Introduction to Modelling Approach
Glossary: Important Definitions

Metrics
- Quantifiable indicators consistent with three pillars of sustainability
- Measurable in real world and from model outputs
- Either linked to a specific SDG or an „informal“ indicator assigned to a SDG
- Not limited to the SDG time frame, go beyond 2030

Long-term Performance Goals (LPGs)
- Stated targets that can be measured
- Inherently globally harmonious
- Defined as outcomes in 2050
- Not all LPG’s are necessarily harmonious (achieving one may make achieving another harder)
- Linked to energy related SDG’s
Glossary: Important Definitions

Interim Performance Indicators (IPIs)
- Modelled values of metrics at specific points in time along a given pathway
- Used to track progress towards LPGs
- May be LPG measures or other metrics
- Either consistent with SDG indicator or an informal indicator assigned to a SDG
Storylines
• Narrative descriptions of alternative futures
• Qualitative in nature
• Do not contain strategies for achieving specific goals or outcomes

Scenarios
• Quantified descriptions of a future (often outlined by a storyline)
• Quantification in 3 stages:
  • Quantified Assumptions (Input)
  • Quantified Relationships (Modelling)
  • Quantified Outcomes (Output)
Model Overview and Definition Summary

INPUT (Quantified Assumptions)
- Demographic: Population by region
- Productivity: GDP per capita by region
- Technology: Power plant conversion efficiency, transport fuel economy, etc., crop yields, etc.
- Resources: Fossil fuel, uranium, solar, wind, geothermal, land, water and other
- Policies: Pollution control, NDCs, water use

MODEL (Quantified Relationships)
- Integrated Model: Resource extraction, imports, energy transformation and use
  - Markets
  - Capital
  - Labor
  - Agriculture
  - Land use
  - Carbon cycle
  - Atmosphere
  - Hydrology
  - Oceans

OUTPUT (Quantified Outcomes)
- Energy Security: Price of energy, energy imports/exports, electricity access, energy/GDP
- Quality of Life: GDP per capita, energy services per capita, share calories from non-staples, water stress
- Environmental Sustainability: \( \text{SO}_2 \), \( \text{NO}_x \), \( \text{O}_3 \) concentrations, deforestation/afforestation, avg. earth surface temp, water withdrawals/recharge

Targets/Goals: LPG
Modelling Approach: Start

Reference Scenario

- Contains baseline assumptions from historical trends and current policies
- Reference Scenario for this project is SSP2 (Shared-Socio-Economic-Pathway) – termed “the middle of the road”

Modelling starts with the reference scenario (SSP2)
Modelling Approach: Next Step

1. BASELINE PATHWAY
   Reference

SSP2
population and GDP growth rates;

2. NDC PATHWAY
   SSP2
PLUS NDCs

- In a next step Nationally Determined Contributions (NDCs) are added to the base scenario
Modelling Approach: Policy Scenarios

In a third step policy scenarios are added

**Policy Scenario**

- 2 types of policy scenarios
  - A *policy proposal* is given (i.e. a subsidy for technologies x,y,z) and modelled on top of the base scenario
  - Or an *LPG* can be analyzed. For this the target range/value of the LPG is inserted into the model as a constraint
Example Policy Scenarios

**S1**
- **P1**: Consumer Pull: Green & Responsible Lifestyles, shared economy, e-vehicles, public transport, circular economy

**S2**
- **P2**: Integrated low-carbon energy supply: High RE & EE, storage, digitalisation,
- **P3**: Interconnected Low Carbon Energy Supply: FF with HELE + CCUS, digitalisation, hybrid solutions

**S3**
- **P4**: Government Control: High Self-sufficiency focus, CC adaptation, high EE, continued use of FF

**S4**
- **P5**: Fairness: equal carbon budgets / footprint, shared burdens; technology transfer, conservative, nuclear, high EE