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DAURES GREEN HYDROGEN CONSORTIUM
DAURES GREEN HYDROGEN VILLAGE

Fact sheet – IER project Hy4Daures Namibia

4.2 ENERGY SYSTEM MODELLING

ENERGY SYSTEM MODELLING

Energy models are tools for planning and exploring the posterity of energy settings and the consequences of energy use on humans and natural environment by means of scenario-making. Scenario-making simulates the consequences of energy usage for regions and countries based on diverse pathways. Energy transition can be scrutinized, planned and controlled by use of energy models [1].

Various energy modelling tools are available, each with its own pros and cons, hence suitable in different conditions e.g. economies and energy systems and are tailored to the specific research objectives. A classification of the various types of energy system modelling approaches is given in Figure 1 and identifies the variety of parameters that shape the applicability of specific models (e.g. purpose, analytical approach, solution methodology and mathematical approach, geographical and sectoral coverage and time resolution.

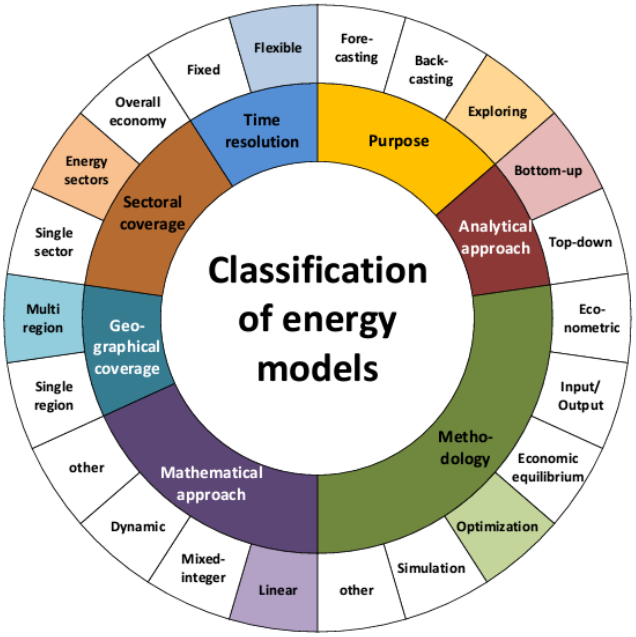

Figure 1: Classification of energy models. Source: https://elib.uni-stuttgart.de/handle/11682/2330

TIMES OPTIMISATION ENERGY MODELLING TOOL

The **I**ntegrated **M**ARKAL **E**fOM **S**ystem (TIMES) is an energy-economic model used to conduct in-depth energy and environmental analyses using two different and complementary approaches: a technical engineering approach and an economic approach for the exploration of possible energy futures based on contrasted scenarios [2]. As described in Figure 2, the purpose of the model is to simplify the complexities of decision-making relating to the trade-offs and impacts of long-term decisions within the energy system. Based on the observation of the real world, the model's structured is developed through the inclusion of various input data, the cost-optimal supply and demand options result from the mathematical computation. TIMES is an explorative, bottom-up, linear optimisation model and can be constructed to encompass the required geographical and sectoral coverage as well as the necessary time resolution.

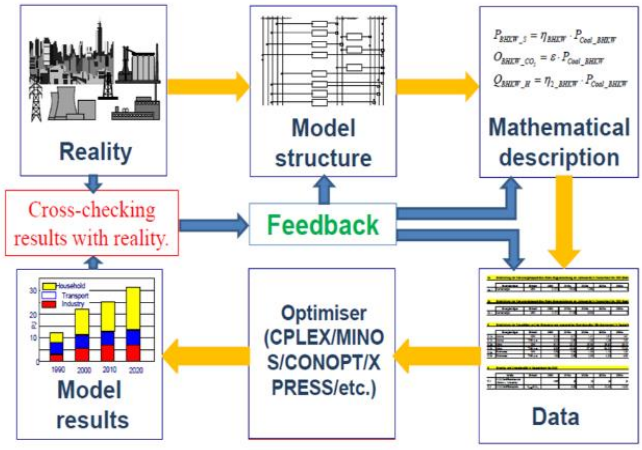

Figure 2: Steps of modelling in TIMES optimisation energy modelling tool. Source: https://wires.onlinelibrary.wiley.com/doi/full/10.1002/wene.62

Therefore, TIMES is well-placed to explore various scenarios in which to explore how to achieve specific energy and climate-related targets, to investigate the impacts of particular policy measures, or to assess the future role of certain technologies or energy carriers.

Types of Scenarios

- Normative (how to): Achievement of policy goals, i.e. how to reach CO_2 reduction targets, etc.
- Explorative (what if): Impacts of policy measures, i.e. Consequences of nuclear phase-out in terms of structure of the energy sector, etc.
- Assessing the future role of energy technologies/energy carriers e.g. renewable energies

FURTHER WORK

The TIMES optimisation energy modelling tool will be deployed to model Namibia's energy system, exploring how to achieve universal energy access with substantial renewable energy penetration [3] and reducing greenhouse emissions with 21.9MtCO2 in Namibia by the year 2030 and reaching net zero emissions by 2050 [4], by integrating green hydrogen in its energy pathways.

The Government of the Republic of Namibia is following long term goal of reaching net zero emissions by 2050 [4] and achieve energy transition. The net zero emission will be achieved by developing green hydrogen production capacities and creating compatible value chains at both national and international scale. The scope of the planned hydrogen production has the potential to decarbonize Namibia's energy sector, eliminate its reliance on imported electricity and position the country as a net-exporter of clean renewable energy, supporting decarbonization the Southern African region. There is widespread acknowledgement that hydrogen will play a pivotal role in decarbonizing the global economy.

FOR FURTHER INFORMATION AND FEEDBACK

Have a look at our other Fact Sheets covering topics from Project Descriptions, Use Cases, Techno-Economic analysis, Indicators, Energy System Analysis, Macro-Economic modelling, and many more:

https://github.com/IER-Hy4Daures/Fact-Sheets

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[2] G. Goldstein, M. Gargiulo and A. Kanudia, "Documentation for the TIMES model: part", 2016.
[3] "Namibia vision 2030: policy framework for long term National Development", Namprint, Windhoek, Namibia, 2004.
[4] "Namibia's updated nationally determined contribution", 2021.