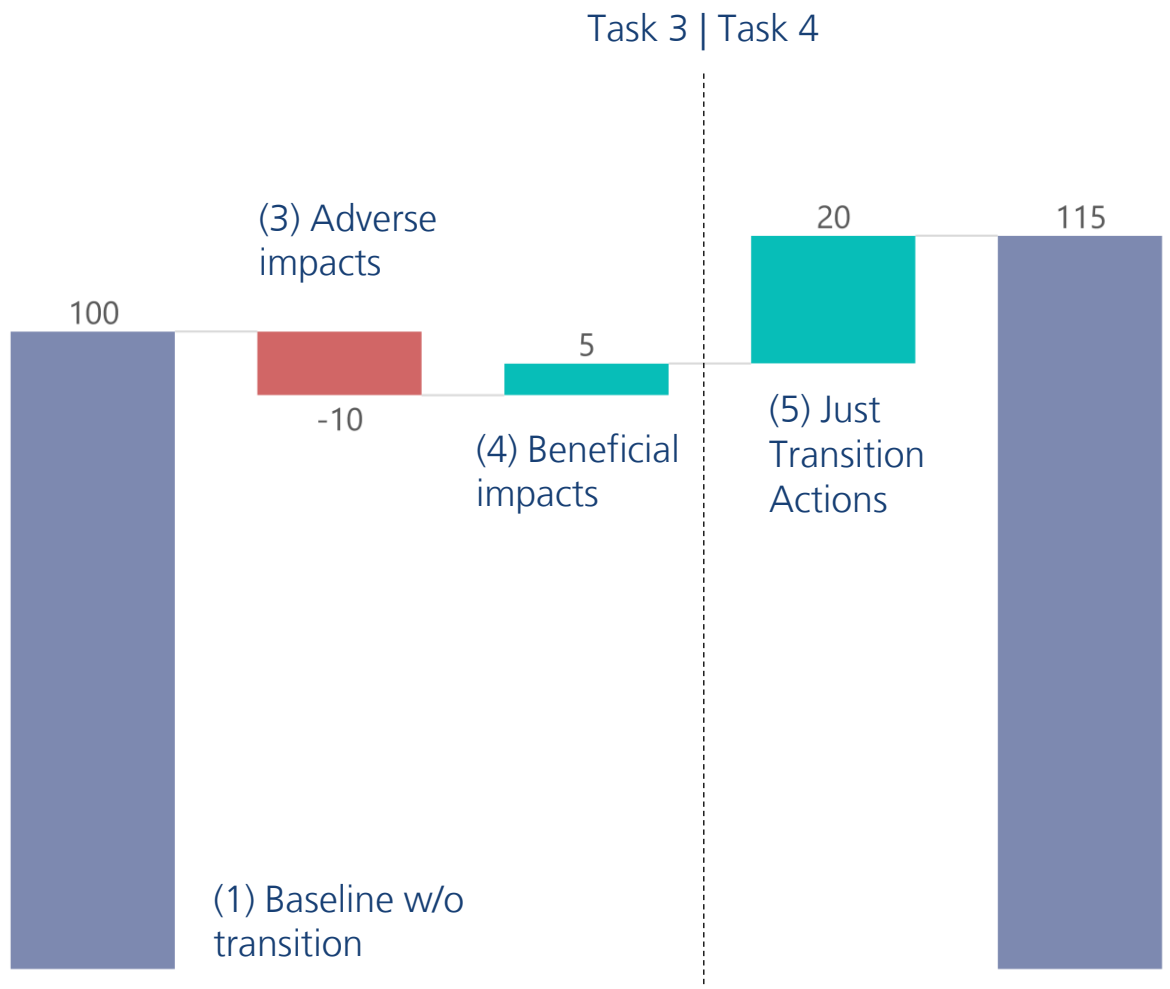
WHAT WE ARE AIMING FOR

Quantifying transition impacts and prospects

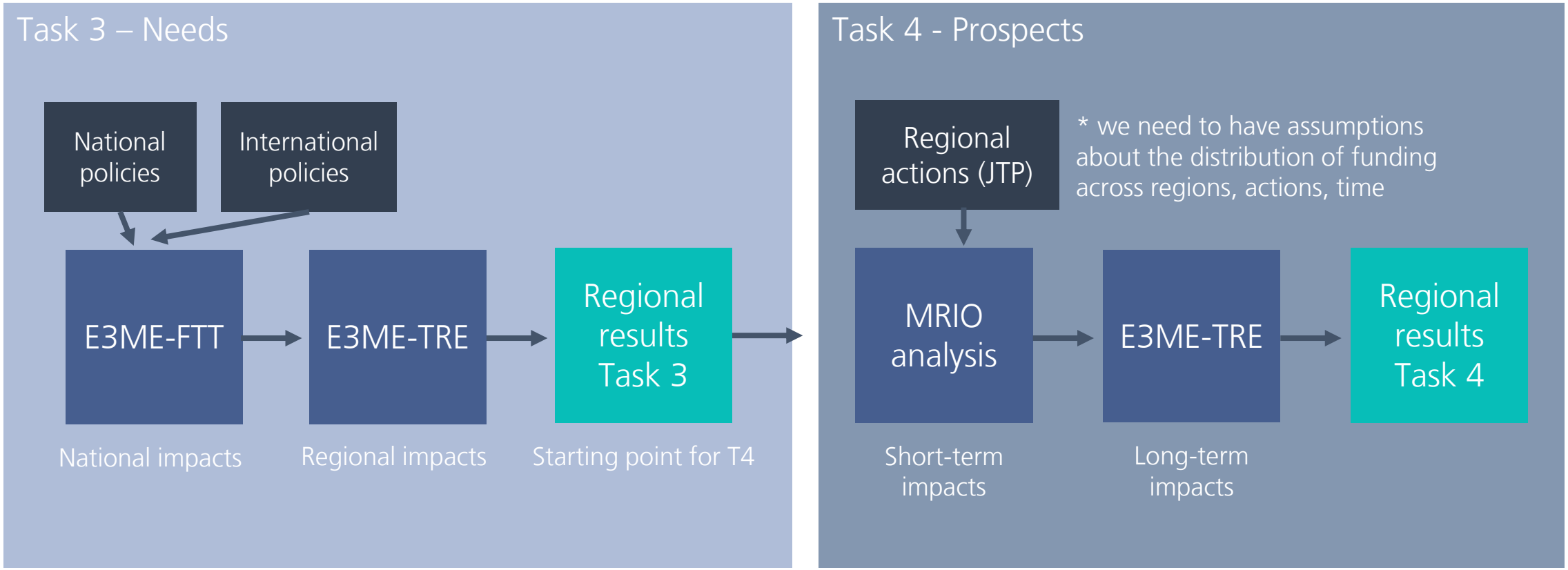
Modelling transition impacts

- The transition towards a carbon-neutral economy as envisioned in the European Green Deal inevitably means the transformation of certain sectors of the economy and labour market as well
- As the JTF articles say:
  " … managing the transition will lead to significant structural changes. Citizens and workers will be affected in different ways and not all Member States, regions and cities start the transition from the same point or have the same capacity to respond."
- But the transition can also bring beneficial impacts, in the form of new green jobs and new sources of incomes
- While the JTF is specifically established to offset these losses and to provide capacity for transitioning



Not actual data, for illustrative purposes only!

OVERVIEW OF LINKAGES IN MODELLING



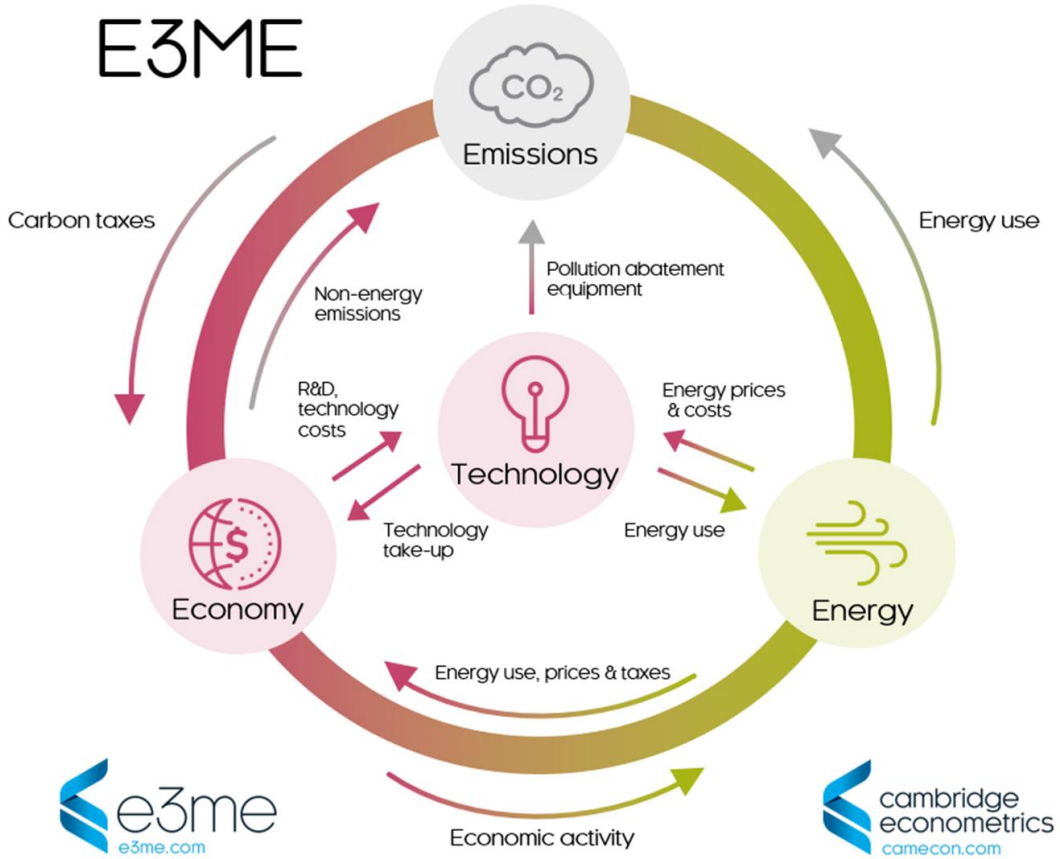
ANNEX

Further details

E3ME DETAILS

Further details of the E3ME macroeconometric model

ENERGY-ENVIRONMENT-ECONOMY INTERACTIONS – WITH TECHNOLOGY



FEATURES OF THE E3ME MODEL

Structural

- disaggregation of variables

Organized around a Social Accounting Matrix

- i.e. on accounting principles, e.g. System of National Accounts

Dynamic

- behavioural equations with effects from previous outcomes: i.e. history matters

Estimated on cross-section & time-series data

- identifies current-year responses and long-term trends
- allows sectoral and regional differences

Open as regards economic policy

- i.e. no assumptions of full employment, budget balance, or balance of payments equilibrium

"Scenario" approach

- computation of many scenarios with comparisons of policy packages and provides quantified explanation of results

Treatment of uncertainty

- in parameter estimates (econometric estimation of error distribution)
- in assumptions and policies (by scenario analysis)

MODEL DETAILS

Econometric specification

- Cointegration (long-run) and error-correction (short-run) methodology
  - particularly as promoted by Engle and Granger (1987) and Hendry et al (1984)
  - estimated using 2SLS method (IV)
- Error correction term is a key variable (dynamics of system)
  - ECM coefficient determines speed and type of return to equilibrium following an external shock to the system
- This makes E3ME suitable for both short, medium and long term analysis
- Special 'shrinkage' treatment for long-term equations in regions with limited time series data (Spicer & Reade, 2005)

Theoretical considerations

- Institutional behaviour (e.g. of an industry) is specific to a region over a time period
- Demand-led: consumer demand made effective by income
- Production assumed to be in conditions of uncertainty, imperfect competition and variable returns to scale
- Demands for labour, investment, energy in production process are derived indirectly from consumers' demand

TREATMENT OF SPECIFIC AREAS

The labour market

Treatment of the labour market is an area that distinguishes E3ME from other macroeconomic models:

- our approach allows for **both voluntary and involuntary unemployment, wage rigidity and labour market imperfections**
- includes econometric equation sets for employment, average working hours, wage rates (disaggregated by economic sector) and participation rates (disaggregated by 5-year age band)
- labour force is determined by multiplying labour market participation rates by population
- unemployment is determined by taking the difference between the labour force and employment

The role of technology

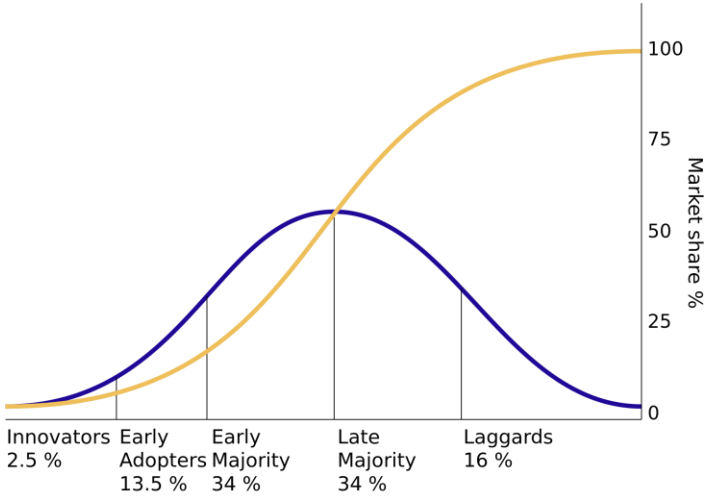
Technological progress plays an important role in the E3ME model, affecting all three E's: economy, energy and environment:

- The model's endogenous technical progress indicators (TPIs), a function of R&D and gross investment, appear in nine of E3ME's econometric equation sets including trade, the labour market and prices
- Investment and R&D in new technologies also appears in the E3ME's energy and material demand equations to capture energy/resource savings technologies as well as pollution abatement equipment
- In addition, E3ME also captures low carbon technologies in the power, road transport, heating, and iron and steel sectors through the FTT (Future Technology Transformations) sector models

WHY / WHAT IS FTT?

Why?

- **Bottom-up model**; econometric equations not appropriate for power generation because there is typically a small number of large plants and the econometric approach is not well suited for the development of new renewable technologies
- Which methodology, which question: Planning vs Projecting
- Is optimisation always what policy-makers find useful?



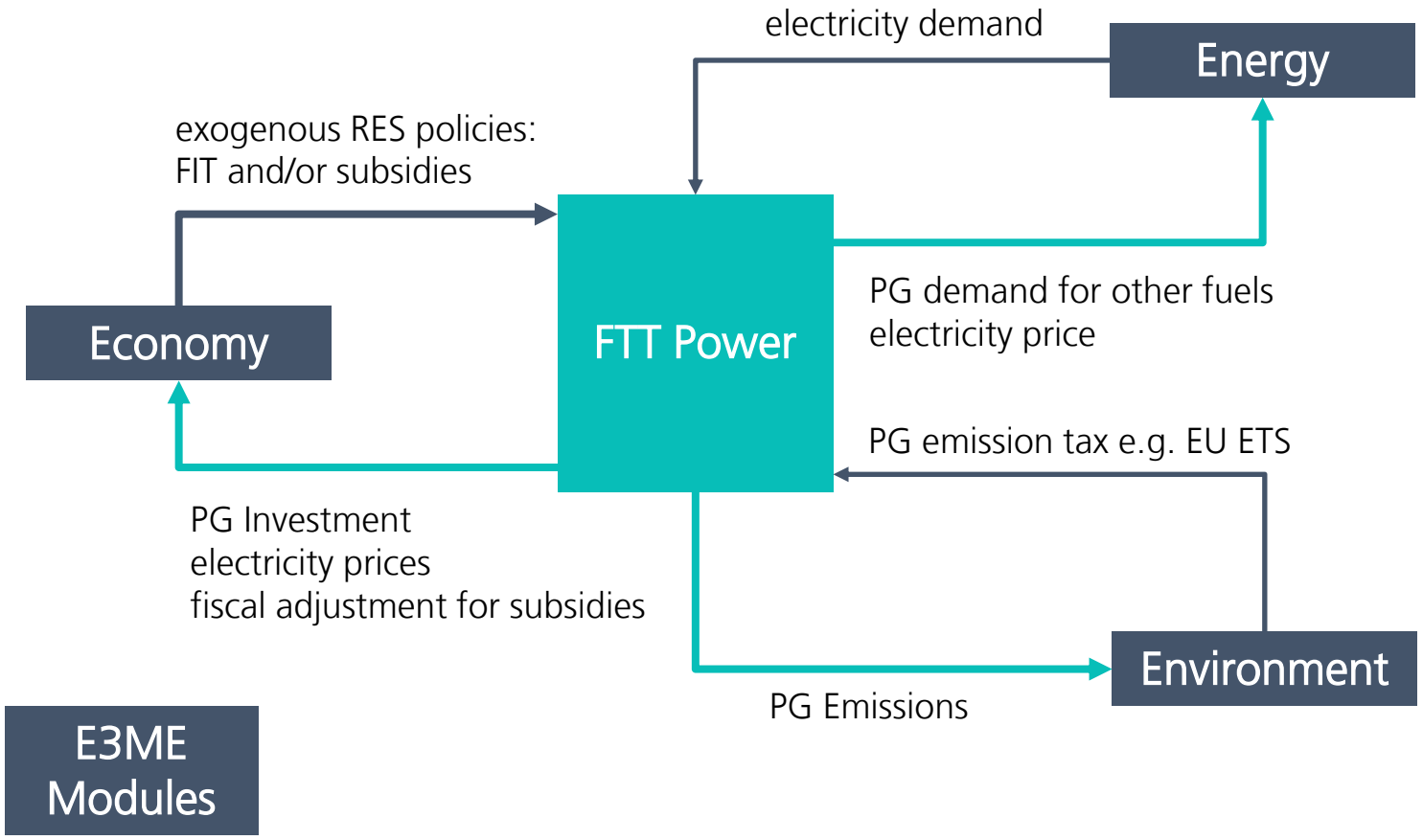
Based on Rogers (1962)

FTT:Power

FTT is a framework for the dynamic selection and diffusion of innovations developed by J.-F. Mercure (Mercure 2012).

- **Technology diffusion** following an *S-shaped curve* , but dependent on lifetime of existing technology
- FTT:Power uses a **decision-making core for investors** wanting to build new electrical capacity, facing several options, building on ecosystem modelling
- The decision-making core takes place by pairwise **levelised cost (LCOE) comparisons**, conceptually equivalent to a binary logit model, parameterised by measured technology cost distributions.
- Costs include **reductions originating from learning curves**, as well as increasing marginal costs of renewable natural resources (for renewable technologies) using **cost-supply curves**.
- Due to **learning-by-doing and increasing returns to adoption**, it results in **path-dependent technology scenarios** that arise from electricity sector policies

ENERGY-ENVIRONMENT-ECONOMY INTERACTIONS – WITH TECHNOLOGY



THE E3ME ECONOMETRIC EQUATION SETS

Energy	Economic	Labour	Price	Trade	Materials
Aggregate energy demand	Aggregate consumer demand	Employment demand	Industry prices	Internal import (EU)	…
Coal	Disaggregate consumer demand	Wages	Export prices	External import (EU)	
Oil	Investment demand	Participation rate	Import prices	Bilateral trade	
Gas	Investments in dwellings	Hours worked			
Electricity*	Normal output				
	Residual incomes				

OVERVIEW OF E3ME-TRE

Overview of the E3ME Tool for Regional Estimation

INTRODUCTION TO E3ME-TRE

Regionalisation of estimated impacts

E3ME-TRE

Using national-level E3ME estimated impacts: Employment, GVA

Achieved through a combination of two methods:

- **Top-down approach**
  regional disaggregation of macro-sectoral E3ME results using shift-share analysis and ARIMAX modelling
- **Bottom-up approach**
  applied to Power Generation sector
- **Outputs**
  Estimation of employment, GVA by region by sector