OSeMOSYS Global:
An open-source, open-data global energy system model generator

Dr. Taco Niet, ΔE⁺ Research Group
  Sustainable Energy Engineering, Simon Fraser University
Dr. Abhishek Shivakumar, SDG Integration Team
  United Nations Development Program (UNDP)
Maarten Brinkerink, MaREI Centre,
  Environmental Research Institute, University College Cork

ΔE⁺ Research Group
ESMs are a key tool in addressing climate challenges

Existing global ESMs are not fully open

- Transparency
- Repeatability
- Barriers to entry

- Expanded spatial detail
- Full energy system model

Introduction and Background
Conceptual Approach

- Series of Python scripts that process specific input data and produce parameter files
- Built using the PLEXOS World Open Dataset
- Fully open source, from input data, scripts, visualizations, etc.
- Customizable
Naming Conventions

PWR - Power
MIN - Mining
RNW - Renewable
TRN - Transmission

CSP - Concentrated Solar Power
SPV - Solar PV
WOF - Offshore Wind
WON - Onshore Wind
...
...

AGO

Region

XX

Sub Region

01

Plant Number

ΔE⁺ Research Group
Representing International Trade

ΔE⁺ Research Group
Workflow - Snakemake

1. Database of raw data
   - Powerplant Data
   - Temporal Parameters
   - Variable Costs
   - Demand Projections

2. All formatted data (csv)
   - Geographic Filter
   - Specified region data (csv)

3. File Check

4. Visualize Results
5. Build and solve
6. Model compatible data file (*.txt)
7. otoole

ΔE+ Research Group
Data Validation – Residual Capacity

Residual Capacity

Year

Gigawatts

2015 2020 2025 2030 2035 2040 2045 2050

BIO CCG CDA GEO HYD OIL SPV URN
Data validation – demand projections
Spatial respresentation

ΔE⁺ Research Group

Brinkerink et al., 2021
Example: Gulf Undersea India Interconnect

Bi-Directional Interconnector Flows S15 2050
GUI – Power Demand by Country 2050

Power demand - monthly average by hour
GUI – Power Generation New Capacity

New capacity

Years

Gigawatts (GW)

2015 2020 2025 2030 2035 2040 2045 2050

Biomass
Coal
Geothermal
Heavy fuel
Hydro
Natural gas
Nuclear
Solar
Crude oil
Wind

SFU
GUI – Power Generation Total Capacity
GUI – Power Generation Profile 2050

Power generation - monthly average by hour

- Biomass
- Coal
- Diesel
- Interconnector
- Geothermal
- Heavy fuel
- Hydro
- Natural gas
- Nuclear
- Solar
- Wind
Conclusions

ΔE+ Research Group