, actual data on implementation should not be reported based on contractual commitments of the beneficiaries, but on physical progress and actual outcomes; otherwise, the indicators reported are overoptimistic and do not present an accurate image of the status.

225. *Recommendation:* Improve capacity to prepare output and outcome indicators. This would require building capacity not only at the MA level, but at the strategic level concerning energy policy (MoE) and is closely linked to strategic planning capacity.

8. To what extent may the observed progress be attributable to the funded interventions (that is, what is the net effect)?

226. *Conclusion:* In all Axes 6-8, EU funding is used to support interventions not covered by other policies. The interventions in Axis 6 are more "demonstrative" in nature, mostly to provide information on costs and benefits in these areas to allow for future scale-up with other sources of funding (own revenues, commercial financing, recognized costs in regulated tariffs). The SO most at risk is SO 6.3, where demonstrative projects may not contribute to the roll-out of smart metering if the roll-out continues to be postponed and technology advances. Axis 7 supports the most important interventions in DH; similar investments financed under the national budget, such as the Termoficare program or under the local budgets for investments, are significantly smaller, limited by budgetary constraints (such as annual budgeting) and lower standards. SO 8.1 and 8.2 consist of "missing links" (or existing bottlenecks) without which the targets of RES integration and interconnectivity cannot be achieved.

227. *Recommendation:* Scaling up demonstrative projects and improving broader sector results in district heating, electricity and gas transport and distribution level requires enhanced strategic planning in the MoE (beyond MA).

9. What is the existing estimated network effect of the funded interventions? and

10. To what extent could the effects occur beyond the targeted territory, sectors, or groups (estimated spillover effects)?

228. *Conclusion:* Given the current level of implementation, with very few projects finalized and operational, questions 9 and 10 are treated together. There is no current network impact and it is too early to assess in detail the potential impact, including spillover effects after the finalization of the program. We expect the projects will indeed have spillover and network effects after the finalization of the program in 2023, consisting mostly of: increased knowledge from demonstrative projects; revitalization of certain local industries, such as pipeline production; knowledge of infrastructure issues and operation problems; raised awareness of industrial consumers on energy efficiency benefits; increased confidence of energy investors, in particular RES, that the business environment is improving.

229. *Recommendation:* If the interventions are continued post-2023, higher standards will be needed to ensure technological compatibility. Most importantly, some measures (DH support, infrastructure investments in Transelectrica and Transgaz) should be continued only if there is clear commitment for reforms in these sectors that would ensure viability and performance. DH in particular needs to be supported only after the adoption of the DH law, and beneficiaries should be required to present a clear, viable long-term strategy for DH in their cities with an implementation schedule that cannot be put at risk by political cycles.

5.5. Sustainability

11. To what extent are the interventions' effects expected to be sustainable over a longer period of time (that is, can interventions be integrated into national sustainable development plans)?

230. *Conclusion:* At this stage, sustainability can be assessed mainly in terms of expectations of beneficiaries and provisions for the adequate maintenance of investments. The projects financed under LIOP will be monitored for a period of five years after finalization and start of operation, which will provide additional assurance on their sustainability.

231. Projects at risk in terms of sustainability are, however, the projects for which finalization could be extended after end-2023 ("phased" into the next budgetary cycle) – notably DH Bucharest. SO 8.1 might be at risk as well, if delays occur during the procurement of works and the actual construction. In particular in the public sector, the sustainability can be ensured if it translates into policy decisions and investments are accelerated (e.g. ANRE adopts a schedule for full roll-out of smart metering; DH law is approved and clarifies responsibilities; Transelectrica and Transgaz start accelerating the implementation of the 10-year network development plans).

232. *Recommendation:* The decision to further fund the interventions should be clearly linked with such policy decisions indicating ownership for state projects and willingness to use the experience of LIOP in designing support for energy efficiency, renewables investments or smart metering roll-out in the private sector.

233. Financial instruments can be designed for the next programming cycle to increase the amounts of the support for interventions. However, this is possible only to the extent OPs can be fully integrated into overarching national strategies (energy and climate) and budgeting processes (like in Poland or Lithuania). For example, based on Polish or Lithuanian models, funds can be set up for each intervention which can be supplemented by additional support from the Romanian budget and private loans to leverage EU funds; the latter will of course be repayable by beneficiaries. For example, such a fund can be set up to support DH integrating OP interventions and national programs such as Termoficare. Integrating OP interventions with similar measures envisaged in national strategies and budget processes would support the adoption of the same level of technical standards for projects regardless of the source of funding, while ensuring scale-up.

234. We also recommend the inclusion of energy efficiency in buildings in the next cycle in the same OP with energy. This would allow coordination of supply and demand; ensure prioritization of projects for heat provision in cities which have an integrated approach; and facilitate the application process for beneficiaries (municipalities), which would deal with only one implementation system and set of counterparts instead of two (LIOP and ROP).

12. To what extent should the LIOP energy interventions be further funded—for example, to maintain their relevance for the next programming period?

235. *Conclusion:*

Current program challenges:

- The evaluation capacity in the MA has led to delays in contracting financing projects
- Low capacity for state aid interpretation (including in the Competition Council)
- Low technological requirements for current projects – e.g. standards for district heating or gas networks are low, consisting of replacement of existing pipelines, with little investments in digitalization or technologies that would allow the transition from fossil to RES.
- Limited capacity to collect data and prepare output and outcome indicators that are both monitorable and relevant for the impact of the interventions
- Fragmented interpretation of permitting and expropriations across public institutions and local authorities
- Possible future risks related to the next stage of implementation. Given the low level of implementation (with few large public infrastructure projects started), there is no clear assessment of the risks concerning the next stage of the projects. For example, there is experience on permitting and expropriations, but one can expect difficulties in the procurement processes which are just starting. Delays in procurement may push some of the projects (SO 8.1, SO 7.1, SO 7.2) well beyond the 2023 deadline.

Broader programming challenges:

- The OP compensates for the absence of broader energy sector strategies, instead of being an instrument to support a strategic vision (such as an energy and climate strategy, supported by multiple decision-makers and funded from different sources, of which the OP is just one). This reduces the potential impact of the OP, the possibility to leverage EU support and complement with other financial sources; also, the lack of political commitment to a broader strategy leads to lack of ownership and determination to solve the outstanding administrative bottlenecks to implementation of the projects in the LIOP.

236. *Recommendation:* Further support for LIOP energy interventions should take into account both current and broader program challenges, as follows:

Current program challenges:

- The evaluation capacity in the MA needs to be increased, including the process of selecting evaluators. Significant delays in most SOs were caused by the lengthy evaluation process.
- Increased capacity on state aid (including in the Competition Council) may be critical to eliminate delays in approving guidelines for applications, in particular for large projects involving natural monopolies and state-owned companies. For industrial beneficiaries (such as SO 6.2), a different approach concerning state aid may be needed to provide large companies with the opportunity to apply – especially because the cap of the de minimis scheme (and hence of the support) is just €200,000, well below the costs of highly sophisticated smart metering systems for industry. Also, the intervention could benefit from more applications from SMEs if an information campaign is organized to raise awareness. In addition, the MA could organize round tables with beneficiaries and potential applicants; this could contribute to knowledge sharing and program visibility (such discussions can be organized without concerns of sharing

commercially sensitive information) while also providing information to industrial consumers in various sectors on the demonstrable economic potential of energy efficiency.

- Eligibility criteria for projects that beneficiaries consider risky must be reassessed. For example, beneficiaries of support for geothermal resources face the risk that project expenditure will not be eligible at the end of the project if the project proves not viable (a circumstance which is not known until the project is finalized).
- It is critical to step up on the technical ambitions of interventions to ensure investments are "future-proof" (e.g. higher standards for infrastructure; new technologies, digitalization, storage; compatibility of gas networks with hydrogen). These must take into account the types of projects that are supported by EU funds in other member states.
- Indicators for outcomes and outputs need to be adjusted to effectively measure the real impact of the interventions (direct impact or contribution to broader targets, but directly attributable to the intervention).
- Practices concerning permitting and expropriations must be unified. Currently, though the legislation on expropriations and on construction permits is clear, there are different interpretations by various institutions and local authorities. A meeting / round table with the responsible institutions may help reach unitary interpretations and facilitate the implementation of large infrastructure projects (e.g. electricity lines or gas pipelines) which need numerous similar approvals from many institutions (e.g. construction permits from dozens of local authorities on the site of the projects).
- Areas of procurement risk (preparation of TORs, contestations, etc.), supervision of works, guarantees for execution, etc. must be assessed to identify in time mitigation measures.

Broader programming challenges:

- Before deciding on interventions that should be pursued in the next cycle, most importantly, significant reforms must be undertaken in the sectors for which funding is intended. Responding to the latest Council recommendations and priorities in the National Reform Plans entail inter alia the adoption of national strategies and action plans, aligned with clear responsibilities and budgets; these are currently the major missing link between OPs and EU strategic documents. They have proved to be a significant obstacle for the programming for the current cycle (e.g. the difficulty in formulating indicators is just a consequence of not knowing how to embed interventions in LIOP within broader policy measures; the lack of progress in large infrastructure projects such as DH, Transelectrica, and Transgaz is a sign of lack of ownership and political will to pursue ambitious investments in critical infrastructure important at the strategic level). The 2014–20 OPs were based on interventions and lessons learned from the previous cycle (focusing on areas identified as worth spending on, with no clear prioritization), but for 2021–27 the level of ambition expected is much higher, given the strategic directions of the new Green Deal and NextGenerationEU. If no such reforms are forthcoming, the scale-up of interventions so far, increasing of ambition of similar interventions, or amending of priorities will only lack ownership. The requirement to prepare the NECP and NRRP (and LTRS for energy efficiency in buildings) is a good opportunity to anchor national strategies to EU processes; the preparation of action plans is the next step. OPs must be viewed as one of the financing sources for the implementation of these strategies and action plans. Funding in the next OPs should be targeted to sectors where there is willingness to leverage the use of EU funds demonstrated by the existence of a national strategy and availability of other sources of funding.

Annex A. LIOP Theory of Change

Challenges and needs

Challenges

- Absence of up-to-date energy strategy
- A limited appetite for the development of technologies for RE and EE
- Constrained capacity of networks
- Delays in implementing well-functioning energy markets and interconnectivity of the gas system.
- Poor performance of district heating systems
- Emergence of vulnerable consumers, prosumers, and electromobility

Needs

- Corporate governance of state-owned energy companies
- Market liberalization for gas and electricity markets
- Adoption of coordinated energy and climate strategies

Strategic framework: Investment priority	Strategic framework: Strategic objective	Outputs and results: Outputs indicators	Outputs and results: Results indicators
Thematic objective 4: Supporting a low carbon economy *Priority axis 6: Clean energy and energy efficiency*			
4.a: Production and distribution of energy from RES 4.b: EE and RE in enterprises 4.d: Smart distribution systems (L, MV) 4.g: High efficiency in co-gen. of heat and power	6.1: Energy prod. from less exploited RES 6.2: Reducing cons. of ind. consumers 6.3: Reducing power cons. hh 6.4: Increasing cons. savings of primary energy produced by high efficiency cogeneration systems	- Subst. modernized; inst. capacity; energy savings - Companies supported - Hh with smart metering systems - Installed capacity, supported cos, energy savings	- Additional RE - Decr. ind. energy intensity - Red. hh avg. elec. cons. - Energy svgs high efficiency cogen.
Priority axis 7: EE at system level centralized heating in selected cities			
4.c and iii: EE, smart energy Management and RE in publ. Infra and housing (secondary Cities and Bucharest)	Incr. EE of district heating systems in selected cities (7.1) / Bucharest (7.2)	Kms of network modernized	Reduction of heat losses from T&D network
Thematic objective 7: Promoting sustainable transport and removing bottlenecks in key network infrastructures *Priority axis 8: Intelligent and sustainable transport systems for electricity and natural gas*			
7.e: EE and security of supply smart systems for D, storage and T and distributed generation (RE)	Increase capacity of energy system from RE (8.1) and interconnection capacity of gas transmission system (8.2)	Kilometers of electricity and gas grid built	Incr. capacity to integrate RES in grid/ interco. capacity

Annex B. Evaluation matrix (inception report)

Evaluation questions (EQ)		Indicators/descriptors	Data collection methods	Data analysis methods
EFFECTIVENESS				
EQ1	To what extent the LIOP energy interventions are carried out according to expectations and produce the desired change (SOs)?	Direct and indirect contributions of the Specific Objective (SO) to Romania's committed targets: SO 6.1: RES share SOs 6.2, 6.4: Energy efficiency (industrial) SO 6.3: Energy efficiency (households) and rollout of smart metering SOs 7.1, 7.2: Energy efficiency / reduction of DH losses SO 8.1: RES share SO 8.2: Interconnectivity; households' access to gas	Desk review (including project operational reports, where available, and secondary data sources) Semi-structured interviews Focus groups Case studies	Quantitative and qualitative analysis of primary and secondary statistical data ToC SWOT Benchmarking Estimated sample of projects[14]: —Selected projects from SOs 6.1–6.4, 7.1 —Project SOs 7.2 and 8.1 —Inter-connection project SO 8.2; sample of distribution projects from SO 8.2
EQ2	What factors influence the results of the LIOP energy interventions?	—Economic: economic growth increases demand of energy, additional efforts needed to decarbonize generation	Desk review (including secondary data sources) Semi-structured interviews Focus groups	Quantitative and qualitative analysis of primary and secondary statistical data

[14] As of today, it is unclear whether sampling of projects will be needed to carry out the evaluation. The evaluation team will consider the final status of the program implementation as of December 31, 2020. This is also to assess the latest potential reallocation before program closing. If sampling is required, the sampling methodology will be included in the associated evaluation report.

		and improve energy efficiency —Demographic and Geographic: mismatch between energy demand and supply regional patterns; shifts in energy demand structure require efforts to bridge the gaps —Legislative framework: legal and regulatory instability affecting interest of beneficiaries in accessing LIOP available funds —Availability of complementary resources: potential for scale-up of proposed interventions (particularly SOs 6.1–6.4)	Case studies	ToC Selected sample of projects PEST Benchmarking
COHERENCE				
EQ3	To what extent are the LIOP energy interventions coherent with national strategies, plans and programs?	Contribution of LIOP interventions to overall targets committed to in Romania's relevant national energy policies	Desk review Semi-structured interviews Focus groups Case studies	Quantitative and qualitative analysis of primary and secondary statistical data ToC SWOT Benchmarking Selected sample of projects
EQ4	To what extent are the LIOP energy interventions coherent with strategies at the European level (EU energy and climate strategies)?	Contribution of LIOP interventions to Romania's commitments (Europe 2020, but also new directions in the Green Deal and Next Generation EU)	Desk review Semi-structured interviews Focus groups Case studies	Quantitative and qualitative analysis of primary and secondary statistical data ToC

				Selected sample of projects SWOT Benchmarking
EFFICIENCY				
EQ5	To what extent is the implementation system of the LIOP energy interventions functional and operating efficiently?	Implementation level: —Contracting rate —Status of physical completion —Finalization rate	Desk review Semi-structured interviews Focus groups Case studies	Quantitative and qualitative analysis of primary and secondary statistical data ToC Selected sample of projects SWOT
EQ6	To what extent are the LIOP energy interventions cost-efficient?	Benchmarking across similar projects from LIOP or other financing sources	Desk review Semi-structured interviews Focus groups Case studies	Quantitative and qualitative analysis of primary and secondary statistical data ToC Selected sample of projects Benchmarking
IMPACT				
EQ7	What is the emerging progress in meeting the program/project SO in targeted sectors, territories, and groups since the adoption of the interventions (what are the gross effects)?	Progress in implementation inferred from monitoring output and outcome indicators	Desk review Semi-structured interviews Focus groups Case studies	Quantitative and qualitative analysis of primary and secondary statistical data ToC Selected sample of projects Benchmarking

EQ8	To what extent may the observed progress be attributable to the funded interventions (what are the net effects)?	Counterfactual based on evolution of similar projects from LIOP or other sources	Desk review Semi-structured interviews Focus groups Case studies	Quantitative and qualitative analysis of primary and secondary statistical data ToC PEST analysis Selected sample of projects Benchmarking
EQ9	What is the existing/estimated network effect of the funded interventions?	Factual elements of particular relevance to SOs 6.1–6.4: scale-up effects of demonstration / pilot projects	Desk review Semi-structured interviews Focus groups Case studies	Quantitative and qualitative analysis of primary and secondary statistical data ToC Selected sample of projects Benchmarking
EQ10	To what extent could the effects occur beyond the targeted territory, sectors or groups (estimated spillover effects)?	Spillover effects in other sectors, e.g., labor market, connected sectors such as construction, engineering, etc.	Desk review Semi-structured interviews Focus groups Case studies	Quantitative and qualitative analysis of primary and secondary statistical data ToC Selected sample of projects Benchmarking
SUSTAINABILITY				
EQ 11	To what extent are the effects of the interventions expected to be sustainable over a longer period of time (i.e., possibility of	Lessons learned / contribution of project implementation to preparation and design of other interventions	Desk review Semi-structured interviews Focus groups	Quantitative and qualitative analysis of primary and secondary statistical data

	integrating interventions in national sustainable development plans)?		Case studies	ToC SWOT and PEST analysis Selected sample of projects Benchmarking
EQ 12	To what extent should the LIOP energy interventions be further funded (i.e. in order to maintain their relevance for the next programming period)?	Implementation level, causes for adjustments during implementation	Desk review Semi-structured interview Focus groups Case studies	Quantitative and qualitative analysis of primary and secondary statistical data ToC Selected sample of projects SWOT and PEST analysis Benchmarking

Annex C. Data collection tools and project selection

The implementation of LIOP energy (PA 6, PA 7 and PA 8) remains low at the stage of the present evaluation. Significant reallocations have been done across PAs and SOs in the LIOP by end-2020, to ensure contracts can be finalized by end-2023, most notably on SO 8.2 – extension of distribution grids, 235 mn EUR. Also, a large number of contracts are under evaluation on the existing allocations. The present evaluation focuses only on projects under implementation, i.e. projects for which a financing contract was signed. These are summarized in Table 1.3 of the main report, below:

	Project title	*Beneficiary*	*SMIS*
SO 6.1 – Increasing production of energy from renewable and less-exploited sources (biomass, biogas, geothermal)			
1.	Upgrading of the 20 kV overhead line (OHL) Mofleşti – Melineşti and the 20 kV branch axis Fratostita and Pojaru, Dolj County to increase the distribution capacity for taking over the power delivered by the photovoltaic power plants	Distribuție Energie Oltenia S.A.	122825
2.	Upgrading of the 20kV OHL Axes Parangu – Sadu and 2B – Novaci and of the 20kV OHL Axis Carbunesti – Novaci, in order to increase the distribution capacity for taking over the power delivered by the Low Power Hydroelectric Power Plants in the N-E area of Gorj County	Distribuție Energie Oltenia S.A.	127410
3.	Upgrading of transformer stations under the management of Delgaz Grid in order to take over the electricity produced from renewable sources in safe conditions of operation at SEN – Huși, Stănilești, Vetrișoaia, Fălciu, Murgeni stations	Delgaz Grid	127686
4.	Upgrading of transformer stations of E.ON Distributie Romania S.A. – building additional capacity into the electrical network upstream of the connection point so it can handle the electricity produced from renewable resources in safe conditions of S.E.N. – Unit 110 / 20kV Hirlau, Unit 110 / 20kV Pascani, Unit 110 / 20kV Gorban	Delgaz Grid	105731
5.	Combining geothermal energy with heating pumps to produce thermal agent for heating and hot water for Nufarul I Area, Oradea	Oradea Municipality	115839
6.	Increasing the production of thermal energy based on geothermal water in Beiuș	Beius Municipality	127641
7.	Construction of the biomass thermal energy production unit and the thermal energy distribution network in Maieru	Maieru Village	119846
8.	Increasing the production of energy from less exploited renewable resources obtained in the Salonta geothermal perimeter	Salonta Municipality	125691
SO 6.2 – Reducing energy consumption at industrial consumers			
9.	Implementation of a system for monitoring energy consumption (electricity, heat, compressed air) at the level of SC Sortilemn SA	SORTILEMN SA	105740
10.	Intelligent energy consumption monitoring system within Yazaki Component Technology Romania	Yazaki Component Technology S.R.L.	106581
11.	Smart metering application for utility consumption and production	Vel Pitar S.A.	106965
12.	Intelligent energy consumption monitoring system within Antibiotice SA	Antibiotice S.A.	109717
13.	Reducing energy consumption at the level of SC Zoppas SRL by implementing a high-performance monitoring system	Zoppas S.R.L.	111829
14.	Implementation of an energy consumption monitoring system at AZUR S.A.	AZUR S.A.	116222
15.	Smart metering utility consumption application	COMELF S.A.	117803
16.	Intelligent energy consumption monitoring system within CIECH Soda Romania S.A.	CIECH Soda Romania S.A.	117977
17.	Development of the energy consumption monitoring system at Hammerer Aluminum Industries Santana S.R.L.	Hammerer Aluminum	118591

		Industries Santana S.R.L.	
18.	Technical solution study – energy consumption monitoring system	Infopress	118973
19.	Implementation of advanced metering system with on-line monitoring to reduce energy consumption at Takata Romania SRL	Takata Romania SRL	120195
20.	Intelligent energy consumption monitoring system within CEMACON SA	CEMACON SA	127985
21.	Advanced metering system for reducing energy consumption at CELCO SA – Lime Factory	CELCO S.A.	128259
22.	Implementation of energy consumption monitoring systems for industrial consumers	Heineken S.A.	128334
23.	Energy consumption monitoring system within S.C. Meat Industrialization KOSAROM S.A.	KOSAROM S.A.	130415
SO 6.3 – Reducing average power consumption of households			
24.	Implementation of intelligent measurement system in Craiova, central area (partially) and Sărari (approx. 10,000 consumers from Craiova)	Distribuție Oltenia	114790
25.	Implementation of an intelligent distribution monitoring system in a homogeneous area of predominantly household electricity consumers	DELGAZ	117855
SO 6.4 – Increasing savings of the consumption of primary energy produced by high-efficiency co-generation systems			
26.	Increasing the operational energy efficiency at SC AMBRO S.A. Suceava by implementing a high efficiency cogeneration installation	AMBRO S.A.	115900
27.	Optimization of primary energy consumption within CEMACON S.A. by installing a high efficiency cogeneration plant	CEMACON S.A.	119391
SO 7.1 – Increasing energy efficiency for DH systems in selected cities			
28.	Rehabilitation of the district heating system in Oradea for the period 2009-2028, to comply with environmental legislation and increase energy efficiency – Stage II	Oradea Municipality	108460
29.	Rehabilitation of the district heating system in Focșani Municipality for the period 2009–28 to comply with environmental legislation and increase energy efficiency – Stage II	Focșani Municipality	114845
30.	Rehabilitation of the district heating system in Iași Municipality to comply with environmental standards regarding the emissions in the atmosphere and to increase the energy efficiency in the urban heat supply – Stage II	Iași Municipality	115253
31.	Rehabilitation of the district heating system at the level of Râmnicu Vâlcea Municipality for the period 2009-28 to comply with environmental legislation and increase energy efficiency – Stage II	Râmnicu Vâlcea Municipality	118892
32.	Rehabilitation of the district heating system in Oradea for the period 2009–28 to comply with environmental legislation and increase energy efficiency – Stage III	Oradea Municipality	123600
33.	Re-engineering of the centralized district heating system in the Municipality of Timișoara to comply with environmental protection regulations on air pollutant emissions and to increase efficiency in urban heat supply – Stage II	Timișoara Municipality	127006
SO 7.2 – Increasing energy efficiency of district heating system in Bucharest			
34.	Rehabilitation of the heating system of Bucharest Municipality	Bucharest Municipality	138142
SO 8.1 – Increasing the capacity of the national energy system to use energy produced from renewable resources			
35.	LEA 400 KV d.c. Gutinas-Smardan	Transelectrica	129245
SO 8.2 – Increasing interconnection capacity of National Transmission System of natural gas (NTS) with other neighboring countries			
36.	Developments of NTS in the North-East area of Romania to improve the natural gas supply of the area as well as to ensure the transmission capacities to the Republic of Moldova	Transgaz	122972

Given the current level of implementation (with few projects finalized, recently, which means that outcomes and sustainability of the results cannot be assessed at this stage), the evaluation was mostly qualitative. It focused on detailed case studies – projects in green highlight above; and a general overview of the projects on each SO, based on interviews and statistical project data from SMIS and internal AM reporting. The data collection methods are highlighted below.

Interviews and focus groups were based on the detailed interview and focus groups guidelines below.

- MA – planning and contracting interview (Jan 29, Feb 23)
- SO 6.1 – two group interviews, for distribution and production (Feb 24)
- SO 6.3 – interview project 114790 (Feb 26)
- SO 6.2 – focus group all projects (Mar 2)
- SO 7.1 – focus group all projects (Mar 2)
- SO 7.2 – interview project 138142 (Mar 3)
- SO 8.1 – interview project 129245 (Mar 3)
- SO 6.4 – interview project 115900 (Mar 5)

Focus groups were particularly relevant to collect information in a comparable form from a large number of respondents. Focus groups were chosen for projects on which there is a relatively large number of potential beneficiaries (SO 6.2 and 7.1); for SO7.2, SO8.1 and SO8.2., as well as SOs where only one project was in a more advanced implementation stage, in-depth interviews were more appropriate.

Interview guidelines:

Context and coherence	1. What are the strengths, weaknesses, opportunities, threats in the energy sector in Romania? (gas, electricity, heating and industrial sector) 2. To what extent are LIOP PAs 6, 7, 8 complementary to or coherent with other energy-sector interventions financed from national budgets, EU, or private sources? Are the proposed interventions consistent with other EU programs, in particular energy-efficiency measures in the Regional Operational Program, and national programs such as DH programs? 3. Have there been changes in the socioeconomic environment or in policy (national; EU) which affected the relevance of the initially envisaged LIOP interventions? Are the planned objectives relevant to current needs, and initially identified needs still relevant?
Effectiveness	4. What have been the effects of LIOP interventions? Have they been carried out in line with expectations, and have they produced the expected changes? 5. What is the difference between planned and actual performance (namely, in contracting, absorption, implementation, results)? 6. Were there delays in achieving planned results and objectives? If yes, what was the cause? (internal vs external factors) 7. Have PAs and key areas of interventions been implemented effectively, contributing to OP objectives?
Efficiency	8. Is the management system functional and operating efficiently, with internal procedures supporting efficient implementation of LIOP? 9. How are the relationships with beneficiaries throughout the process?

	• guidelines for applicants: duration, quality of documents • calls for projects; quality of applications • evaluation process: selection of evaluators, duration, reasons for rejections • contracting and implementation: approvals, processing contracts, amendments, reimbursement; quality of project design; permits; public procurement etc. • monitoring: consistency of indicators with overarching program objectives, compliance etc. • Disclosure: are allocations publicly disclosed, and does feedback and opinions from citizen and relevant stakeholders inform the process? 10. Are LIOP interventions cost-efficient compared to similar actions financed from different sources? 11. Are available resources sufficient (institutional capacity, personnel, budgets)?
Results and spillover effects of interventions	12. What are the higher-level causes of different results across PAs? 13. Have the foreseen network effects of LIOP interventions been realized? (e.g., scale-up of interventions with other sources of funding) 14. Were there unforeseen impacts of LIOP interventions, positive or negative? (e.g., positive would include growth of investments in connected sectors, etc.; negative would include crowding out of private-sector investments, etc.) 15. What amendments were needed to the original LIOP interventions and why? 16. Which effects can be attributed directly and exclusively to LIOP interventions (as opposed to other actions, policies, market evolution, etc.)?
Sustainability	17. Are the LIOP interventions sustainable? Will beneficiaries have enough capacity and resources to maintain or even to scale up, etc.? 18. Are the results and actions of the LIOP transferable to other similar programs; future EU funding; private sector financing; local and national budgets?

Focus group guidelines:

Context and coherence	1. What are the strengths, weaknesses, opportunities, threats in the energy sector in Romania? 2. To what extent are LIOP PAs 6, 7, 8 complementary to or coherent and consistent with other energy-sector interventions financed from national budgets, EU, or private sources? 3. Have there been changes in the socioeconomic environment or in policies at national and EU level which affected the relevance of the initially envisaged LIOP interventions? Are the planned objectives relevant to current needs, and initially identified needs still relevant?
Effectiveness	4. What have been the effects of LIOP interventions? Have they been carried out in line with expectations, and have they produced the expected changes? 5. What is the difference between planned and actual performance (namely, in contracting, absorption, implementation, results)?

	6. Were there delays in achieving planned results and objectives? If yes, what was the cause? (internal vs external factors) 7. Have PAs and key areas of interventions been implemented effectively, contributing to OP objectives?
Efficiency	8. Is the management system functional and operating efficiently, with existing procedures supporting efficient implementation of LIOP? 9. How are the relationships with beneficiaries throughout the process? 10. Are LIOP interventions cost-efficient compared to similar actions financed from different sources? 11. Are available resources sufficient (institutional capacity, personnel, budgets)?
Results and spillover effects of interventions	12. What are the higher-level causes of different results across PAs? 13. Have the foreseen network and scaling-up effects of LIOP interventions been realized? 14. Were there unforeseen impacts of LIOP interventions, positive or negative? 15. What amendments were needed to the original LIOP interventions and why? 16. Which effects can be attributed directly and exclusively to LIOP interventions (as opposed to other actions, policies, market evolution, etc.)? Have similar effects been observed without LIOP support?
Sustainability	17. Are the LIOP interventions sustainable, with long-term impact? 18. Are the results and actions of the LIOP transferable to other public policy interventions, including EU funding?

Data used for case studies:

- Project data (beneficiary's application for financing, CBA analysis, latest progress report)
- Project details from LIOP databases (SMIS, internal AM reporting)
- Data collected from beneficiary on the project – e.g. maps, list of procurement / financed equipment
- Previous internal World Bank research on specific topics (e.g. renewables; district heating)
- Context data (e.g. policy and strategic documents relevant for each subsector of intervention)

Annex D. Case Studies

SO 6.1. distribution - Upgrading of transformer stations of E.ON Distributie - 105731

1. Brief project description

The general objective is to increase the security of taking over the electricity produced from renewable resources by reducing the number of interruptions, decreasing the amount of undelivered electricity and the reduction of the maintenance costs of the E.ON Romania electricity distribution network.

The specific objective is Modernization of Hirlau, Pascani and Gorban transformer stations belonging to E.ON Distributie Romania to increase safety taking over the electricity produced from renewable resources.

Expected results:

- 1/ 3 modernized 110/20 kV transformer substations: Station 110/20 kV Hirlau, Pascani 110/20 kV substation, and 110/20 kV Gorban substation
- 2/ 1 Functional Project Implementation Unit
- 3/ 1 design and execution contract for construction and modernization works signed
- 4/ 1 technical project elaborated

Main activities:
In accordance with the EDRO strategy and taking into account the data resulted from analysis of the situation of electricity producers in renewable sources connected in the three substations, at the level of the three 110/20 kV transformer substations the following types of works are carried out:
- modernization of equipment from 110 kV cells;
- modernization of 20 kV cells located in the connection room;
- modernization of internal services, direct current and alternating current;
- integration in SCADA of the modernized installations;
- modernization of terminal boxes;
- grounding installation restoration;
- modernization of exterior lighting installation and lightning protection installation.

Project justification

Modernization of the 100/20 kV stations Hirlau, Pascani and Gorban of the company E.ON Distributie Romania, stations where they charge manufacturers of RES energy and which ensures its delivery in SEN meets the needs identified at national level regarding the operation in conditions of safety, security and efficiency of distribution networks.

The actions proposed in this project are in line with the directions of action established in the Energy Strategy of Romania for the period 2007- 2020 updated, thus contributing to the achievement of the objectives set out in the Energy Strategy on Energy Security and lasting development.

E.ON Distributie Romania S.A. (ERDO), the first integrated distributor of natural gas and electricity in Romania, ensures energy distribution electric in the six counties in the Moldova area: Bacau, Botosani, Iasi, Neamt, Suceava and Vaslui. The main activity of the company is electricity distribution at the parameters required by its suppliers and customers, in accordance with the Performance Standard for electricity distribution service and performance indicators.

The proposed investment is a component of the EDRO Network Development Strategy, based on the objectives of the Perspective Plan of the development of the electrical distribution network of E.ON Distributie Romania SA. In accordance with the provisions of H.G. no.2139 of 2004, the normal operation duration of the equipment from the power transformation stations should have between 16 and 24 years old, while the electrical equipment in most stations are in operation for over 30 years.

The analysis of the company’s main performance indicators as well as the forecast of the future demand on the profile market reveals the potential of its development, which, however, cannot be achieved in the current conditions due to the following needs identified at the infrastructure level:

1/ To ensure a high level of quality of services and investments to ensure compliance mandatory performance standards for electricity distribution operators;

2/ To streamline the company's costs in order to ensure a high level of competitiveness on the market;

3/ To create a modern infrastructure, able to take over and deliver in SEN the energy produced from renewable sources;

4/ To ensure operating conditions with minimal impact on the environment, in accordance with the principles of development durable;

5/ To ensure a safe working environment for the company's employees.

Progress of project implementation:

The project started on 01.01.2018 and was extended until 31 May 2021. Until the cut-off date of the most recent progress report (31.12.2020) two transformation stations (Hîrlău and Pașcani) out of the three covered by the project were fully modernized and started to function.

2. Reason for selecting the case (criteria, significance of the selected case)

This project is the most advanced among the 4 energy distribution projects contracted under the Specific Objective 6.1. of the LIOP PA 6.

3. Methodology for case study

The case study was drafted based on the desk review of the relevant project documents (e.g. financing contract, initial progress report and project CBA), project details from LIOP databases (SMIS, internal MA LIOP reporting) and on the primary data collected from the individual interview with project manager, as well as from the interviews with the MA LIOP staff.

4. Budget

Total project budget: 16,838,862.75 lei
Total eligible budget: 12,804,627.05 lei
Total contribution of the beneficiary: 1,024,370.17 lei
Total non-eligible costs: 4,034,235.70 lei

5. Effectiveness of the intervention

Internal and external factors which are contributing to achieving the desired results

The project started effectively in early 2019 and it went on well in the first stage, but the pandemic broke and things slowed down because the contractor's, builder's or equipment supplier's personnel were most probably reduced, and they could not deliver services and equipment in time. The beneficiary got an extension of the financing agreement and an addendum for an extension of the project implementation time (the project was supposed to be finalized at the end of November – beginning of December 2020, and due to the addendum it was extended by 31 May 2021). The implementation was cumbersome, the investment involves large equipment for transforming 110 - 120 kilovolts, switches, separators, current transformers etc. These are expensive equipment that require experts at all stages, from building to installing and integration in the SCADA system that the beneficiary only partially had, and they should do tests, trials, verifications and upgrades to ensure that the equipment is operational at the end of the project. Related to the constructions component, there was one builder only, a company that provides all the services which explains why the project progressed slower. The equipment suppliers were dependant from the builder's capacity to deliver on time. On the reimbursement part, submitting the requests and liaising with the DRIs went smoothly, the collaboration was good. However, the SMIS seems to me fairly muddled, which in the beneficiary's opinion should be simplified.

Difficulties faced in implementation

The beneficiary encountered several difficulties in implementation. For example, in the procurement procedure the European regulations require the access of providers from outside the European Union. The beneficiary got a 5% penalty for not mentioning 'or equivalent" in the specifications. According to the auditors the beneficiary was not open enough to allow all international entities to participate in the tender.

The beneficiary considers that the implementation path as slow because they had a first SCADA project covering 30 something substations, and sometime in 2017 – early 2018, they thought up these projects that are currently under implementation. The beneficiary carried out the feasibility studies (FSs) for their projects which was a non-eligible expenditure that took over 4-5 months. So, they started working on these projects sometime in the spring of 2018, and sometime in September they succeeded to complete the FSs, had them approved, got the agreements, permits, and wrote the projects and prepared the proposal documentation in October – November and submitted in December 2018. The beneficiary prepared the feasibility study working together with a specialised consultant.

In addition, the year 2020 was difficult, they had to push the builder hard and to make all the factors influencing this part of execution and finalisation meet. In the stations the consumers' supply cannot be reduced to zero and the beneficiary had to take care of the safety of the exploitation as well as of their own staff. The cooperation with internal and extern entities complicates the implementation process.

6. Efficiency

The beneficiary considers that renewables energy has a future, therefore the company must improve distribution services, to reduce the discomfort caused by disruptions/outages, to reduce disruption time, and to manage to automate their equipment such as to be able to ensure, to make efficient manoeuvres, so that the clients, producers and consumers to be impacted as little as possible. By modernising the equipment in substations through which the power is delivered directly, the beneficiary considers they can provide quality services, reduce power losses, reduce the number of outages, and increase efficiency. Overall, upgrading the substations involves increased efficiency of beneficiary's human resources and equipment.

7. Sustainability

a/ Financial sustainability

During the investment period, the financial sustainability of the project will be ensured from the following sources: non-reimbursable financial assistance in the amount of 11,524,164.34 lei and the beneficiary's own contribution in the amount of 4,985,825.20 lei.

According to the financial analysis undertaken for this project, this is going to be financially sustainable, because the beneficiary's cumulative net cash flow is positive for each year of the entire reference period considered, which demonstrates the beneficiary's ability to ensure the necessary liquidity for an adequate financing of the project.

For optimum functioning of this investment the company will allocate the necessary personnel who is characterized by professionalism and experience in this sector.

b/ Technical sustainability

The technical sustainability of the investment is guaranteed by the purchase of modern equipment, with a high level of reliability that does not require maintenance costs. These elements create the premises for the efficiency of the company's operational costs and ensuring continuity in energy delivery, contributing to ensuring the long-term sustainability of the investment. The proposed project produces effects after its implementation by improving the SAIFI, SAIDI and ENS indicators, as well as by reducing the technological losses.

8. Conclusions

- The beneficiary is confident that their project would indeed enhance their capacity to integrate newly-built renewable capacities in their region, once the project implementation is finalized.
- An important factor for a successful implementation of the project is the beneficiary's experience with other projects implemented. In case of this beneficiary, in 2018, they completed a SCADA project, there was another project on the development of company's human resources and they are implementing a smart metering project in the Iași area. It appears

that the estimated impact increases when this type of project is combined with smart metering projects in the same region, covering both urban and rural areas.

- Using SCADA automated remote-control system (SCADA) is contributing to increasing the efficiency in terms of reducing operator's intervention time. The SCADA system involves carrying out remote operations without requiring the presence of personnel at the consumer or generator's end. The control operations are carried out from dispatch which monitors the quality of power. This technology does not require personnel at the substation or at the client. Ultimately, it entails a reduction of expenses and a benefit for the energy producers, clients and distributors.
- According to the beneficiary's knowledge and experience over the last years, the number of the entities looking for energy independency grew, more people want to produce photovoltaic energy, so last year the beneficiary had hundreds of requests from potential prosumers. The „Casa Verde" (Green House) programme for photovoltaics generated a wave of requests, but the Ministry and the managers of the programme appear not to be supportive. Bureaucracy is high and for the year 2020 less than a third of the total number of the requests submitted to the Ministry were approved.

SO 6.1. – production Utilization of geothermal energy combined with heating pumps, to produce thermal agent for heating and hot water for Nufărul I Area, Oradea - 115839

1. Brief project description

The general objective is increasing production of energy from renewable sources (geothermal) by modernizing and achieving the production capacities of thermal energy based on geothermal energy in the Nufarul 1 neighborhood of Oradea and the realization of the distribution network to take over the energy produced. The project's purpose is to produce clean energy and increase energy efficiency in the centralized district heating system.

The specific objectives of the project are the followings:
1. Increasing the degree of use of geothermal (renewable) energy from the deposit located in the basement of Oradea Municipality by making an investment in the district heating system in Nufărul 1 Oradea District.
2. Improving the quality of life in Oradea Municipality by annually reducing the greenhouse gases by 9,859 tons of CO2 / year after the implementation of the project.
3. Increasing the capacity of energy production from renewable sources (geothermal) by 12.85MW by modernizing the district heating system in the NufăruI 1 district of Oradea.

Expected results:
1. Geothermal water / heating agent transport pipes made 22 Km
2. A "Nufarul 1" Geothermal Thermal Station built
3. A Drilling Well production Nufarul 1- built
4. 277 "Mini thermal points" installed

Activities:
- Project preparation
- Elaboration of the technical-economic documentation phase of the Feasibility Study (FS)
- Elaboration of the funding request and submission of the project
- Project implementation activity
- Preparation of procurement documentation for the works, development of procedures, concluding the contracts
- Elaboration of the technical project, obtaining Building Permit and execution of works
- Provision of technical assistance services – on site management and technical project verification
- Reception at the end of the works
- Project management and monitoring of public procurement contracts
- Information and publicity within the project
- External audit of the project

- Project monitoring and reimbursement.

Project justification

Energy is an essential element of development at EU level, and the instability of international energy markets and the tendency to monopolize hydrocarbon resources by a small group of owners, has led to a focus of the European policies towards the development of production of energy from renewable resources available in Europe, as well as the implementation of savings and policies towards adequate use of existing resources. At the same time, by transposing the acquis communautaire, Romania has accepted and adopted new laws and standards on environmental quality. The implementation of European directives represents a radical change in national policies and in the way of approaching the issue of environment, change that involves consistent and long-term investment costs. In this context, local authorities become an important actor for approaching and solving environmental problems specific faced by their own communities and for satisfying the needs of the community by providing public services at a higher quality level in this domain.

The implementation of the project contributes to achieving the targets assumed by Romania regarding the provisions of Directive 2009/28 / EC - promoting the use of energy from renewable sources and Directive 2012/27 EU of the European Parliament and of the Council of 25 October 2012 regarding energy efficiency and responds to local conditions according to the directions established at national level through the National Strategy for Sustainable Development 2013 - 2020 - 2030 and the Energy Strategy of Romania 2016 - 2030, with perspective for 2050.

Regarding the local strategic documents, through the Integrated Urban Development Strategy - SIDU, Oradea clearly pursues a policy in the field of energy efficiency, with the prioritization of the portfolio of projects by fields of interventions, the proposed project can be found at the position 225 - in the list of projects in SIDU. This project aims at: Policy VIII. ENERGY EFFICIENCY, Program P25: Growth share of renewable energy use, Specific measure / objective 25.1. Utilizing the energy potential of thermal water resources.

In the context of the existence of the geothermal deposit as a locally available resource with superior use potential, Municipality of Oradea decided to invest, modernize and bring the centralized thermal energy (TE) supply system to a higher quality level, also aiming at improving the public district heating service offered to consumers. Given the fact that the existence and adequate functionality of the ACC system depends on the ACC insurance and the thermal comfort during the cold season for approximately 70% of the city's population, the complete rehabilitation of the city's centralized TE supply system is a strategic option, both by integrating in the component of production of renewable energy sources (in this case geothermal water), by improving and streamlining the way in which energy is managed from the point of view of efficiency as well as by increasing the degree of operational safety of all system components. At the same time, investments aimed at the centralized system will have the effect of reducing losses in reducing fossil fuel consumption and increasing energy efficiency, thus helping to reduce greenhouse gas emissions and pollutants in the atmosphere.

Thermal energy is currently insured to produce ACC from geothermal water from existing boreholes (4797 and 4081) and for heating from the thermal network of SACET.

The object of the present investment is the development of the exploitation of geothermal water from the hydro-geothermal perimeter of Oradea to replace it at a scale as high as possible of conventional TE production - obtained by burning fossil fuels (with emissions into the atmosphere) - with energy geothermal - obtained by extracting the highest possible flows of geothermal water. The technical solution for the simultaneous protection of the air and surface water, in case of increasing the amount of geothermal energy, is the exploitation of geothermal water in "double" system – well production + injection well - which involves extracting water through production wells, directing it in geothermal thermal stations with heat exchangers and, after the heat release of the thermal agent from the secondary circuit, the injection into the field through injection probes.

The novelty element is given by using heat pumps that allow the recovery of additional energy from geothermal water. The TE difference will be covered by a link to the CET, on the M5 line. Thermal energy provided by CET for coverage peak load is TE produced by high efficiency cogeneration. The existing PTs in the neighborhood will be closed, they will be replaced with fully automated modules, installed at the level of the consumers located in the Nufărul I neighborhood (6217 apartments, commercial spaces, kindergarten and high school, old people's care center, approximately 11,870 inhabitants) and will benefit from energy services improved. At the same time, the entire network within the neighborhood will be replaced with a new pre-insulated network. Water transport pipelines geothermal from drilling to / from the geothermal point will also be replaced.

According to the technical solution from Feasibility Study, the proposed investment is an integral part of SACET Oradea, respectively the Geothermal Thermal Station of production of the thermal agent necessary for the preparation of the ACC and of the heating being provided to work in tandem with the new source of energy production through high efficiency cogeneration - CET Oradea, the plant that uses natural gas as fuel, and which was installed through a project financed by SOP Environment 2007-2013.

Thus, the Geothermal Thermal Station (the location where the thermal agent for consumers is produced) is proposed to be connected to the thermal transport M5 from where it will receive energy, for the summer regime, to cover the necessary during the peak period of consumption from the winter season and to be able to take over, also through it, all the necessary energy necessary for the neighborhood in the event some incidents occurred in the geothermal energy supply system.

The realization of the project will contribute significantly to the fulfillment of the objectives specific to the priority axis and to the objectives of the program in general. Thus, reducing the dependence on fossil fuels, environmental protection, diversification of energy production sources, creation of new jobs in the field as well as the active involvement of Oradea but also of the private environment in the use of renewable energy resources. The implementation of this project will contribute through its own indicators to the achievement of the program indicators. Reducing energy production costs will contribute to lowering the energy tariff on the local market (for the energy produced from the geothermal resource - cheaper, part of the common basket to establish PLR for TE) and will contribute to the elimination of local subsidy, thus stimulating local economic development.

Progress of project implementation:

The project is substantially delayed. The financing contract was signed on 17 December 2020. As presented in the Section 5 of this case study, mostly preparatory activities were carried out to the date of the interview (second half of February 2021).

2. Reason for selecting the case (criteria, significance of the selected case)

Under the Specific Objective 6.1. of the LIOP PA 6 there are four projects contracted in the domain of energy production. All have just started the implementation and among these four projects, the one implemented by Municipality of Oradea has the higher budget. Municipality of Oradea is the most experience project beneficiary.

3. Methodology for case study

The case study was drafted based on the desk review of the relevant project documents (e.g. financing contract, initial progress report and project CBA), project details from LIOP databases (SMIS, internal MA LIOP reporting) and on the primary data collected from the group interview with project manager, project technical coordinator and representative of the works supplier company, as well as with the MA LIOP staff.

4. Budget

Total project budget: 86,764,146.71 lei
Total eligible budget: 66,118,312 lei
Total contribution of the beneficiary: 1,322,366.23 lei
Total non-eligible costs: 20,645,834.65 lei

5. Effectiveness of the intervention

The project implementation has recently started. So far, three main activities were implemented including the followings: 1/ a video conference for the start of the project monitoring activity was organized by MA LIOP and DRI Cluj, 2/ a video conference was held to clarify the issues regarding the need to update the value of the project by applying the methodology of Government Decision 379 / 07.05.2020, and 3/ the documentation related to the public procurement procedure for the execution of the works was prepared.

Despite the delays and the fact that the project is an early stage of the project implementation, the project beneficiary has a clear understanding of what is to be done. Thus, according to the beneficiary's representatives, the Municipality makes the investment, at the end of the works the Municipality makes the reception and after this is done the results of the works are handed over to the operator of the heating system. The Municipality cooperated with the operator from the very beginning, from the project idea and is constantly involving the operator in the validation of the project progress. This close cooperation ensures good premises for an effective implementation, continuity to supply the services and for maintaining the investment to run properly until the end of its life cycle.

Difficulties faced in implementation

The beneficiary considers the investment covered by this project as being ambitious. The context is such that instead of having the work done and being in a more advanced stage, for the moment they do not have no contractual partner. Finding such a partner to carry out the works is difficult. There is too little investment in the heat systems throughout the country and, unfortunately, the projects that were started were not finalized. The beneficiary searched for examples of practices, for example in Iernut. The country lacks companies capable of doing complex works in the energy field, that have the necessary 5-year experience - as required by the procurement legislation - in heat systems or energy supply. The market demand is too low, and this distorts the market and puts the beneficiary in a risk position. Financially these projects are not interesting for a foreign contractor. Consequently, the only possible partners are Romanian, and they are few. But even them, they did not submit bids. They asked for clarifications on the two tenders, they showed interest, requested further clarifications, but they did not submit an offer.

Also, there should be a national approach to geothermal energy. Throughout 2019-2020 period, besides the talks with the ministry, there were calls from other municipalities interested to submit applications, asking questions, not knowing whether to go for such a project (e.g smaller communities from the counties of Arad and Timiș). They were raising questions related to the drilling costs, which are significant: 2 million euros for drilling a hole of 250 m depth. This in a commune that may have a total budget of 4-500,000 euros, to cover the drilling costs from the local budget is problematic. According to the Applicant‘s Guide and to the financing contract, the costs related to the drilling are eligible if, until the end of the project, the beneficiary obtains operating license, not exploration license. Municipality of Oradea accepted this risk because there are about 13,000 people who are running the risk of having problems with the heat supply. A small commune cannot take this risk of going bankrupt as a public administration just because contractually is bound to the action or lack of action of a third party, who in this case may very well be the National Agency for Mineral Resources (ANRM). Perhaps there might be a mechanism that could allow these beneficiaries to get joint insurance policies, a mechanism that could unblock these situations. For the beneficiaries, it is difficult to set up something in this direction. However, it is perceived that at national level some mechanisms of the type could be designed.

Overall, the geothermal component is riskier than the installation of some equipment 100% known that works on fossil fuels. The beneficiary does the drill, assesses what historically is known in terms of properties, where the reserve is; there is geological information, but still the risk exists. This is the most that can be done.

6. Efficiency

The project evaluation took a lot of time, and the evaluation rules changed while this process was ongoing. Part of the costs that were eligible in the beginning have turned to be non-eligible, including the VAT. In addition, there was a State aid issue which was difficult to be dealt with by the beneficiary, which led to getting the financing contract with delays and, eventually, with extra costs for the beneficiary. Currently, there is legislation allowing beneficiaries to update the value of projects for which financing contracts have already been signed. There is a Government decision allowing it and the beneficiary has started negotiating with the MA LIOP in that sense.

7. Sustainability

Regarding the revenues, they will be represented by revenues from the local budget (subsidy) and revenues from the sale of thermal energy. The subsidy from the local budget will decrease compared to the current level but will not be eliminated because the energy used will continue to be a mix (from CET 1 Oradea and geothermal energy). It should be noted that the proportion of energy from renewable resources respectively geothermal water) will increase. Revenues will increase and expenses will increase in the same measure, throughout the analysis the cash flow being 0. The existence of a regulated price contributes to the sustainability of this project.

The implementation of the project generates savings in terms of operational costs (electricity at pumps and drilling, cold water) because of the reduction of losses in the district heating network and of the reduction of reactive interventions in the network. These savings are equated by the simultaneous reduction of heat revenues and price subsidies because of reducing the amount of thermal energy delivered. The phenomenon is explained by the social and environmental character that most of investments in district heating systems have, respectively the approach according to which the costs are fully recovered only based on the tariffs paid by the population. It is estimated that the subsidies granted by the municipality to cover the difference between the price of production, transport, distribution, and supply of thermal energy delivered to the population and the local price of thermal energy, will be ensured until the end of project implementation. According to the cost-benefit analysis of this project, the cumulative net cash flow is equal to 0 for each year of the project reference period due to the intervention of the local budget through the subsidy mechanism.

Secondly, to ensure the continuity and sustainability of the project from an institutional point of view, the human resources as well as the organizational framework for operating the investment are considered. According to CBA forecasts the municipality of Oradea has the capacity to ensure the operation and maintenance of investment, as well as the human resources necessary for project implementation due to the annual allocation of the amounts necessary to cover the respective expenses.

The human resource that will be made available during the operation of the investment is represented by 7 employees (5 dispatchers and 2 people in the intervention teams). The staff for the operation of the investment will be provided by SC Termoficare Oradea SA and will be trained to carry out successfully the kind of activities required by the implementation of the operations. SC Termoficare Oradea SA is the delegated operator for the management of the service, transport, distribution and supply of thermal energy in a centralized system, in accordance with Contract no. 196/1 / 06.08.2013. The team responsible for the implementation and monitoring of the investment project also includes specialists of the operator, they together with representatives of the engineer (who will be appointed through the public procurement procedure within the project) will monitor and evaluate the quality of the execution during the development of the project, thus ensuring the premises for an efficient operation of the installations since design phase.

The Feasibility Study carried out for this investment is mentioning the entity responsible for the investment, for each component of the investment, their operation and maintenance the responsibility was clearly allocated. Thus, components 1, 2 and 4 will be operated by the operator SACET, SC Termoficare Oradea SA, while the component 3 will be operated by the Municipality of Oradea through SC Termoficare Oradea SA in collaboration with SC Transgex SA.

The municipality of Oradea through SC Termoficare Oradea SA will have the following responsibilities regarding the operation of the investment:

a) will ensure the transport of geothermal energy from the extraction wells to the thermal point and to the thermal mini-points, because the thermal energy obtained to be delivered to the population;

b) will ensure the production of geothermal energy from the geothermal water extracted from the geothermal water deposit at its disposal the city of Oradea;

c) will perform maintenance;

d) will carry out repair works of any kind, as well as investment works that are necessary for the proper functioning of infrastructure so that there are no bottlenecks in providing thermal energy for heating and hot water and the revenues are not affected society;

e) will have a department dedicated to the operation of this investment.

Thirdly, to ensure the project's sustainability from a technical point of view, financial resources will be needed. The financial resources that will be used during the operation period will be allocated by SC Termoficare Oradea SA. In addition, to ensure the sustainability of the investment from a technical and operational point of view, the Municipality of Oradea has made / is making investments in district heating system to reduce the cost of supplying thermal energy. Thus, the Municipality of Oradea has in implementation investments in network rehabilitation through LIOP Priority Axis 7. At the same time, the Municipality of Oradea submitted several projects within axis 3.1B of the ROP to increase the energy efficiency of some subordinated public institutions (County Hospital, Municipal Hospital and 4 educational units). Through these projects, the share of thermal energy resulting from sources will increase renewable share in the total energy produced, this being possible by continuing the program to increase the energy efficiency of buildings in the Municipality of Oradea through the ROP program Axis 3.1.

Municipality of Oradea intends to submit projects for financing in the field of renewable energies and especially geothermal energy including through the Financial Mechanism of the European Economic Area. Through this source of funding was completed in the year 2017 project "Utilization of geothermal energy, for the production of thermal heating agent for consumers of the thermal point PT 902 with the re-injection of thermally used geothermal water in the reservoir ”through which a drilling was performed for the reinjection of geothermal wastewater thermal, through this type of project ensuring the sustainability of the geothermal deposit in Oradea and implicitly the sustainability of this project because the investment is dependent on the geothermal deposit in Oradea. At the same time, the Municipality of Oradea will use funds from the local budget for the development of the district heating system and for the increase of the use energy produced from renewable resources.

8. Conclusions

- Dispite the delays in the project implementation which makes any consideration on the project's effectiveness premature, the beneficiary estimates that the project will increase the share of renewable heat in district heating, contributing to the committed targets. However, the beneficiary highlighted significant implementation risks as the viability of the project would be clear only after the finalization of the works will be accomplished.
- The economic factors affect less the production of geothermal energy for district heating, as this is designed to replace existing (fossil) energy source for a largely constant heat demand for residential use, which is therefore not influenced by economic factors.

- While the geothermal potential is known only generally before the well is drilled, the economic potential (whether the actual temperature and pressure of the water allows its economic use for DH) is only fully discovered after the well is finalized. Thus, there is a high risk for beneficiaries to access EU funds and discover at the end that the entire investment is ineligible because the economic potential is not realized.
- Investments in geothermal can have significant spillover effects into providing DH systems with low-cost, clean and renewable energy. The measures can still be funded in the next programming cycle based on lessons learned in the current 2014-2020 OP (mainly the state aid scheme).
- Some investments cannot be conceived if there is no vision and strategy at national level. So far Romania was lacking a coherent strategy on energy in general, and even less so in geothermal, heat energy. If there is no such strategy, beneficiaries will continue to have difficulties to propose good projects, to adapt possible ideas to opportunities and to do projects with robust impact.

SO 6.2. Intelligent energy consumption monitoring system, Antibiotice SA - 109717

1. Brief project description

The general objective was to reduce the specific energy consumption (kgep / 1000 euro) at the level of the company ANTIBIOTICE S.A. on average by 1%, for a period of 5 years after the implementation of the project, as a result of monitoring consumption by implementing an intelligent metering system for energy consumption.

The specific objective of the project was to ensure implementation of a functional intelligent metering system to monitor electricity and gas consumption at the level of ANTIBIOTICE S.A.

Expected results:
1. Project submitted for financing in accordance with the requirements of the Aplicant's Guide
2. An intelligent metering system for energy consumption purchased and implemented
3. A project implemented in accordance with the Financing Agreement
4. An external audit report of the project carried out
5. Information and publicity measures implemented.

Main activities:
- Project kick-off activities
- Implementation activities of the intelligent metering system
- Project management activities
- Project audit activities
- Information and publicity activities of the project.

Project justification

The main problems that justified the implementation of the investment project and the implementation of specific interventions were the followings:

a/ High energy consumption at the level of Antibiotice SA (5,203.17 toe in 2015) - a high level of consumption requires measures to reduce energy consumption on the company's platform with the aim of reducing the impact on the environment. At present within the company the monitoring of electricity consumption is performed by old induction meters with precision class 5, between 20 and 35 years old, with problems in operation (caused by mechanical friction), connected by means of old power transformers (15-35 years), most of them no longer suitable for the energy consumption they measure.

b/ Impossibility of implementing measures to increase energy efficiency - given the lack of effective control of how main equipment, sections and technological processes use resources, the impossibility of identifying energy losses and consumption variations given by the age of the existing energy consumption monitoring equipment. Identifying weaknesses of technological processes or equipment in terms of energy consumption by implementing the system of Smart metering will bring significant energy savings and reduce the impact on the environment associated with high energy consumption energy.

Analyzing the main problems encountered in terms of energy efficiency, there is a need to implement a system of intelligent energy metering and specialized software for obtaining real-time data related to energy consumption and automatic production of reports, analyzes and balance sheets on different consumption contours of the factory.

Thus, following the implementation of the investment project, the network of meters for monitoring the existing energy consumption will be replaced and extended with new ones, with a higher degree of accuracy than the existing ones, which have the capacity to collect and provide accurate data on energy consumption up to the level of cost centers (electric meters) and up to the level of equipment (gas metering natural and electricity for compressed air) and software and hardware components required for collection and processing data in order to provide data for taking optimal energy efficiency measures at the enterprise level.

Progress of project implementation:

The project started on 18 November 2016 and was finalized on 21 December 2018. The investment project did not involve construction works and did not contain elements of infrastructure, involving only procurement activities and installation of equipment that composes an intelligent system for metering energy consumption. The equipment that makes up the intelligent metering system is based on BAT (Best Available Techiques). This technical solution was indicated by a multicriteria analysis. The analysis included in the Feasibility Study envisaged two technical-economic scenarios out of which it was decided on Scenario 2 of implementing an intelligent metering system that includes BAT type equipment with the capacity to monitor energy consumption electricity up to large consumers and natural gas consumption up to consumer level.

2. Reason for selecting the case (criteria, significance of the selected case)

This project was selected among the 14 projects finalized under the Specific Objective 6.2. of the LIOP PA 6. The criteria for selection included the status of the project (longer time from the finalization date) and location (in a less developed region, i.e. North-East Region).

3. Methodology for case study

The case study was drafted based on the desk review of the relevant project documents (e.g. financing contract, initial progress report and project CBA), project details from LIOP databases (SMIS, internal MA LIOP reporting) and on the primary data collected from the individual interview with project manager, as well as from the interviews with the MA LIOP staff.

4. Budget

Total project budget: 1,286,158.30 lei
Total eligible budget: 1,080,805.28 lei
Total contribution of the beneficiary: 173,305.28 lei
Total non-eligible costs: 205,353.02 lei

5. Effectiveness of the intervention

Internal and external factors which are contributing to achieving the desired results

Although the project only covered a certain category of electricity, gas and compressed air meters, the results are very good. Besides monitoring consumption, due to the project investment it is possible to monitor several parameters such as the specific consumption of certain pieces of equipment, which one can compare to other types of equipment and see whether it is necessary to invest in new equipment and do all the maths for cost-effectiveness. On the other hand, the monitoring system includes several alarms that warn the beneficiary's personnel about various events that could be harmful for the operation of the equipment. This is considered very valuable by the beneficiary.

This type of smart metering project is addressed to large companies that are permanently adapting to the market requirements; hence they make constant changes to the plant and consumption, and this should be taken into consideration in other projects. That means that future projects should have as much flexibility as possible built-in from the very beginning in terms of relocating meters from one installation to another. That means flexibility of the monitoring system. It is important that all the meters provided in the project be in operation. The beneficiary relocates certain meters from one supply line to another because on a supply line consumers change. Monitoring consumption allows for taking efficiency improvement actions. Thus, knowing and analysing the consumption the beneficiary can identify efficiency improvement measures and decide what investments are needed, whilst also catching up on other economic aspects. The software is the heart of the monitoring system. Thus, it depends on how the decision makers desires the result, the consumption to be shown and more so to whom. In the beneficiary's case, the system allows the heads of departments and heads of cost centres to automatically receive Excel reports with the hourly consumption on the previous day in figures and graphs. Also, the consumption can be monitored from the start of the month to date, and values of consumption can be compared. It is necessary to involve as many persons as possible in analysing the data recorded by the monitoring system and the beneficiary is fully aware of that and applies it in practice.

Difficulties faced in implementation

In the case of this type of projects, according to the beneficiary it is difficult to invest in a consumption monitoring system and determine all the economic indicators such as capital depreciation rate because it is difficult to determine the consumption savings in percentages. So, for this reason it is difficult to convince the management to invest in a monitoring system (e.g. it costs 100,000 Euros and this investment will be recovered in three years).

The beneficiary appeared to be concerned about not having the possibility to have other projects funded from Structural Instruments in the same domain, especially from the perspective of making better use to the staff who is getting specialised in designing and managing such projects and not being used in an economic manner (not enough workload in this domain for a longer period).

6. Efficiency

The signing of the financing contract is subject to certain laws, there are certain annexes that must be observed in the relation with the MIEP. The beneficiary encountered certain bottlenecks which caused a decrease in the efficiency of project implementation because of the changes in the reporting requirements. Also, the Ministry's staff turnover some had a negative effect on the project's administration efficiency at the beneficiary’s level because quite often the new staff was asking again for documents that were already submitted.

However, the beneficiary appreciated that once the payment request was approved, the payment was processed in a few days, despite that the Applicant Guide indicates that the payment request is first approved and then the money will be disbursed when available. This efficient practice of processing payments contributed to a good cash flow of the project.

7. Sustainability

The financial self-support of the project during the sustainability period is ensured by the company’s positive cash flow, the project being financially viable taking into account the investment costs and all the financial resources of the company.

The results of the project are exploited by the company Antibiotice S.A. Intelligent metering system is used to increase energy efficiency at the enterprise level through consumption reduction measures taken based of analysis of the data provided by this system.

Antibiotice SA took all feasible measures to reduce consumption, based on the data provided by the monitoring system, whether it refers to staff awareness measures energy efficiency (non-cost measures), either for measures to make investments in new equipment / machinery, more energy efficient, or improving / bringing to an improved technical condition the existing ones in order to obtain a superior energy performance (investment measures) and an energy-optimized production facility using the investment as efficiently as possible.

To ensure the sustainability of the investment project, the company Antibiotice S.A. established the following maintenance to ensure the operation of the investment on the entire duration of the project (five years from the completion of the project), in accordance with the maintenance plan established in the Feasibility Study. These measures include:

a/ Maintenance of meters for electricity, natural gas and compressed air are ensured annually and include the following minimum operations, according to maintenance manuals and manufacturer specifications:

- annual inspection of the condition of the appliances;

- analysis of indications;

- local interventions (for example: replacement of power batteries, checking the oil level and operating the lubrication of the gas meter mechanism, unlocking meter, purge pressure transducers, etc.);

- cleaning of internal meters and checking mechanisms.

b/ For maintenance of communication systems and computers the following operations are provided annually, in compliance with the manufacturer's recommendations:

- annual inspection of the condition of the appliances;

- local interventions (eg: replacement of UPS batteries, checking moving parts: fans, HDD, etc.);

- dust cleaning.

c/ Software maintenance is ensured through the following annual operations:

- application of patches;

- application of upgrades to later versions.

The average annual maintenance costs are: 39,300 lei with VAT.

The data collected from the monitoring system is used to capitalize on the results of the project and based on the analysis of such data possible improvements are identified that lead to a reduction in the company's specific energy consumption. This action is performed by accessing data on the system server by any staff through a web browser which generates the necessary information through an easily accessible interface, the data being stored for a period of at least two years, for the measurement points. Thus, decision makers have the opportunity to take optimal measures to increase energy efficiency at the enterprise level.

When identifying the possibilities for energy efficiency, two categories of measures were defined:

a/ Measures that do not involve financial resources - these measures are characterized by raising staff awareness of energy savings through online consumption monitoring and taking immediate prevention and correction measures (efficient use of energy throughout the technological process cycle, bringing in parameters of inefficient equipment, optimal loading to obtain a maximum efficiency in specific working conditions); analyze monitored consumption and decision-making to reduce consumption (comparison of operating parameters for the same type and comparison of consumptions at different stages of technological processes); calculation of specific consumptions used as support and consulting in establishing modernization strategies/projects, with better energy efficiency, acquisition of equipment with lower specific consumption.

b/ Measures involving financial resources (investment measures):

- bringing in parameters of superior energy efficiency the existing equipment, inefficient in terms of energy consumption energy, as a result of the analysis of consumption and the comparison of the operating parameters of consumers of the same type and the comparison consumption at different stages of technological processes;

- replacement of existing machinery or equipment with new generation ones, with high energy efficiency, as a result of the analysis specific consumption and taking measures to increase energy savings.

The measures involving financial resources were established through an Investment Plan which includes all the measures to streamline the consumption of electricity and natural gas at the enterprise level, with the related resources allocated. The Investment Plan for the increase of energy efficiency was established following the implementation of the intelligent metering system and the obtaining of consumption data to establish the most efficient measures, as the data is processed, to increase the energy efficiency. The measures are provided from beneficiary’s own sources.

8. Conclusions

- It appears that the beneficiary of project is confident that the installed smart metering systems will contribute to process optimization and inform future purchases of energy-efficient supplies.
- For industrial beneficiaries, a different approach concerning state aid may be needed, to provide large companies with the opportunity to apply, in particular because the cap of the de minimis scheme and hence of the support is just 200,000 EUR, well below the costs of highly sophisticated smart metering systems for industry.
- The introduction of smart metering does not lead to reduced energy consumption as such, but provides adequate and detailed information on consumption, allowing the company to optimize production processes and invest in energy-efficient equipment in priority areas. The follow-up measures to reduce energy consumption are still to be implemented and the beneficiary considers that the smart metering investments have indeed produced valuable information for the optimization of the industrial processes that would be forthcoming.
- For the large companies which are not newly established, it would be good to have access to funds for projects aimed at the digitalisation of power plants. More specifically, these companies have low, medium and high voltage distribution systems with older components that could be replaced with new ones, including a computer-based control system wherefrom one can see all the commuting, make all the switching from the computer, without needing personnel in the stations. However, such projects are expensive, at least 1 million Euros.

SO 6.3. Implementation of intelligent measurement system in Craiova, central area - partially and Sărari - approx. 10,000 consumers from Craiova - 114790

1. Brief project description

The general objective is to ensure implementation of an intelligent electricity metering system for approximately 10,000 domestic and non-domestic consumers small in a homogeneous area of Craiova, to reduce the average energy consumption at the households' level.

The specific objectives of the project are the followings:

1/ To increase by 10,000 the number of users connected to smart power grids by mounting and connecting to the grid of approx. 10,000 smart meters.

2/ To increase the quality of electricity distribution services of Distributie Energie Oltenia S.A. as a result of implementation of MDM (metering data management) system by generating predefined reports.

3/ To modernize/refurbish 7.54 km of low/medium voltage distribution network related to the homogeneous area of the project proposed (including 985 connections adapted to the modernized network), in order to ensure the optimal operating conditions of the intelligent measurement systems.

4/ To reduce the average annual electricity consumption per household from 1.42 Mwh in 2018 to 1.35 Mwh in 2023 in the sustainability period of the project.

5/ The contribution calculated at the level of the homogeneous area of 0.05% to the LIOP indicator, to reduce the average consumption per household from 1.35Mwh / year in 2013 to 1.2Mwh / year in 2023.

Expected results:
1/ 1 subsystem for measuring and transmitting information (including 10,000 smart meters) implemented in the homogeneous area
2/ 1 hardware infrastructure required for the operation of the purchased MDC Application
3/ 1 hardware infrastructure required for the operation of the purchased MDM Application
4/ 1 metered data management subsystem implemented
5/ 1 Data acquisition subsystem from implemented meters
6/ 7.54 km modernized low/medium voltage network, including 985 connections adapted to the modernized infrastructure
7/ 1 project implemented according to the conditions of the financing contract.

Main activities:
The project has the following two activitiy components:
C1- The intelligent measurement system, which includes the following three subcomponents:
C11: Subsystem for measuring and transmitting information / data from meters (includes measuring group, filters, repeaters, data concentrators, data acquisition system from meters)

C12: Counter Data Acquisition / Collection (HES) subsystem, which includes a Software and Services Application also called the HES application, as well as the hardware infrastructure required to operate the HES application
C13: Counter information / data management subsystem, which includes a software and services application, also called a Metering Data Management (MDM Application) and the Hardware Infrastructure required to operate the MDM Application.
C2 - Modernization / refurbishment of the JT / MT network, which includes the following three subcomponents:
C21: Modernization of Transformation Points (PT) - construction part-21 pieces and electrical part 12
C22: Modernization of JT networks (overhead, underground) - 7.4 km of low voltage network will be upgraded (6.86 km overhead network and 0.68 km underground network);
C23: Adaptation of existing connections to the modernized network - 985 connections will be adapted, by executing the following operations: disconnecting connections from the existing network, disassembling the connection, installing the connection, connecting to the modernized network.

Project justification

Justification of the project at national level

European energy policy has at its center a set of various measures, which are intended to achieve an integrated energy market and to ensure security of energy supply and sustainability of the energy sector. Improving energy efficiency is one from the priority elements of Romania's energy strategy for ensuring the energy supply of consumers, development sustainability and competitiveness, saving energy resources and reducing greenhouse gas emissions.

This project is coherent with the following plans and strategies in the field of energy, energy efficiency and sustainable development:

a/ Romania's Energy Strategy for the period 2007-2020 updated for the period 2011 - 2020

The project contributes to achievement of the national strategic objective regarding sustainable development and increasing energy efficiency by improving energy efficiency throughout the chain: sources - production - transport – distribution - consumption. The project is in line with one of the main directions of action of Romania's energy strategy, converging with those of the European Union's energy policy, namely "the transformation of electricity transmission and distribution networks and large-scale implementation of smart metering systems ".

b/ The National Action Plan for Energy Efficiency

European regulations on increasing energy efficiency as a result of the implementation of energy efficiency smart metering systems (Directive 2009/72 / EC) have been transposed into national legislation on energy. The project contributes to the fulfillment of national objective in energy efficiency to reduce primary energy consumption and to ensure alignment with national legislation on energy, by increasing the number of consumers who have smart metering.

Initially, by 2020, 80% of consumers were supposed to have smart metering systems. According to a draft order of ANRE regarding the implementation at national level of intelligent electricity measurement systems and its implementation schedule all consumers will have to be integrated in IMS

(Intelligent Measurement System) by 2026 and by 2020 in each concession area of the distribution service IMS was planned to be installed for at least 30% of the total number of consumers.

The project contributes to the achievement of this national objective, its implementation leading to an increase of approximately 10,000 in number of smart meters installed.

Justification of the project at the level of the beneficiary's level

The beneficiary (Energy Distribution Oltenia - EDO) provides electricity to 1,421,297 customers from 7 counties in the Oltenia region, with a coverage area of approximately 42,134 sq km. The main mission of the company is to provide electricity distribution service to all customers, at the quality parameters established by ANRE and in accordance with the international standards operating on the electricity energy market. The activities of the distribution service include operation, maintenance and development of electrical equipment, in order to distribute electricity from producers to consumers, in safe operating conditions of electrical installations, ensuring quality parameters and reducing maintenance and repair costs.

The proposed investment (i.e IMS) is part of a complex program of EDO called Smart Transformation which aims to implement a medium-term development strategy (5 years) including implementation of intelligent distribution networks, to increase efficiency of resources' management, as well as a better adjustment to possible changes of the internal regulations, including market liberalization.

In the context of the investment strategy described above, developed in accordance with the development objectives of the company, the following needs specific to the homogeneous area were identified:

1/ To align with national regulations on the implementation of intelligent measurement systems

2/ To increase data processing capacity

3/ To ensure the optimal operating conditions of intelligent measurement systems

4/ To ensure operating conditions with minimal impact on the environment, in accordance with the principles of development sustainable

5/ To ensure a safe working environment for the company's employees.

The project addressed these needs by proposing an investment which aimed to implement a system of intelligent measurement and modernization/refurbishment of the energy infrastructure in the homogeneous area, to ensure the optimal functioning of measuring system.

Progress of project implementation:

The project started on 01.01.2018 and was extended until 30.04.2021, due to the restrictions imposed during the COVID-19 alert state that generated difficulties in carrying out the commercial contracts.

2. Reason for selecting the case (criteria, significance of the selected case)

Considering that the overall criteria for the selection of case studies was to cover all energy-related specific objectives of the LIOP and this is the only project contracted under the Specific Objective 6.2., no further criteria for selection were applied.

3. Methodology for case study

- The case study was drafted based on the desk review of the relevant project documents (e.g. financing contract, initial progress report and project CBA), project details from LIOP databases (SMIS, internal MA LIOP reporting) and on the primary data collected from the individual interview with project manager, as well as from the interviews with the MA LIOP staff.

4. Budget

Total project budget: 37,725,264.21 lei
Total eligible costs: 28,190,632.41 lei
Total contribution of the beneficiary: 5,400,632.41 lei
Total non-eligible costs: 9,534,631.80 lei

5. Effectiveness of the intervention

The project is complex, besides smart metering the beneficiary is upgrading the electricity distribution network to receive the signals from the meters which communicate only via the distribution network. In addition to the 10,000 meters installed, a software is also being implemented for the data supplied by the 10,000 meters. The target area is relatively homogenous: the city of Craiova and some smaller adjacent areas. There are over 10,000 smart meters that are currently being installed, there are no implementation problems. There are only two eligible contracts still ongoing the MDM (Metering Data Management) and the MDC (Metering Data Collection) applications having the highest value in the project.

The 10,000 smart meters already installed and sending data and the whole data processing system purchased and scalable can be used in the roll-out. The functionality is the one that matters: to collect, to process and to validate data. So, we purchased the system that manages all data, including the equipment. This initiative relates to others beneficiary has; all the programs are interconnected. The beneficiary also implemented the GIS system, a system of smart measures that collects certain data and processes including among others the workforce management systems (i.e. for the automation of electricians' workflows). The project is integrated in a System Oriented Architecture, in which things run in parallel and the communication of all systems is made more effective and efficient.

Difficulties faced in implementation

There was a particularly important time gap between the moment when the call was launched by the MA and the moment when they get the technical assistance necessary for the evaluation of the projects. This generated most of the delays. The beneficiary submitted the projects, and then waited for the MA to award the technical assistance contract for the consultants required to assess the projects. Nevertheless, ssubmitting an application requires to conduct a feasibility study, to consider market shares, what functionalities are available, to plan additional noneligible expenses that are supposed to be covered by the beneficiary. If it takes more than a year until the contract is signed and starts, everything that was planned gets outdated and basically the whole planning and preparation process must be started all over again.

Concerning the reimbursement, the beneficiary submitted six requests for reimbursement. Each application was followed by a random check of equipment, electric networks and meters that had been installed. The biggest problem during the pandemic was the access to households for the installation of meters. In March-April 2020 the beneficiary access was not granted access. Later, the people understood that if the everybody wears protective equipment and things can go on.

6. Efficiency

This is a long-term investment project for which roll-out is planned until 2028 with approximately half of the clients in the system. The beneficiary expects the implemented system to last for some five more years without problems because the system constantly upgraded to the latest version, as for Windows. There are some concerns for the ground technology of smart meters because communication technology follows certain tendencies, and it takes account of market indicators. For instance, cellular communication is the best, but also the most expensive presently. If the price drops, the respective technology will be preferable in the future. Currently, another technology is being used, the one using electric cables, which is financially accessible. However, the other systems purchased through this project are more advanced and of the future.

Concerning the suppliers, in the tenders launched by the beneficiary with the budgets available in the project, there were no problems. According to the beneficiary, there was a tough competition, for all tenders there were enough competitors, and even if they were few, they were serious and strong.

7. Sustainability

The sustainability of the project and of the results obtained following the implementation of the intelligent measurement system will be ensured from several perspectives:

• Financial sustainability

During the investment period, the financial sustainability of the project will be ensured, according to the project budget, from the following sources: non-reimbursable financial assistance in the amount of 22,830,000.00 lei and own contribution (contribution to eligible expenses + contribution to ineligible expenses) of Oltenia Energy Distribution in the amount of 14,942,691.68 lei.

As it results from the financial analysis of the project, the project is financially sustainable, the cumulative net cash flow (not updated) being positive for each year of the entire reference period considered, which demonstrates the Applicant’s ability to ensure the necessary liquidity for an adequate financing of the project.

• Necessary actions to ensure the continuity of the project - the sustainability of the project will be ensured through the PIU which will follow, for 5 years from the completion of the project implementation, the achievement of the indicators proposed by the Funding Application and by the personnel structure of the Applicant which is characterized by professionalism and experience in this sector. Through the project it is provided the necessary infrastructure for the development of the services offered by the Applicant to its clients; the system implemented by the project must be developed by subsequent investments of the Applicant by adding an Analytics application, which will allow him to develop a coherent strategy that it can determine the change of the customers' consumption behavior, at the level of individual dwellings.

Technical sustainability

The technical sustainability of the investment is guaranteed by the purchase of modern equipment, with a high level of reliability that does not requires maintenance costs. These elements create the premises for the efficiency of the company's operational costs and create the necessary premises in order to align the company's activity with the national and international requirements.

The proposed project produces effects after its implementation by increasing the number of users connected to smart energy networks.

8. Conclusions

- While the results indicators selected might be suboptimal to capture the energy efficiency gains from smart metering in electricity distribution, the expected increase in electricity consumption in fact renders more urgent the modernization of electricity distribution and the roll-out of smart metering, which supports optimization of grid operations and granular data (real time) on consumption and production by prosumers.
- The Energy Law 123 has been amended and the roll-out deadline was postponed, now extended by 2028 (though it is expected that even by 2028 the roll-out could be as low as 50%, since the law allows significant room for ANRE to decide even beyond that date). Consequently, there is a risk that all smart metering projects such this one implemented in recent years (from LIOP and several pilot projects promoted by ANRE) might not be compatible with the equipment that would be installed by the time of the full roll-out in 2028 or well beyond, as technology changes.
- The outcome indicator (showing electricity consumption per household, with the baseline 2014 and target for 2023) is unlikely to be achieved, mostly because there are other factors apart from energy efficiency which influence the consumption. These include the substitution of electricity for other energy sources (e.g. change of heating source, electromobility) and increased usage of household appliances.
- This is a demonstrative project supporting distribution company to gain experience in the installation and operation of smart metering, which can be further scaled up.
- The beneficiary plans to ensure the smooth integration of this demonstrative project under the full roll-out, which requires compatibility of the equipment installed now (with LIOP funding) with the equipment used for the whole system. The sustainability will decrease if the full roll-out of smart metering is further delayed, because the technological changes could limit the compatibility with technical solutions that would become mainstream by the full roll-out by 2028.

SO 6.4. Increasing the operational energy efficiency at S.C. AMBRO S.A. Suceava by implementing a high efficiency cogeneration installation - 115900

1. Brief project description

The general objective is to increase energy efficiency at the level of AMBRO SA by reducing consumption energy (implicitly reducing the consumption of primary energy resources) and reducing carbon emissions by purchasing, installing and the use of a high efficiency cogeneration plant.

The specific objectives of the project are the followings:

1. To purchase a high efficiency cogeneration unit with gas turbine and recovery boiler steam without additional combustion, within the limit of 19.99 MWt fuel input and in compliance with the restrictions imposed by the applicant's guide. The realization of this indicator, ie the support of a company for a productive investment, contributes to the CO01 indicator (program level indicator).
2. Installation and commissioning of a high efficiency cogeneration capacity of 17,139 MW of which 6,407 MW for electricity production and 10,732 MW for thermal energy production. This specific goal contributes to indicator 2S58 (program level indicator).
3. To improve the global energy efficiency of AMBRO SA by obtaining an annual savings of primary energy of 30,765 MWh (ie a saving of 2,645 thousand toe), a specific objective that contributes to the 2S57 (program level indicator).
4. To reduce the negative impact on the environment (as an effect of energy production in cogeneration) by reduction of CO2 emissions by 6,305,303 tons / year as an effect of cogeneration energy production taking into account the primary energy. This specific objective contributes to indicator 2S118 (program level indicator).
5. To reduce the negative impact on the environment by reducing greenhouse gases, i.e. the estimated annual decrease of greenhouse gases by 12,683 tons of CO2. This specific objective contributes to the CO34 indicator (program level indicator).

Expected results:

1. Purchase of a high cogeneration unit efficiency with gas turbine and steam recovery boiler without additional combustion, within the limit of 19.99 MWt fuel input and with compliance with the restrictions imposed by the applicant's guide. Another result obtained as a result of the realization of OS 1 consists in the construction of the 2 buildings (according to those presented in the feasibility study) that would not have been made without reaching OS 1.
2. Increasing the power installed within AMBRO SA by installing and putting in function of a high-efficiency cogeneration capacity of 17,139 MW of which 6,407 MW for electricity production and 10,732 MW for thermal energy production.
3. Achieving an improvement in the overall energy efficiency of AMBRO SA by obtaining an annual primary energy saving of 30,765 MWh.

4. Reduction of the amount of CO2 emissions by 6,305.303 tons / year as an effect of cogeneration energy production taking into account the primary energy saving.
5. Reduce the negative impact on the environment by reducing the gases with greenhouse gas, ie the estimated annual decrease of greenhouse gases by 12,683 tons of CO2.

Activities:
- Acquisition of the cogeneration unit (gas turbine plus related machinery and equipment)
- Realization of constructions and installations (the 2 buildings in which the gas turbine and the related equipment will be mounted)
- Installation of technological equipment.
- Arrangements for environmental protection and restoration to the initial state
- Realization of the technical project and of the execution details
- Technical assistance from the designer
- Site management
- Construction works and installations related to the site organization
- Training of operating personnel
- Technological tests and trials.

Project justification

In accordance with the “National Action Plan 2016-2020 on climate change”, Romania aims to reduce the amount of CO2 emissions by 20% and support investments aimed at installing new high cogeneration capacities efficiency for industrial consumers. The implementation of this project, it contributes to the achievement of this objective by reducing the amount of CO2 emissions by 6,305,303 tons / year as an effect of cogeneration energy production considering the primary energy saving.

According to the “Energy Strategy of Romania 2016-2030, with the perspective of 2050”, “energy efficiency is one of the least costly reduction of greenhouse gas emissions, reduction of energy poverty and increase of energy security. The EU's energy efficiency target for 2020 is to reduce primary energy consumption by 20% compared to the reference level established in 2007 (MRDPA 2015). For Romania, the target is 19%, corresponding to a primary energy demand of 500 TWh in 2020. By 2030, the EU is aiming for a cumulative reduction of at least 27% in energy consumption. "

The implementation of this project contributes to the achievement of this objective established within the national energy strategy mentioned both by obtaining an annual primary energy saving of 30,765 MWh and by reducing the negative impact on as a result of the reduction of greenhouse gas emissions, ie by the estimated annual decrease of greenhouse gases 12,683 tons of CO2 / year.

The implementation of this project is also part of the "National Action Plan in the field of energy efficiency" which stipulates that "The industrial sector is complex, comprising large energy consuming industries with high energy intensity (steel industry, building materials, chemistry), small energy consuming industries, but with high energy intensities (food and beverages industry, tobacco industry, the wood processing industry, the manufacture of paper and paper products etc.). "

Regarding Romania's energy governance, according to the "Romania's Energy Strategy 2016-2030, with a view to 2050" there is a need to modernize the energy governance system. Increasing the quality of the energy governance system in Romania constitutes the basis for the achievement of all the other strategic objectives ”. This goal can be achieved by improving governance corporate efficiency of companies by streamlining, professionalizing and technologically modernizing these companies to be competitive at regional and European level.

Implementation of this project aimed at increasing operational energy efficiency at AMBRO SA by implementing an installation of high efficiency cogeneration contributes to the efficiency, professionalization and technological modernization of AMBRO SA, contributing in this way to increase the quality of the energy governance system in Romania.

As a result of the analysis of the existing situation and the identification of the deficiencies (chapter 2.3 of the Feasibility Study) it appears that AMBRO SA is currently facing deficiencies of energetic nature (respectively the way of supplying electricity and heat) and of economic nature (respectively the cost of energy in the final product). These deficiencies have been identified in the context of the increase in paper production, an increase that implies the need for energy supply efficiently from an energy point of view, optimal from the point of view of economically and safely and continuously.

By implementing this project aimed at installing a newly installed high-efficiency cogeneration plant (cogeneration with gas turbine and steam recovery boiler without additional combustion within the limit of 19.99 MWt fuel input and less of 8MWe output), AMBRO SA intended to produce in the cogeneration system both the technological steam necessary to carry out the activities of production as well as a part of the electricity, the rest of the necessary electricity will be provided from SEN.

The sizing of the cogeneration plant considers on the one hand the requirements that will be stipulated in the specifications according to the requirements the applicant’s guide (for priority axis 6, specific objective 6.4) and on the other hand by the forecasted evolution of the application presented in feasibility study.

By making this investment, the aim is to ensure the continuity and safety of the energy supply (electrical and thermal) of AMBRO SA in terms of technical and economic efficiency. As a result of the implementation of the project, the reduction of energy consumption from the National Energy System (SEN) by using electricity and heat in 100% production processes obtained by high efficiency cogeneration.

Basically, the implementation of this investment project will lead to an increase in the efficiency of electricity and heat production required, will improve technological production processes within AMBRO SA and will contribute to the reduction of pollutant emissions for the environment.

Progress of project implementation:

The project is in an advance stage of in implementation (80% pay rate at the end of January 2021) and is planned to be finalized (based on the project extension approved by MA LIOP) on 30 June 2021. Because of the conditions created by the pandemic, the beneficiary had difficulties to bring in foreign experts for decommissioning and commissioning. For this reason, the beneficiary requested an extension of the completion deadline, which was approved for 30 June 2021. Currently, the work is completed, and decommissioning carried out; after 15 March the beneficiary planned to start the commissioning tests and estimates to finish the project implementation at the end of May.

2. Reason for selecting the case (criteria, significance of the selected case)

Under the Specific Objective 6.4. of the LIOP PA 6 there are two projects contracted. It was selected the larger project, in a more advanced stage of implementation.

3. Methodology for case study

The case study was drafted based on the desk review of the relevant project documents (e.g. financing contract, initial progress report and project CBA), project details from LIOP databases (SMIS, internal MA LIOP reporting) and on the primary data collected from the individual interview with project manager, as well as from the interviews with the MA LIOP staff.

4. Budget

Total project budget: 51,496,635.72 lei
Total eligible budget: 37,416,177.85 lei
Total contribution of the beneficiary: 14,966,471.14 lei
Total non-eligible costs: 14,080,457.87 lei

5. Effectiveness of the intervention

The beneficiary found challenging to find a good supplier. The project was not turnkey in the sense that the same supplier, the same builder, fitter was supposed to do all the work. The potential suppliers from whom the beneficiary had quotations when they carried out the Feasibility Study did not undertake to do building works too. Therefore, the project was developed with separate supply of equipment, installation work, building work and fitting of the external connection. In the end, the awarded equipment supplier was awarded the contract for the building component in partnership with other companies, plus the installation component too. So, the supplier tendered other components in partnership with other companies.

Concerning the process of preparation of the project proposal, this was found a cumbersome process by the beneficiary. For the initial part – the financing application and Feasibility Study – the beneficiary worked with consultants. The feasibility study, with a technical company, and the financing application and the study were submitted with a consultancy specialised in European Funds. The beneficiary carried out the implementation part, including the project management and preparing terms of reference for the bidding. This has been challenging for the beneficiary because of the overload with bureaucratic requirements, even though Order 1594 simplifies and allows more leeway to private companies/private beneficiaries. It also comes with certain restrictions, and the beneficiary must pay great attention to details to avoid penalties. DRI Bacău carried out periodic site visits. The beneficiary also had visits from the Court of Auditors, on financial issues, and from DRI on technical issues. In general, there were no observations, the payments were disbursed very quickly compared to other experiences beneficiary had with the implementation of EU funded projects (SOPIEC[15]) which were much more difficult.

Difficulties faced in implementation

There was a limitation to 20 megawatts in the thermal chamber which means that the beneficiary was limited to 6.5 kW on the electricity part, according to the Applicant's Guide. It is the same limit applicable to CO_2 emissions. For the beneficiary it would have been more relevant and useful if they could generate more. For many years the beneficiary had been contemplating to build a co-generation plant – that was when they managed to get funding.

Another difficulty was that they planned three years for the implementation of the project, but time was lost because of the pandemic. With the addendum to the contract the project timeframe came up to three years, what was initially envisaged, which allowed for the optimum implementation of most activities. The most difficult was to carry out the tests and commission the plant. There were restrictions at the time; experts from Switzerland, Turkey and Italy were supposed to come – it was difficult to bring them all over. Finally, at the beginning of the year the beneficiary managed to overcome this problem and carry out the verifications before commissioning was carried out.

6. Efficiency

The beneficiary managed to implement the project within the budgeted amount. However, the ratio of eligible and non-eligible expenditure has slightly changed. In the award procedure, the beneficiary managed to get a lower price than it was stated in the Feasibility Study, re-allocated some amount of funds from installation to constructions based on notifications, but overall, there are savings for the two components. There may be small differences on constructions between the FS estimates and the final blueprint, they exceeded the budget on one side, and on the other they had even larger savings. The beneficiary exceeded the non-eligible expenditure – overall they planned in this project to replace the connection substation, the supply substation wherefrom the company is supplied by the zonal distributor – EOn and respectively DelGaz – and from there they have all the 6kW branches in the factory and the generator is also connected there. The estimate was below the final cost, but some extras were necessary on top of what was initially planned. The taxes were something extra – they were not envisaged in the initial stage: the ANRE approvals, a new agreement to connect to the gas distributor, and all these took time and came with extra costs. But all these were non-eligible expenses from the start. Overall, considering these rather high non-eligible expenses the beneficiary estimates they will exceed the total budget by 2-3%, but will remain below the budget of eligible expenditure.

7. Sustainability

According to the financial analysis (presented in the Feasibility Study) it appears that both during the project implementation (36 months) as well as in the post-implementation period corresponding to the reference period (17 years) the cumulated net cash flow is positive for each year of analysis. This demonstrates the sustainability of the project both in the implementation period and in the post-

[15] Sectoral Operational Programme "Increasing Economic Competitiveness"

implementation. Therefore, after the financial support will end, the project will be financially self-sustaining without any gaps or bottlenecks.

The ability to operate and maintain this investment after its implementation will be ensured both with the help of net cash flows, positive cash flows generated by the company's production activities (cash flows that will help cover all costs involved in the operation and maintenance of this investment) as well as with the help of AMBRO SA employees who will serve their investment after completion of its implementation.

The activities that will be carried out / continued after the completion of the project consist in ensuring the proper functioning of the entire equipment of high efficiency cogeneration that is the subject of this project, in the maintenance and periodic overhaul of all machinery and equipment which will be purchased through the project. These activities will be performed by AMBRO SA specialists who will operate the investment.

Regarding the possibility to obtain additional funds after the completion of the project, the beneficiary is undertaking efforts to access such funds (if opportunities will occur) but for other investments / types of investments that are not related to the investment that is the subject of this project (respecting the principle that states that double financing cannot be obtained for the same project).

After the completion of the implementation of the project, the machinery and equipment which determine the high cogeneration plant efficiency will be used by AMBRO SA specialists in the location where this project will be effectively implemented.

8. Conclusions

- While the beneficiary is optimistic about the efficiency of the investment, the cogeneration unit is not yet under operation to measure the actual savings. The intervention might be sub-optimal: given the restrictions for eligibility of the project (maximum capacity – 20 MWt, 6.5 MWe), the beneficiary installed a smaller capacity than would have been optimal for its industrial process.
- Industrial cogeneration supported from SO 6.4 could probably have been implemented without the support from ESCO, own resources, commercial loans, but the investment recovery would have been much longer.
- Romania’s policy has been to support high efficiency cogeneration, but current support covers only cogeneration for DH; a new scheme may be introduced to support industrial cogeneration with the condition to deliver a certain share of the electricity to the market (not only for self-consumption). Since the benefit of energy savings is achieved in any cogeneration process, regardless of whether the energy is consumed “in house” or sold to the market, EU financing could continue to support high efficiency cogeneration not covered by other schemes, to avoid as much as possible market distortions.

It should be noted that CO2 emission reduction is estimated based on the characteristics of the equipment, not actually measured, which means the indicator would be automatically reported as achieved once the capacity is installed.

SO 7.1. – Rehabilitation of the district heating in the municipality of Oradea for 2009-2028, phase II - 108460

I. Brief project description

The general objective of the project is to increase energy efficiency increase energy by the development of the centralized DH system (transmission and distribution networks) in Oradea, including the reduction of network losses. The goal is to contribute to increasing the competitiveness and efficiency of the entire centralized DH system. The project is part of a consistent strategy to modernize the DH system and which Oradea has been implementing consistently in recent years. Under the project, investments will be made to rehabilitate 20 km of primary transport networks (40 km of pipeline), which represents roughly a third of the total transport network. The interventions will enhance the energy efficiency of the system and the quality of the public service by reducing heat transport losses, CO_2 emissions and rapid detection of leaks for speedy interventions. Losses would be reduced by 370 TJ (26.7% reduction compared to 2015, from 1387 TJ in 2015 to 1017 TJ by the end of the project); the contribution to national heat loss reduction in DH networks is 2.42%. Additional benefits include the reduction of CO_2 emissions (by 22,558 t/year); NO_x (by 17.09 t/year); SO_2 (by 3.98 t/year) and dust (0.56 t/year); the reduction of primary energy (gas) would be 12,766,000 m3 (or 10,277 toe).

Oradea is a medium-sized DH system with about 67,000 connected end-users (households and public buildings; about 70% of the heating in the city is provided by the DH). The municipality had benefitted EU funds in the previous cycle 2007-2013, which focused on the environmental compliance of the heat generation (new gas turbine and heat recovery boiler) and about 17.5 km of priority transport grid. The city has a strong capacity for strategic planning and a consistent road map for improvements in the DH system and energy efficiency. It must be noted that Oradea is considered a success story in the DH sector in Romania: since 2013, the municipality turned around from bankruptcy; modernized the gas- and coal-fired CHP; introduced geothermal energy in the DH network (supplied by a private company, Transgex, while the municipality is currently implementing another geothermal project under LIOP); eliminated tariff subsidies over 2015-2020 by gradual improvements of the service quality without increasing end-user tariffs; and is the only DH system which manages to attract new consumers (including by local regulation, but also consumers are content with the quality of the service). The consistent, long-term strategic approach is also visible in the municipal capacity to attract all financing sources available for its projects (EU, Swiss, Norwegian, but also national budget). The municipality had approved a strategy for 2009-2028, prepared in the SOP Environment 2007-2013, which is still followed through and consists of 3 stages – the first was financed under SOP Environment, the second from LIOP and the third consists of 20 km of network and 43 substations for which a new contract has been signed on LIOP. The overall strategy includes investments estimated at 192 mn EUR includes a new gas turbine, two new hot water boilers, rehabilitation of the T&D network and exploring the new geothermal resources. One third of the money should be directed to the generation facility and two-third to the modernization of the T&D pipes. In 2013-2018, Oradea had invested 104 mn EUR in the DH system (88 mn in EU funds, 6 mn national budget, 6 mn local budget and 4 mn other international grants).

Source: Oradea city hall. LIOP supported interventions in red.

II. Reason for selecting the case

The project is the only finalized intervention under SO 7.1. The city of Oradea recently signed another financing contract for the modernization of the DH system and also has a project on SO 6.1 on geothermal energy as renewable heat source for the DH.

III. Methodology for case study

The data and information collected for this case study consist of:

- Project data (Oradea city hall’s application for financing, CBA analysis, latest progress report)
- Project details from LIOP databases (SMIS, internal AM reporting)
- Data collected from the city hall on the project - maps of priority network interventions and list of network sections
- Previous internal World Bank research on district heating in Romania

IV. Budget

The total eligible project cost is estimated at 22.2 mn EUR (of which 18.8 mn EUR financed from EU funds; 2.9 mn EUR national contribution and 4.6 mn EUR contribution from the municipality's budget). Under SO 7.1, financing is 85% EU funds, 13% national budget and 2% local budget.

V. Efficacy of the intervention

The project has been finalized and the municipality reports having achieved the target reduction of losses on the DH network. Procurement comprised 3 separate contracts (design-build for the works, supervision and audit). On the municipality's side, the project had been ready by 2015, but delays in the approval of the guidelines for applicants (which was released only in 2017, following discussions on state aid approvals needed for the entire Axis 7) and the restructuring of the DH operator prompted the municipality to start works on own funding and seek reimbursements after the contract was signed in 2018. While the procurement and approvals went relatively smoothly (because of the well-organized administrative units in the city hall and capacity for strategic planning), the company may face constraints related to the availability of materials, most notably pipes, for the contract that has only recently been signed for the third phase of modernization of the network. The DH operator has also made investments simultaneously at consumer level (distribution network and connections at the level of multi-family buildings), which allowed partly for the correct sizing of the network; however, the disconnect between priorities for thermal insulation of buildings (financed from ROP) and supply and network modernization (financed by LIOP) allowed the municipality to only partially coordinate the two measures (by prioritizing for thermal insulation multi-family apartment buildings connected to DH).

VI. Efficiency

The project is not efficient in CBA terms, including with EU financing, given the fact that the municipality still had subsidized tariffs during the implementation of the project (though the municipality intends to gradually increase the end-user price and eliminate completely the subsidy, with tariffs covering the maintenance and operational costs). DH remains the only viable option in terms of climate and energy efficiency for the city, and the system has good prospects to become economically sustainable if the strategic planning capacity is maintained and the priority projects in the strategy continue to be implemented.

VII. Sustainability

The project is sustainable as the DH investment plan is followed consistently in Oradea and the city manages to connect new consumers. The viability of the DH system will be further reinforced by the enhanced use of renewable energy (geothermal), both from private suppliers (Transgex) and the geothermal well under finalization by the municipality on LIOP financing on SO 6.1.

VIII. Conclusions

The project has been the only intervention finalized so far under SO 7.1. and the municipality of Oradea obtained another funding to speed up the modernization of the DH network. This highlights the superior planning and project implementation capacity of the municipality.

The delays incurred between the finalization of project preparation (2015) and the final signing of the financing contract (2018) suggest there is a need to increase capacity for state aid interpretation at the

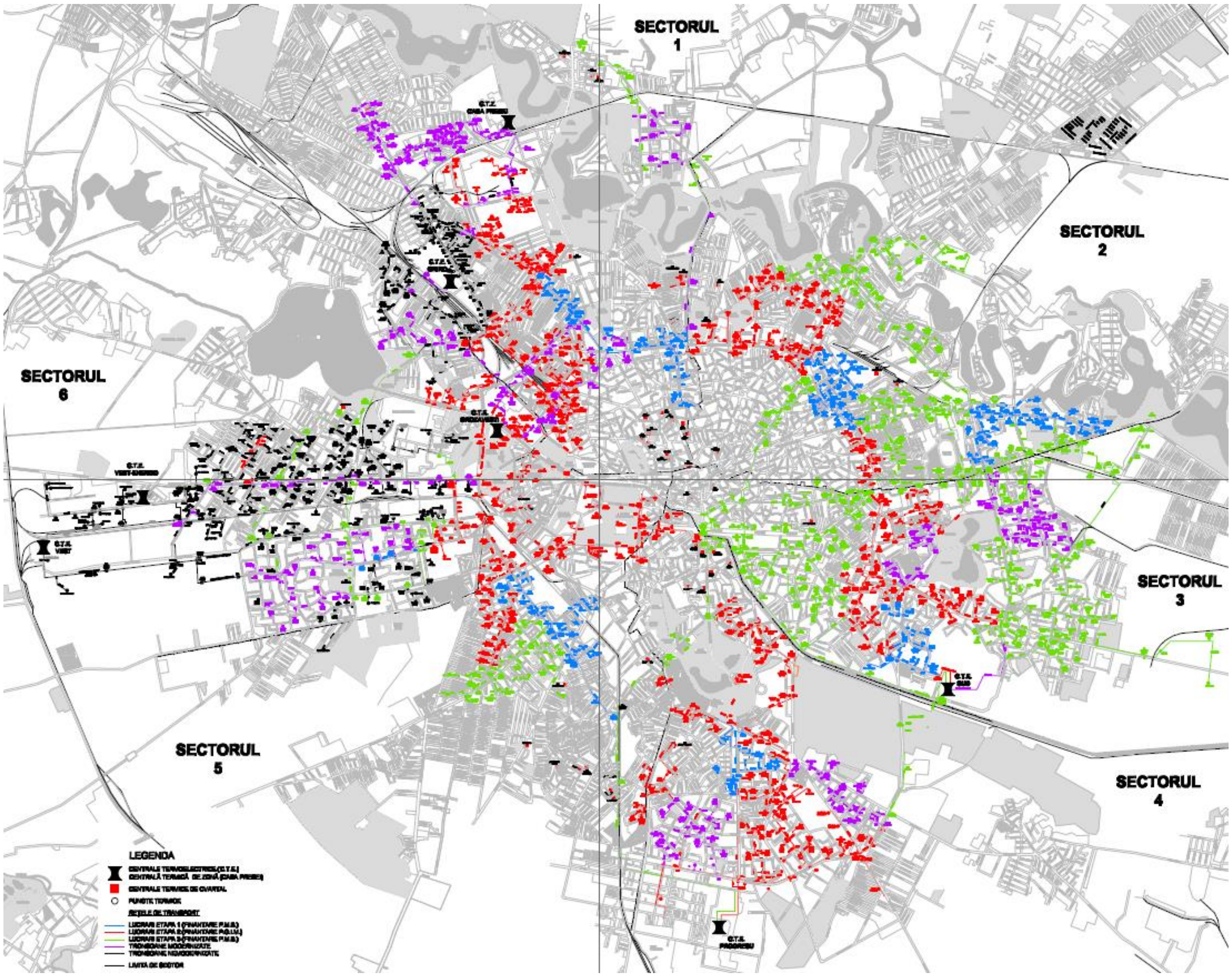
Competition Council to avoid delays in finalizing the guidelines for applicants. As highlighted by the relative success of Oradea's absorption of EU funds, major investments in DH infrastructure need a clear commitment at the municipal level for the continued supply of heat beyond one electoral cycle (an actionable strategy, consistently implemented, and targeted at maintaining the consumers connected to the grid, both by regulation and by improved quality of service).

SO 7.2. – Rehabilitation of the district heating in the municipality of Bucharest - 138142

I. Brief project description

The general objective of the project is to increase energy efficiency by reducing heat losses on transmission networks; to reduce the negative impact of DH pollution to improve the quality of life of the population in Bucharest by 2028 and to comply with environmental commitments in the EU Accession Treaty. The project aims to ensure a sustainable, affordable district heating system by modernizing 212 km of priority transport network (106x2), as illustrated in red in the map below. The network addressed in the project represents sections of pipeline where the modernization is critical, focused on areas around the heat source (large CHPs) and pipelines sections that need to be modernized to ensure the functioning of the DH ring. The ring allows that any part of the city can be supplied from several CHPs.

Bucharest has the largest DH system in the country, which serves about 1.2 million consumers (560,000 apartments); most of the 4000 km of network (1000 km transmission, 3000 km distribution) is obsolete and oversized compared to the residential demand. The heat source is mainly (about 93%) supplied by ELCEN, which has 4 main CHPs and is under the Ministry of Energy; the network (transmission and distribution) belongs to the municipality and is administered by a locally-owned company, Termoenergetica. The LIOP-supported intervention to modernize priority sections of the transmission network would reduce of the heat losses by 7.1%, from 29.8% in 2018 or 1,479,129 Gcal, to 22.7% in 2023 or 1,150,330 Gcal. Since Bucharest has the largest DH system in the country, the project would represent about 58.8% of the total energy efficiency gain if all remaining DH systems were modernized to reach the target of 15% losses. The specific objectives consist of reduction of losses on the network (to 22.7%, 505,086 GCal/year); reduction of CO2 emissions (195,873 t/year); reduction of heat demand from the source (446,015 GCal/year); reduction of NOx (179 t/year); reduction of gas consumption for the heat source (969,670 MWh/year); reduction of water losses (5,876,314 m3/year).



Source: Municipality of Bucharest. LIOP intervention covers transport network sections in red.

The 212 km (106x2) would be split in 25 contracts. The works consist of resizing the grid (replacement of existing pipes with smaller diameter, insulated pipes to reduce losses), including the management of the network. The pipes would be insulated and provided with sensors to detect leaks – this would also ensure faster response in case of damages. The total eligible costs are 278.3 mn EUR without VAT.

II. Reason for selecting the case

The project covers 100% of the SO 7.2.

III. Methodology for case study

The data and information collected for this case study consist of:

- Project data (Bucharest city hall’s application for financing, CBA analysis, latest progress report)
- Project details from LIOP databases (SMIS, internal AM reporting)
- Data collected from the city hall on the project - maps of priority network interventions and list of network sections

- Previous internal World Bank research on the Bucharest district heating

IV. Budget

The total eligible project cost is estimated at 278.3 mn EUR (of which 236.6 mn EUR financed from EU funds; 36.2 mn EUR national contribution and 5.6 mn EUR contribution from the municipality's budget). Under SO 7.2, financing is 85% EU funds, 13% national budget and 2% local budget.

V. Efficacy of the intervention

Currently, the project financing contract has only recently been signed and constructions are likely to start in 2022 at the earliest date (given also that the construction season is limited to spring-autumn months to avoid major interruptions in heat supply during the winter). The project has been delayed for several reasons. Initially, the project was expected to cover modernization of 250x2 km of pipelines. The feasibility study, prepared for the original project, had to be redone in 2017 because Jaspers considered that the options that had been analyzed were insufficiently well justified and that the total of 250 km of double pipeline well exceeded the implementation capacity of the municipality (the city hall manages to modernize about 20 km/year, while the major constraint is not so much the available funding as the capacity to contract and implement works). Jaspers supported the city hall's project team during the preparation of the second feasibility study and for the preparation of the project for submission to the LIOP. For the motivation concerning the viability of the support from EU funds, Jaspers also undertook an institutional assessment on the viability of the DH system in Bucharest which highlighted the major dysfunctions in the system, particularly the lack of coordination between various institutions responsible for parts of the DH (the heat source belongs to the Ministry of Energy, while the network to the municipality; the tariffs cover only a third of the total heat costs at end-consumer; the municipality incurred arrears in subsidy to the DH, which caused a chain of arrears to ELCEN, gas suppliers Romgaz and Engie, and tax authorities ANAF). The reorganization of the DH system by merging ELCEN and the DH company RADET, discussed since 2013, did not take place. Additional delays resulted from the state aid interpretations and the notification process to the EC, which in the end followed two separate tracks for the operational subsidy and the financing for the investment. Currently, the municipality awaits the final decision on state aid from the EC. The feasibility study, institutional assessment and CBA required adjustments as the municipality made several significant changes concerning the DH company (it set up two companies, which were contested in court, and finally set up a new company in November 2019, Termoenergetica, which took over operations from RADET, declared bankrupt). The envisaged merger of ELCEN and Termoenergetica (by takeover of ELCEN by the municipality) may require a new green light from the EC during the implementation of the LIOP-supported project. Given the lengthy process of institutional setup, the total costs had to be amended because of legislative changes that had occurred in the meanwhile (e.g. Ordinance 114/2018); and because works undertaken with own municipality funds for other sections of the network identified additional interventions (e.g., the galleries for the underground pipeline needed consolidation that had not been expected at the preparation of the original feasibility study). Though most of the works consist of replacing underground pipes inserted in galleries (with no expropriations required), the access will also likely cause delays in the implementation, as the agreement with owners is a precondition for the beginning of works on each section; small realignments may be envisaged if land access is particularly difficult on some sections.

Given all the delays, the municipality expects to organize the first tenders by mid-2021 (works, supervision, project management support) and hopes to sign the contracts by end-year. It is very unlikely that the full 212 km of network would be finalized by 2023 (considering the implementation capacity which so far was about 20 km/year, and that the works would entail considerable disturbance for traffic on major routes). The project is thus likely to be "phased" (i.e., split in works done by 2023 and works that could be finalized later, for which the municipality would seek financing from the next EU budget cycle). However, the "phasing" decision would be made in the second half of 2023. In the meanwhile, the DH system in Bucharest faces increasing interruptions of supply during winter, which suggests that extending the project beyond 2023 might require a reassessment of the viability of the system and of the commitment of the municipality to ensure the DH remains a going concern.

VI. Efficiency

The project is not efficient in CBA terms, including with EU financing, given the low tariff (though the municipality intends to gradually increase the end-user price). DH would be the only viable option in terms of climate and energy efficiency for the city, and the system could be made economically sustainable if well managed over a longer period (there is significant private interest for a concession of the Bucharest DH, with the condition that the tariff policy would allow recovery of investments and operational costs).

VII. Sustainability

The sustainability of the project (which may be finalized well beyond the 2023 deadline) is questionable in the absence of a clear action plan and policy for sustainable heating in Bucharest. Currently, tariffs are less than a third of the total heating price, which does not allow for the maintenance of the network and investments to catch up with the backlog in modernization.

VIII. Conclusions

The project has been significantly adjusted since the programming in 2013-2014 and the original feasibility study before 2017; major changes in institutional setup, the lack of a consistent policy to revitalize and modernize the DH system led to a deterioration of the quality of supply. Though disconnections in Bucharest are officially low (also because Bucharest has one of the cheapest heat in the country), there is a substantial risk that the system may collapse because of the massive losses of heat and water in the pipelines. Currently, parts of the city (particularly N-E) face long interruptions because of the closure of heat producers close to the area and little prospects for improvements, which may accelerate disconnections that have been so far low (less than 10% since 1990).

The delays so far suggest there is a need to:

- Increase capacity for state aid interpretation, including at municipal level for major projects that require state aid on EU funds, to avoid delays in finalizing the guidelines for applicants
- Ensure the split of works in sections that can be finalized by 2023 and sections that require a longer implementation, to allow for a possible "phasing"
- Major investments in DH infrastructure need a clear commitment at the municipal level for the continued supply of heat beyond one electoral cycle (an actionable strategy, consistently implemented); otherwise, if the quality of the service deteriorates rapidly with little prospects

for improvements, the disconnections may accelerate and render the system unviable. At the same time, the city has expanded with new neighborhoods of multi-family apartment buildings not connected to DH; and the DH would require significant resizing and modernization to match the current patterns of demand. This requires major adjustments to the system without which funding may be poorly prioritized to pipelines that may become stranded assets.

SO 8.1. - OHL 400kV Gutinas-Smardan - Transelectrica

I. Brief project description

The broad objective of the financing on this SO is to improve energy efficiency and security of supply by developing smart distribution, storage and energy transport and by integrating renewable energy production. The project consists of the construction of a 400kV line between Gutinas and Smardan and station works in Gutinas. It specifically increases the capacity of the National Energy System to integrate renewable energy production by:

- strengthening the network, much needed because the development of RES production capacities in SE Romania. It allows the takeover of the electricity produced by wind power plants from Dobrogea

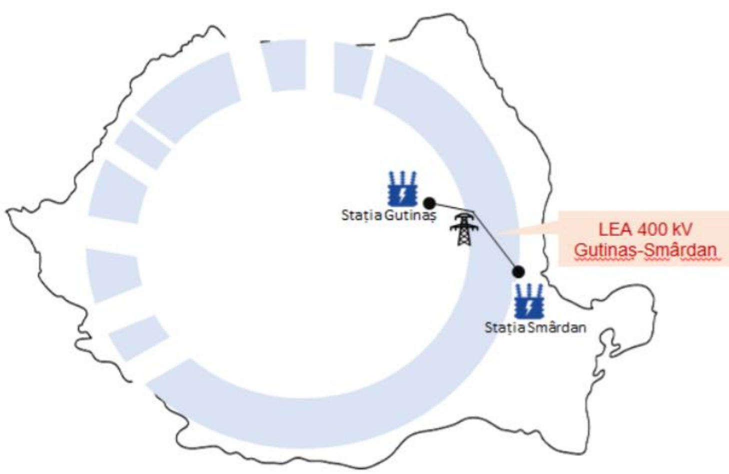
- integrating the renewable energy production from new capacities installed in Dobrogea and Moldova

- increasing security of supply for consumers in Moldova and eliminating network congestions.

The project also contributes to the North-South priority corridor on electricity: “North-south interconnections on electricity in Central, Eastern and Southeastern Europe ("NSI East Electricity"), increasing the Romania-Bulgaria interconnection capacity.

The construction of the line is a priority as after 2010 Dobrogea became a highly congested area with significant new RES capacities (mostly wind; of the total 2500 MW wind capacity installed, 80% are in Dobrogea). At the same time, Moldova is underserved with little electricity generation; and Transilvania is a rapidly developing region with increasing electricity demand. Currently, there is a 400kV line Gutinas-Smardan, which is obsolete (built in 1969) and does no longer meet energy security criteria. Under the project it would be replaced and then the connection would be further strengthened in subsequent projects for the interconnection with Bulgaria.

Under the project, 140 km of line would be built (2 km underground, 138 km OHL), and the connection point in the substation Gutinas. At the finalization of the construction the capacity of the energy system to integrate renewables would increase from 2200 MW (2013) to 3200 MW (2023). The line would cross 25 localities in 3 counties (Bacau, Vrancea, Galati). Originally, the total project value eligible for EU funding was estimated at 23.5 mn EUR, of which 20 mn EUR EU funds (85%).



Source: Transelectrica presentation, available at: https://financialintelligence.ro/wp-content/uploads/2019/04/Adrian-Suta-Transelectrica.pdf

II. Reason for selecting the case

The project covers 100% of the SO 8.1.

III. Methodology for case study

The data and information collected for this case study consist of:

- Project data (Transelectrica's application for financing, CBA analysis, latest progress report)
- Project details from LIOP databases (SMIS, internal AM reporting)
- Interviews (Transelectrica project officers; MA)

IV. Budget

The total eligible project funding is 152,168,390 RON, of which EU contribution would be 129,343,132 RON. The project has only one large works contract which comprises the design and construction; smaller eligible expenditure consists mainly of consultancies (e.g., works supervision). The value of the project has been amended from the original estimates because of expenditure eligibility criteria and increase of costs caused by inflation and legislative changes (such as OUG 114/2018).

V. Efficacy of the intervention

The project faced several delays in implementation and as of March 2021 the main contract for works is under tender (the financial offers were under evaluation). Transelectrica expects to finalize works in 18 months after contracting. The main delays were caused by:

- State aid interpretation. The original guidelines for application issued in 2017 were based on a preliminary assessment of the applicable state aid rules which suggested the support was state aid compatible with the internal market and was excepted from notification to the EC. Following EC clarifications on state aid, the analysis showed that Transelectrica fits under natural monopoly criteria, which led to adjustments (increases) of eligible expenditure and approvals from the Competition Council. The financing contract was signed in October 2018.
- Construction permits and expropriation. While there is legislation allowing for expropriations (a specific Government Decision for Transelectrica's project in 2017), the most difficult land acquisitions were from other state institutions, mainly the Agency for State Domain and the forestry company Romsilva (the latter has 15 plots of land out of the 445 needed by Transelectrica for the line). The construction permitting, which is done by each locality that the project crosses, is not unitary, though there is national legislation (L120) which requires that authorizations should be valid not for a year, but until the project is finalized.
- At this stage, there may be a risk that issues typical for public procurement (e.g. tender contestations) could further delay the project beyond the deadline for construction 2023.

VI. Efficiency

The analysis at this stage can be examined only from the ex ante CBA, as the final costs would be known only after the procurement process is finalized. Based on the ex ante CBA, the project is not cost-efficient (the investments could not have been recovered from the expected transport tariffs); however, it is justified by broader economic and societal benefits such as increased integration of renewables, increased energy security and interconnectivity. It should be noted that the calculations for the CBA were prepared in 2013, when there was a boom in renewables in Dobrogea, which later subsided following the sharp adjustment in the support scheme in 2013-2014 (green certificates). Many RES capacities obtained the connection permits from Transelectrica, though in the meanwhile the construction of additional wind farms may have been abandoned. At the same time, as of 2021, wind investments would be economically viable without green certificates, but are constrained by the limited connection capacity of Transelectrica. The project would be even more relevant if there will be investments in the Black Sea offshore wind (which have good prospects).

VII. Sustainability

The maintenance of the investment is ensured by the inclusion of the assets in the regulated assets base (RAB) once the construction is finalized and put in operation. The transport tariff approved by ANRE is calculated based on the RAB. It is also very likely that, if the project is finalized, it would be more needed to ensure the connectivity between congested areas with high electricity production capacity and low demand and areas with high demand and low installed electricity generation.

VIII. Conclusions

The project has been designed in 2013, when there was a boom of RES, following a very favorable support scheme with green certificates which encouraged investments in wind and solar power plants. The benefits of the project would be fully realized if the business environment for energy capacities becomes more stable and conducive to new investments, particularly in the Black Sea offshore wind. The investments in RES declined temporarily because of the sharp adjustment of state aid support (green certificates); though in the meanwhile RES technologies became viable without needing state aid, they are currently hampered by other legislative and technical barriers – the latter includes the limited capacity of Transelectrica to connect new RES in highly congested areas such as Dobrogea. Thus, the project remains highly relevant and is likely to be sustainable well beyond the finalization of the LIOP. There are however several risks concerning the possible delays of implementation beyond 2023 (e.g., if there are delays in contracting the works, such as caused by tender contestations). The delays so far suggest there is a need to:

- Increase capacity for state aid interpretation (most importantly at Competition Council), to avoid delays in finalizing the guidelines for applicants
- Streamline the interpretation of various institutions concerning permitting and expropriations. E.g., for a project like Transelectrica’s, a round table with representatives from the 25 localities could ensure unitary interpretations of construction permits; a coordination meeting with Romsilva, MEWF (coordinating Romsilva); General Secretariat of the Government (coordinating Transelectrica), Agency for State Domain etc. could help speed up the expropriations, particularly as all state institutions involved are in the central government and preparing the documentation for expropriation requires a government decision.

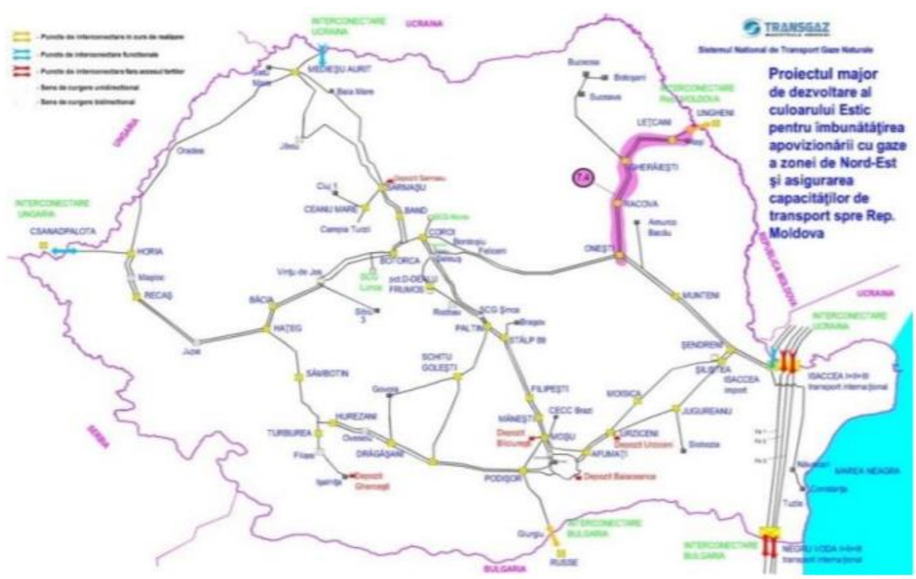
SO 8.2. – Development of the National Transmission Grid in North – East Romania to improve the supply of gas in the region and to ensure transport capacity to the Republic of Moldova - Transgaz

I. Brief project description

The specific objective of the project is to enhance the gas interconnection capacity with the Republic of Moldova. It consists of two sections of pipeline (Onesti-Gheraesti and Gheraesti-Letcani) and two compressor stations in Onesti and Gheraesti, with a capacity of 1.5-2.2 bcm/year. The project has two benefits: it completes the interconnection with the Republic of Moldova (started with the Iasi-Ungheni pipeline finalized in 2014 and the Ungheni-Chisinau pipeline finalized in 2020); and strengthens the gas network in N-E Romania, replacing an existing obsolete pipeline. The components of the project are thus:

- Construction of a new DN 700 gas transmission pipeline, Pn 55 bar, between Oneşti – Gherăeşti, 104.1 km. The route of this pipeline will be parallel mainly to the existing pipelines DN 500 Oneşti – Gherăeşti
- Construction of a new DN 700 gas transmission pipeline, Pn 55 bar, between Gherăești – Lețcani, 61.05 km. This pipeline will replace the existing DN 400 pipeline Gherăești – Iaşi on the Gherăești – Lețcani section
- Construction of a new gas compressor station at Onești with an installed capacity of 9.14 MW, 2 compressors of 4.57 MW each (one active and one backup)
- Construction of a new gas compressor station at Gherăeşti with an installed capacity of 9.14 MW, 2 compressors of 4.57 MW each (one active and one backup).

The estimated value of the project is 174.25 mn EUR.



II. Reason for selecting the case

The project covers 100% of the SO 8.1.

III. Methodology for case study

The data and information collected for this case study consist of:

- Project data (Transgaz's application for financing, CBA analysis, latest progress report)
- Project details from LIOP databases (SMIS, internal AM reporting)
- Transgaz website – TYNDP 2020-2029, project fiche, presentation to stock exchange and report to investors

IV. Budget

The total project cost is estimated at 174.25 mn EUR (of which 44 mn EUR eligible under LIOP, with 38 mn financed from EU funds), detailed as follows:

- Estimated amount for the procurement of materials: 64.95 mn EUR
- Construction of the Onești– Gherăești gas transmission pipeline: 17.32 mn EUR
- Construction of the gas transmission pipeline Gherăești–Lețcani: 15.19 mn EUR
- Onești Compressor Station: 48.46 mn EUR
- Gherăești Compressor Station: 37.06 mn EUR
- Pipeline automation and securing: 8.37 mn EUR
- Other activities (land acquisition, design, technical consultancy, audit and technical assistance): 28.32 mn EUR

V. Efficacy of the intervention

Currently, the project is under construction. Transgaz finalized 5 procurement procedures for the various components of the project (compressors; materials for pipeline; construction; other equipment for compressors and pipelines). There are 14 contracts, of which 13 were signed by end-2020. The contractors are currently executing the works and the project is expected to be finalized in summer 2021 (in December 2020, the physical implementation was 24.18%). Delays in the implementation occurred at the approval of the state aid (similarly to Transelectrica); approval of environment permit and construction permits; and land use (the land had to be temporarily excluded from agricultural use until the finalization of the construction of the underground pipeline). As in the case of Transelectrica, the project was declared a project of national importance by Government Decision, which facilitated the approvals.

The project would increase the interconnection capacity to Moldova from virtually zero at the beginning of the program to a theoretical 1.5 bcm. In reality, the pipeline could be used at half the capacity because, in the absence of storage capacity in the Republic of Moldova, gas would flow only during winter. The use could be however optimized after the finalization in 2021 due to external factors (the availability of gas pipelines transiting Ukraine after the construction of TurkStream which became operational in 2020, which would allow the access of Ukrainian storage capacity). The pipeline would however also compete with the Isaccea Negru Voda for the delivery of gas to the Republic of Moldova. The actual use of the pipeline would also depend on other external factors (e.g. the competitiveness of Romanian gas, the market rules in the Republic of Moldova allowing for effective competition).

VI. Efficiency

The project is not efficient in CBA terms, including with EU financing; however, the benefits of the project are mostly related to energy security in the regional market (the availability of a gas route to the Republic of Moldova given uncertainties on supplies of Russian gas).

VII. Sustainability

The maintenance of the investment is ensured by the inclusion of the assets in the regulated assets base (RAB) once the construction is finalized and put in operation. The transport tariff approved by ANRE is calculated based on the RAB. It is also very likely that, if the project is finalized, it would be more needed to ensure the connectivity between congested areas with high electricity production capacity and low demand and areas with high demand and low installed electricity generation.

VIII. Conclusions

The project has been designed in 2013, when the gas interconnection with the Republic of Moldova had been envisaged as a project in 3 stages (Iasi-Ungheni, Ungheni-Chisinau and the project currently analyzed). The access to the Transbalkan pipeline (controlled by Gazprom) for reverse flow at Isaccea was not envisaged at the time and the EU supported the alternative route. The shift of Russian gas transit away from the Ukrainian route to the newly-built TurkStream may reduce the economic viability of the project and the use of the infrastructure for gas supplies to the Republic of Moldova, but it could also provide additional access to gas from the Black Sea in the future and the use of the Ukrainian storage for the gas purchased during summer from Romania.

The delays so far suggest there is a need to increase capacity for state aid interpretation (most importantly at Competition Council), to avoid delays in finalizing the guidelines for applicants.

Annex E. Desk review documents

"*World Bank Group Evaluation Principles*", World Bank Group, April 2019 (as available at https://ieg.worldbankgroup.org/sites/default/files/Data/reports/WorldBankEvaluationPrinciples.pdf).

"*Guidance Document on Monitoring and Evaluation – European Regional Development Fund and Cohesion Fund – Concepts and Recommendations*", European Commission, March 2014 (Revision 2018).

"*Evaluation Plan of 2014-2020 Large Infrastructure Operational Programme*", Ministry of European Funds, Government of Romania, draft version, May 2016.

"LIOP: Ex-ante evaluation of Romania operational programme", Ministry of European Funds, Government of Romania, May 31, 2015.

"*Operational programme for the European Union Funds' investments in 2014-2020*", Republic of Lithuania, August 2014.

"Poland Operational Programme for Smart, Sustainable and inclusive growth and the achievement of economic, social and territorial cohesion, 2014-20'' Ministry of Economic Development, December 16, 2014.

"*Qualitative and quantitative evaluation of the achievement of goals and objectives set up in the operational programmes for 2007–2013: 2007–2013 EU structural funds investment for Lithuania*" prepared for the Ministry of Finance of the Republic of Lithuania by Visionary Analytics UAB.

"Energy efficiency in public and residential buildings, Ex post evaluation of Cohesion Policy programmes 2007-2013, focusing on the European Regional Development Fund (ERDF) and the Cohesion Fund (CF)" , European Commission, October 2015.

"*Assessment of the Co-generation Bonus*", World Bank, 2015.

"*Regulatory Impact Assessment for smart metering in electricity*", World Bank, 2016–2017.

*"Raport final de implementare, 2007-13" (a*s available at *www.fonduri-ue.ro/images/files/programe* /COMPETITIVITATE/POSCCE/2018/Raport_Final_de_Implementare_POS_CCE_2007-2013-revizuit_1.pdf).

"Final Implementation Report for the SOP Competitiveness", 2007–2013, March 2017, (as available at: https://www.fonduri-ue.ro/images/files/programe/COMPETITIVITATE/POSCCE/2018/Raport_Final_de_Implementare_POS_CCE_2007-2013-revizuit_1.pdf)

"Development of a system of common indicators for European Regional Development Fund and Cohesion Fund interventions after 2020", prepared by SWECO consortium for the EC, July 26, 2018.

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Annex F. List of members of CCE - LIOP

1. Ministry of European Investments and Projects – Directorate for Analysis and Programming
2. Ministry of European Investments and Projects - Directorate-General for European Programs Large Infrastructure
3. Directorate-General for Transport Intermediate Body, Ministry of Transport and Infrastructure
4. General Directorate of Management and Strategy, Ministry of Transport and Infrastructure
5. Center for Road Technical Studies and Informatics (CESTRIN)
6. National Road Infrastructure Management Company (CNAIR - S.A.)
7. National Railway Company (CFR)
8. National Institute of Statistics (INS)
9. Bucharest City Hall (PMB)
10. METROREX S.A.
11. Ministry of Development, Public Works and Administration
12. Department for Emergency Situations
13. Ministry of Economy, Entrepreneurship and Tourism
14. Ministry of Environment, Waters and Forests
15. Ministry of Health
16. Ministry of Energy
17. National Energy Regulatory Authority (ANRE)
18. Competition Council
19. The National Union of Romanian County Councils (UNCJR)
20. Association of Romanian Municipalities
21. Romanian Airports Association
22. Romanian Association of Consulting Engineers (ARIC)
23. Association of Management Consultants in Romania (AMCOR)
24. Romanian Geoexchange Society
25. WWF Association of the Danube Carpathian Programs Romania
26. Romanian Academic Society (SAR)
27. Romanian Water Association
28. Romanian Chamber of Commerce and Industry (CCIR)
29. Institute for Public Policy (IPP)
30. ANAF - General Directorate of Customs

Reimbursable Advisory Services Agreement on Supporting the Ministry of European Investments and Projects in Assessing the Use of European Structural and Investment Funds (ESIF) in the Energy Sector in Romania (P174407)

Interim evaluation report of selected fully implemented ESIF funded projects, and recommendations on the implementation of the 2014-2020 and design of the 2021-2027 LIOP programming periods

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