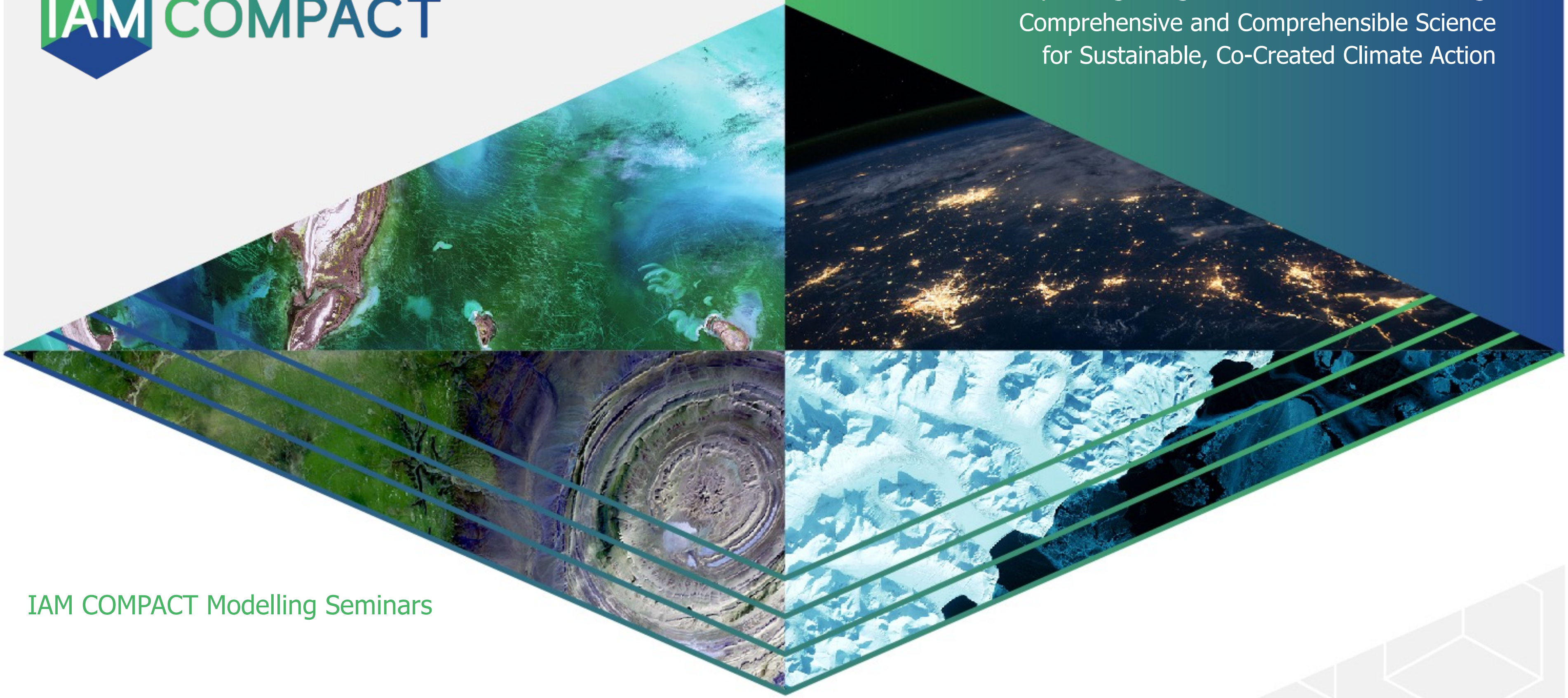
IAM COMPACT

Expanding Integrated Assessment Modelling:
Comprehensive and Comprehensible Science
for Sustainable, Co-Created Climate Action



IAM COMPACT Modelling Seminars

Model Presentation: Calliope

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The IAM COMPACT project has received funding from the European Union's Horizon Europe Research and Innovation Programme under grant agreement No 101056306.

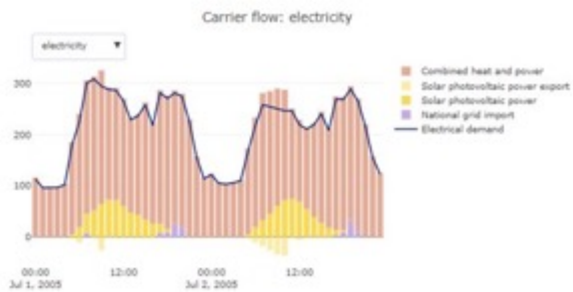
www.iam-compact.eu

Calliope is an open-source energy model developed with the following features:

- Designed to analyse energy systems with **high time resolution (like the variable renewables)**
- Formulated to allow **arbitrary spatial and temporal resolution**, equipped with tools to deal with time series data
- **Modular structure** and easy separation of the data and core code
- Have a **free and open-source code** written in Python

Main focus:

Optimising the **hourly** dispatch of the energy system in a short time horizon in the **operation mode** or optimising the new required capacities for a snapshot of the future in a **planning mode** (no time evolution, a shock on the demand and a new accommodation of the decision variables)



https://www.callio.pe/

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Inputs

- **Different Locations**
- **Load Demand(s)** ∀ *location*
- **VRES time series** ∀ *location*
- **Existing Techs** ∀ *location*
- ***Transmission lines*** ∀ *location*
- ***Cross border lines*** ∀ *pair-location*
- **Techno-economic param** ∀ *tech*
- **Constraint param** ∀ *tech*

Obj Fun: min NPC

Calliope

Outputs

- **Capacity Factors** ∀ *tech*
- **Carrier Consumed** ∀ *tech* ∀ *timestep*
- **Carrier Produced** ∀ *tech* ∀ *timestep*
- **Var Costs** ∀ *tech*
- **Fixed Costs** ∀ *tech*
- **Investment Costs** ∀ *tech*
- **LCOE** ∀ *tech*
- ***Capacity Installed*** ∀ *tech* ∀ *node*

https://calliope.readthedocs.io/en/stable/user/config_defaults.html

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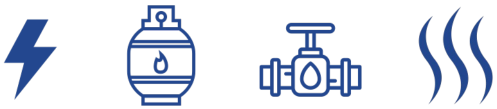
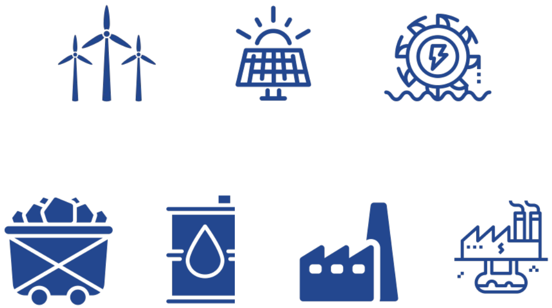
- 1 Year Horizon with 1 Hour Time Step
- 2 Modes of Optimisation: Operation and static Planning:
- Operation: Optimises the dispatch of the existing system at the moment being to fulfill the given load
- Planning: Optimises the installation of new plants, combining with already existing ones, to fulfill a given load
- Possibility to optimize different possible scenarios, to take into account future uncertainties (Stochastic Optimisation)

1. Different energy demands

2. Different energy carriers



3. Different energy sources



4. Adaptable Geographical Resolution

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- Which are the solutions which are close to mathematical optimal solution but are easier to put in practice for policymakers? doi.org/10.1016/j.joule.2020.08.002
- How a given emission reduction target can be achieved with minimal energy systems costs?
- How to provide access to electricity at the minimum cost in a specific region?
- How to assess the impact of a large-scale replacement of a diffused technology in favour of an alternative one on the energy sector? https://doi.org/10.1016/j.energy.2019.01.004
- How to reduce impact on grid stability by finding the best dispatch match in multi-carrier energy systems (electric and thermal)? doi.org/10.1109/ICCEP.2019.8890129

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SDG	Details
§7. Affordable and clean energy	Calliope provides an energy system solution which is characterised by the best energy dispatch to satisfy a given demand.
§13. Climate action	Calliope allows to assess the environmental impact of high-renewable penetration scenarios The SPORES algorithm implemented in Calliope provides policymakers with quantitative tools to select alternative decarbonised energy system configurations which are close to the mathematical least-cost solution but are more practically feasible. (Lombardi et al. 10.1016/j.joule.2020.08.002)

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Thank you!

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