IAM COMPACT

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

IAM COMPACT Modelling Seminars

Model Presentation: OSeMOSYS

Division of Energy Systems, Department of Energy Technology, KTH Royal Institute of Technology

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

- The Open Source energy Modelling System
- Presented in 2008 at the IEW and published in 2011 by Howells et al.
- Similar paradigm to MESSAGE and TIMES
- Long-term techno-economic optimisation
- Applications at Global, Continental, Regional, National, Sub-national, Village scale
- Perfect / Myopic foresight
- Deterministic / Probabilistic
- Available in GNU MathProg, Python, GAMS
- Several interfaces available

OSeMOSYS
Open Source Energy Modelling System

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

It determines the energy system configuration with the **minimum total discounted cost** for a time domain of decades, **constrained by**:

- **Demand for energy** (e.g. electricity, heating, cooling, km-passengers, etc.) that needs to be met
- **Available technologies** and their techno-economic characteristics
- **Emission taxations** and generation targets (e.g. renewables)
- **Other constraints** (e.g. ramping capability, availability of resources, investment decisions, etc.)

Get to know more: http://www.osemosys.org/
Download the interface here
Get started on GitHub: https://github.com/OSeMOSYS/OSeMOSYS

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

Regions and sectoral coverage

Can be applied to any region (and has been)

It is a modelling framework

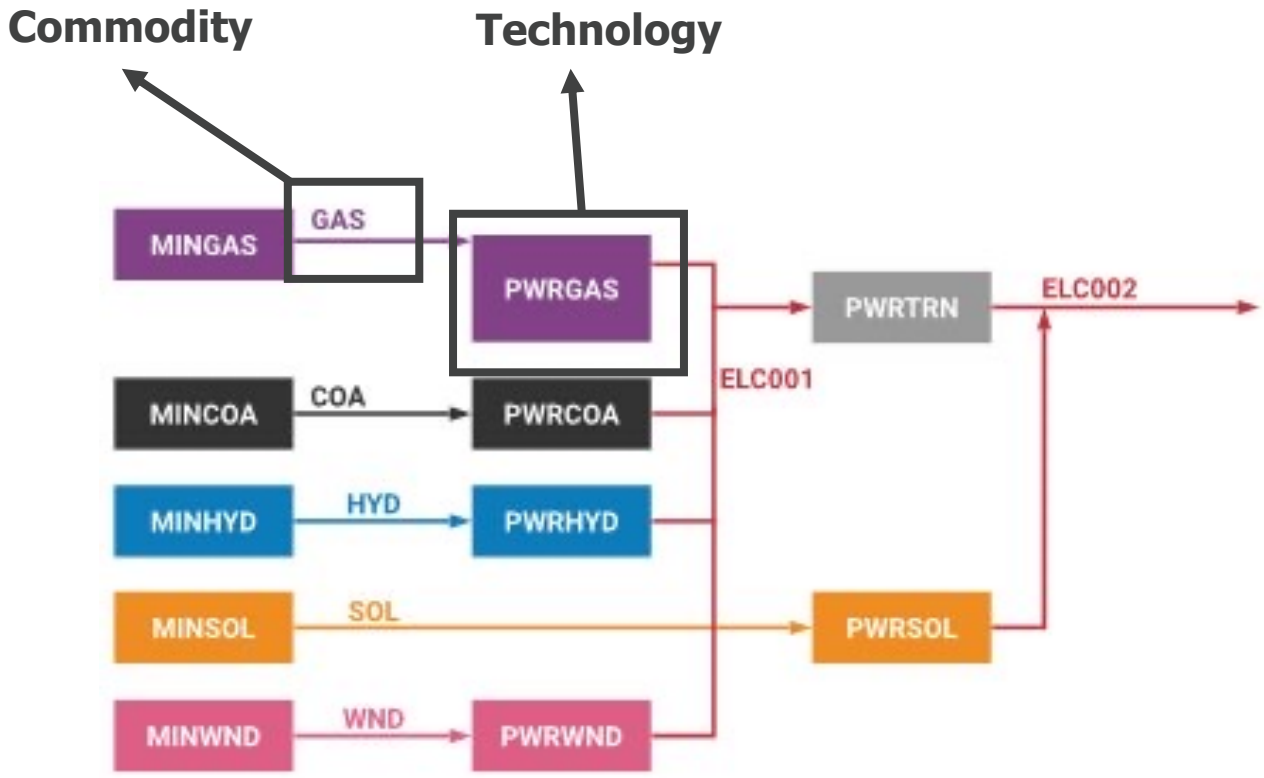
Outstanding applications:

Global
TEMBA (Africa)
SAMBA (South America)
OSeMBE (EU27+3)
Ethiopia
Kenya

http://osemosys.global/

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

Essential elements are ***technologies*** and ***commodities***. User defines sets for these and creates the model structure.

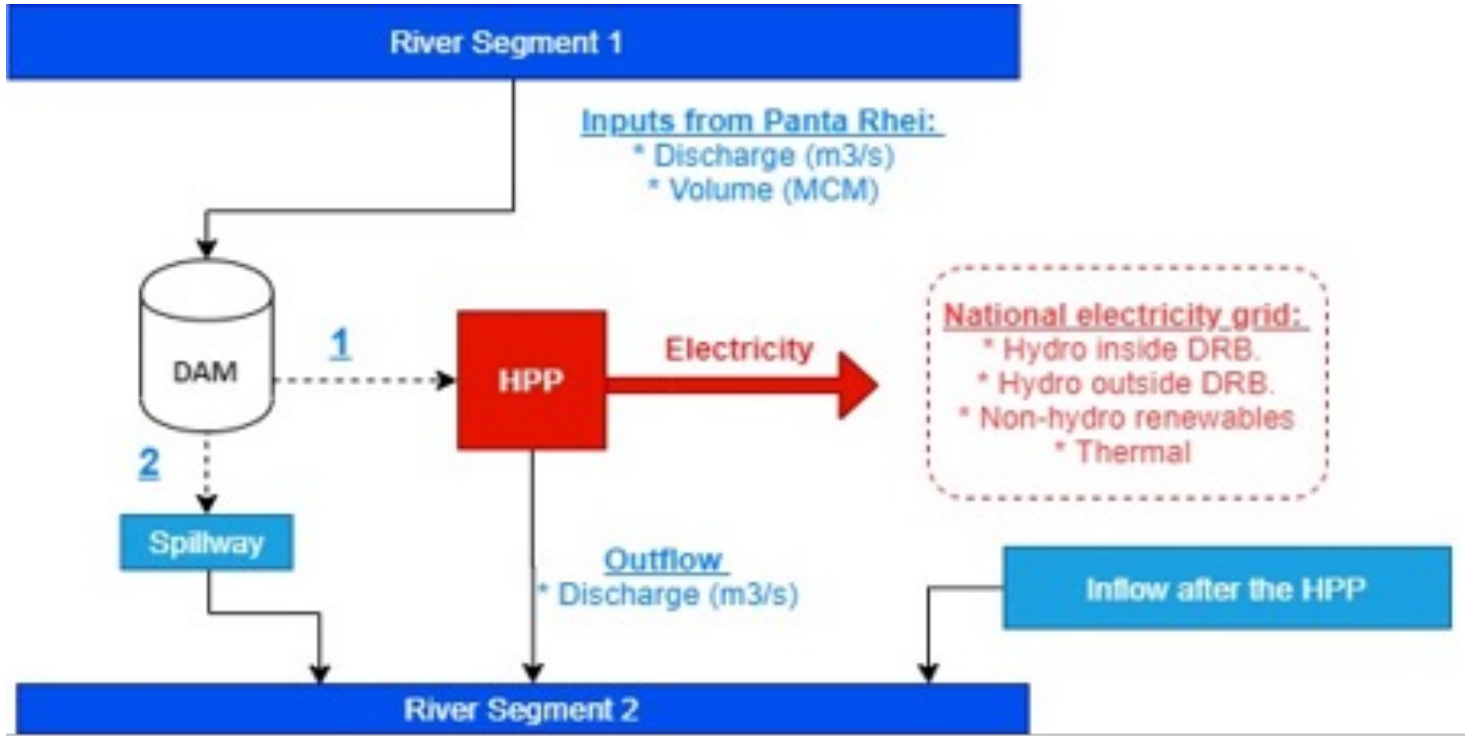


The IAM COMPACT project has received funding from the European Union's Horizon Europe Research and Innovation Programme under grant agreement No 101056306.

Schematic representation of modelled energy system

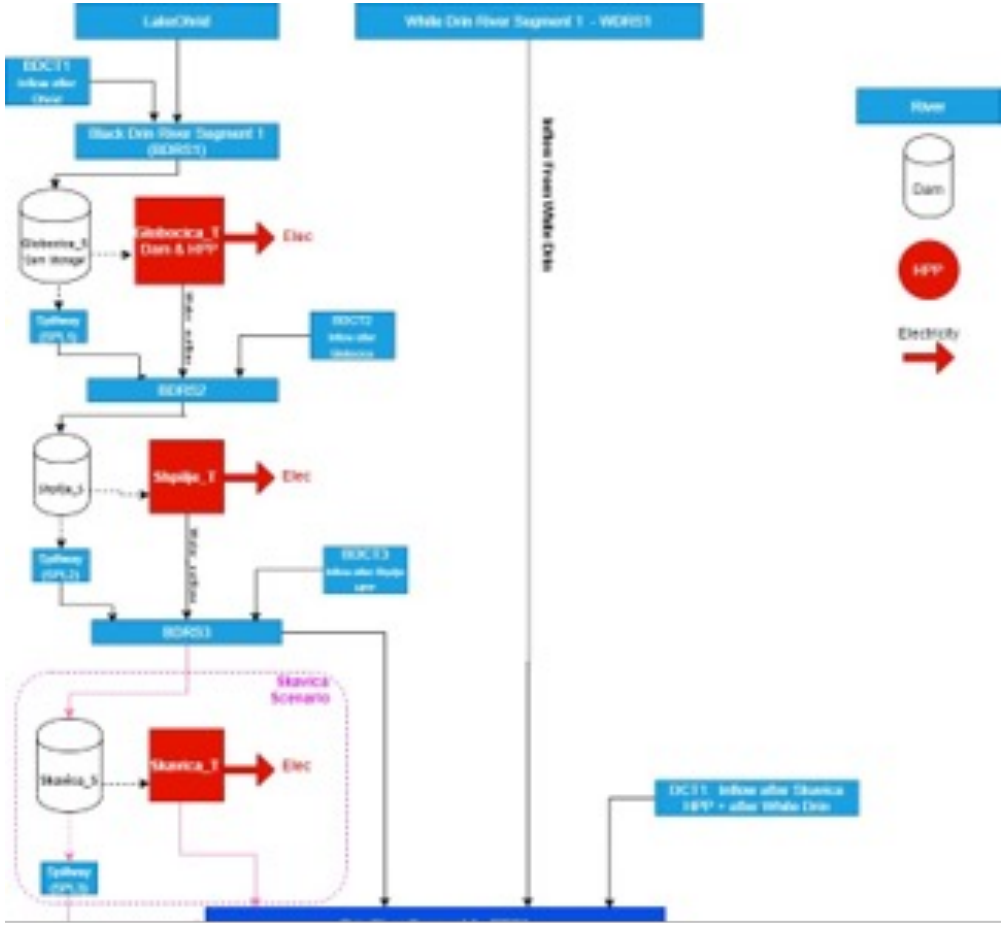
The IAM COMPACT project has received funding from the European Union's Horizon Europe Research and Innovation Programme under grant agreement No 101056306.

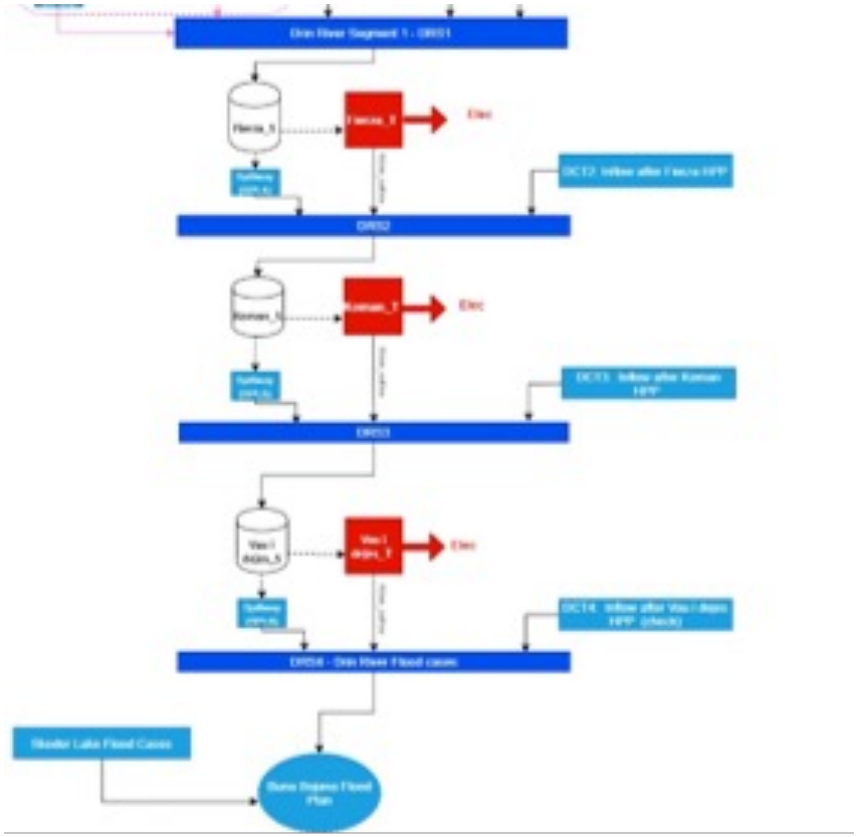
Schematic representation of modelled energy system



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

Schematic representation of modelled energy system





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

The following policy instruments can be implemented, for one country/region or global:

- Emission penalties (e.g. CO_2 cost)
- Emission limits (annual or over the entire modelling period)
- Minimum / maximum capacity factors or activity levels for energy supply options (e.g. to simulate minimum or maximum desired levels of operation);
- Minimum / maximum capacity or annual capacity investment (e.g. to represent constraints on the availability of certain technologies)
- Renewable energy supply targets
- Subsidies on particular technologies (through adjusting their costs);
- Constraints on the growth rates of particular technologies (e.g. carbon capture and storage power generation capacity cannot grow at more than 20% per year)
- Inter-regional emissions trading (or no trading);

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

- What investments in energy supply options are needed to meet expected future demands at the lowest cost?
- What energy supply options can substitute fossil fuels or e.g. nuclear at the lowest cost while meeting operational, resource, climate and policy constraints?
- How can climate and energy policy targets be met at the lowest cost with available or expected supply options?
- What investments may be more convenient if energy commodity prices changes dramatically?
- What investments may create lock in into climate non-resilient infrastructure and cause high no-adaptation costs?

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

SDG	Details
§3. Health (e.g., air-pollution related mortality)	The use of solid fuels in buildings can form the basis of local air pollution calculations.
§7. Affordable and clean energy	Cost-effectiveness and availability of low-carbon energy is a central set of OSeMOSYS outputs.
§8. Decent work & economic growth	OSeMOSYS reports energy system costs under different scenarios, giving a measure of e.g. mitigation costs, or economic losses due to no-adaptation. OSeMOSYS can be soft-linked with IO frameworks to assess job creation and loss related to energy system investments.

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

References

Howells, M., Rogner, H., Strachan, N., Heaps, C., Huntington, H., Kypreos, S., ... & Roehrl, A. (2011). OSeMOSYS: the open source energy modeling system: an introduction to its ethos, structure and development. Energy Policy, 39(10), 5850-5870.

Niet, T., Shivakumar, A., Gardumi, F., Usher, W., Williams, E., & Howells, M. (2021). Developing a community of practice around an open source energy modelling tool. Energy Strategy Reviews, 35, 100650.

Barnes, T., Shivakumar, A., Brinkerink, M. et al. OSeMOSYS Global, an open-source, open data global electricity system model generator. Sci Data 9, 623 (2022). https://doi.org/10.1038/s41597-022-01737-0

Pappis, I., Howells, M., Sridharan, V., Usher, W., Shivakumar, A., Gardumi, F. and Ramos, E., Energy projections for African countries, Hidalgo Gonzalez, I., Medarac, H., Gonzalez Sanchez, M. and Kougias, I. editor(s), EUR 29904 EN, Publications Office of the European Union, Luxembourg, 2019, ISBN 978-92-76-12391-0, doi:10.2760/678700, JRC118432.

Rady, Y. Y., Rocco, M. V., Colombo, E., & Serag-Eldin, M. A. (2018). Soft-linking Bottom-up energy models with Top-down Input-Output models to assess the environmental impact of future energy scenarios. Model Meas Control C, 79, 103-110.

Mekonnen, T. W., Teferi, S. T., Kebede, F. S., & Anandarajah, G. (2022). Assessment of Impacts of Climate Change on Hydropower-Dominated Power System—The Case of Ethiopia. Applied Sciences, 12(4), 1954.

Moksnes, N., Korkovelos, A., Mentis, D., & Howells, M. (2017). Electrification pathways for Kenya–linking spatial electrification analysis and medium to long term energy planning. Environmental Research Letters, 12(9), 095008.

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

Thank you!

#iam-compact

 IamCompact

 iam-compact

 iamcompact