INTRODUCING CCG'S ENERGY MODELLING OFFER

MODELS WITHOUT FRONTIERS

Climate Compatible Growth
COP28

UKaid
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Modelling Energy from Data-to-Deal

Energy models use relevant data to explore a wider variety of future scenarios for the energy transition within a country. This helps policymakers to select the most cost-effective, financially viable, environmentally sustainable and climate resilient projects for which to seek investment support.

CCG curates a suite of open-source modelling tools that support the energy planning process for the climate transition in low- and middle-income countries (LMICs), many of which are contributed by a range of international partners – IAEA, IRENA, KTH

These tools aim to support countries moving along the investment pipeline from 'Data-to-Deal'. The term Data-to-Deal refers to actions taken throughout an entire process that runs from data collection, system modelling, and development planning, all the way through to national financing strategies and project finance arrangements to the agreement of a deal (project financing transaction), all driven by a strong stakeholder engagement process.

Different models have been developed for each step of the Data-to-Deal investment pipeline (see Table 1 for brief descriptions of each).

These models are closely inter-related and increasingly inter-linked to facilitate their integrated usage (Figure 1). At the centre of CCG's modelling ecosystem lies the energy system planning tool OSeMOSYS. Inputs into OSeMOSYS, include energy demand projections (from the MAED model) and energy access plans for electrification (from the OnSSET model) and clean cooking (from OnSTOVE).

The energy capacity expansion plans produced by OSeMOSYS, can be evaluated for system flexibility (using FlexTool), as well as for wider linkages with land and water (via CLEWS), with implications for carbon emissions visualized using the Carbon Calculator. Furthermore, OSeMOSYS output can be used as the basis for developing a national climate finance strategy (via MinFin), including evaluation of the financial viability of individual constituent projects (using FinPlan).

Certain common design features of CCG's modelling ecosystem make it particularly effective and adaptable to a wide variety of contexts. These features are:

- **Ease of use.** All the models are open-source, which makes them accessible and straightforward to use, removing software costs and licensing barriers for LMICs.

- **Speed of results.** Starter data kits have been provided containing the basic data needed to start running modelling scenarios in over 60 LMICs, allowing rapid generation of preliminary results.
- **Interlinkages.** While each model can be run independently, they are also strongly interconnected and can be used in conjunction to shed light on more complex issues and interactions, with outputs from one model acting as inputs to the next. Each linkage is further detailed with an online hands-on exercise for transparency, allowing users to replicate and reproduce the workflow with ease.
- **On-demand training.** Each model in CCG's ecosystem comes with associated training material designed to support both introductory, online, self-administered learning (through the Open University's OpenLearn Collection) and more advanced and intensive in-person learning (via CCG's regular Energy Modelling Platform regional and global training events).

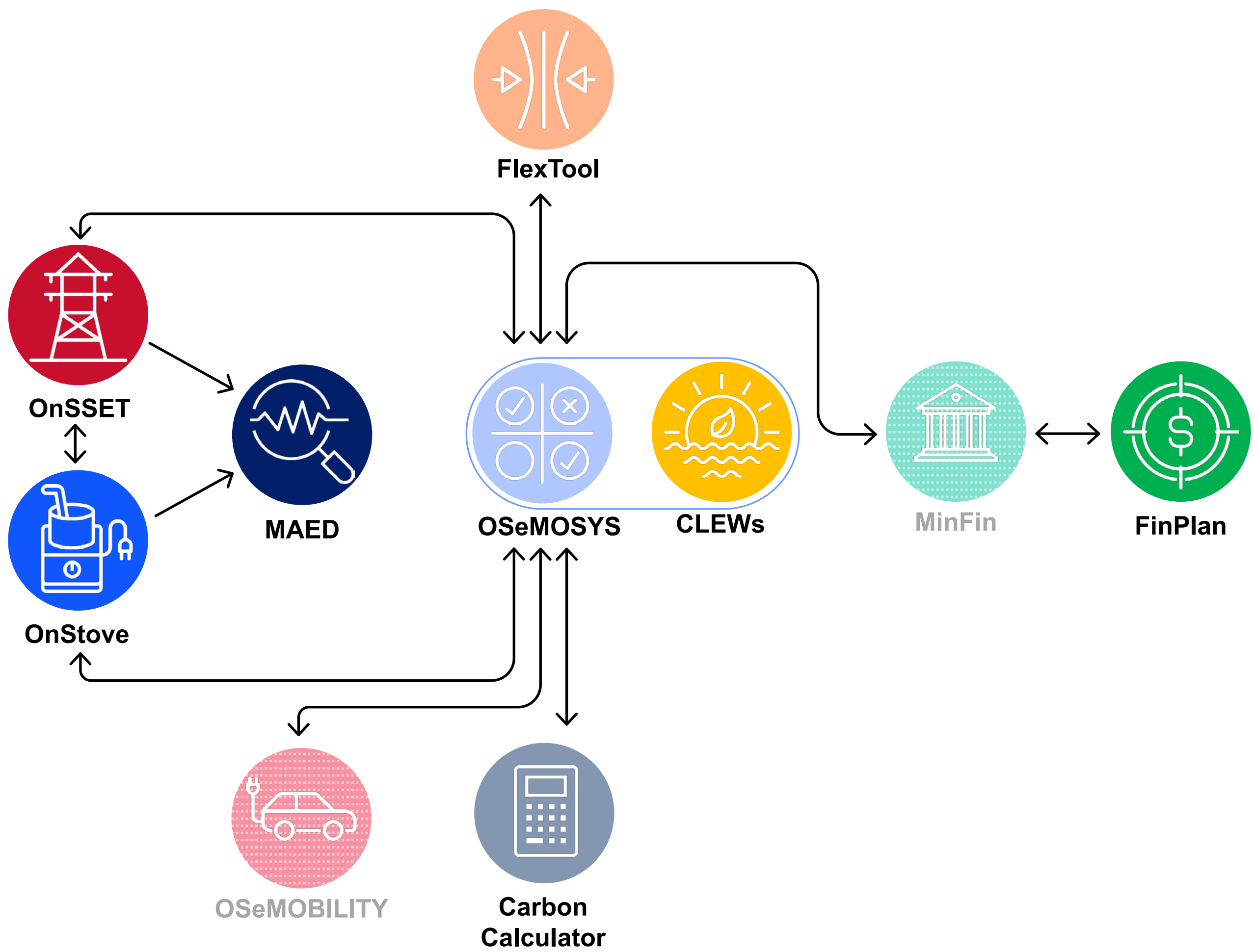

Figure 1: Visual overview and interlinkages between CCG modelling tools

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MAED	**What will future energy demand be?** MAED is a tool developed by the IAEA and is used to evaluate future energy demand of the industrial, transport, household, and services sectors based on a set of consistent socio-economic assumptions such as population and gross domestic product growth.
OnSSET and **OnStove**	**What is the least-cost pathway for reaching universal energy access?** OnSSET and OnStove are two geospatially explicit modelling tools developed by KTH that estimate the most practical and beneficial expansion path for attaining universal access to energy. OnSSET covers the electricity sector and estimates the optimal combination of certain grid and off-grid technology solutions for electrification planning. OnSTOVE covers the clean cooking sector and compares the relative potential of different cookstoves on the basis of their costs and benefits.
OSeMOSYS	**What is the least-cost energy expansion plan to meet projected demand?** OSeMOSYS, developed by KTH, is an integrated assessment and energy planning tool that performs long-term energy system planning and investment optimization. It determines the most cost-effective energy system configuration over a long-term modelling period. For power, OSeMOSYS optimizes the capacities of electricity generation and storage plants and, if desired, may also plan optimal end-use electrification and how this feeds into total electricity demand. A variation of this model, OSeMOSYS Global, is specially designed to evaluate the economics of cross-border power interconnectors and regional power pool integration.
FlexTool	**Does the least-cost energy expansion plan satisfy system operating constraints?** FlexTool, created by IRENA, analyzes short-term operational aspects of the power system, performing single-year flexibility analyses, to identify potential underlying flexibility bottlenecks. It also evaluates flexibility options, such as the deployment of (additional) electricity storage, electric vehicles, power-to-heat, power-to-hydrogen, and the implementation of demand response.
CLEWS	**Is the least-cost energy expansion plan compatible with land and water availability?** The CLEWs approach, which was developed by KTH, offers an integrated, nexus-based framework encompassing energy, water, land, and climate systems. By adopting a nexus approach, CLEWs transcends sectoral silos recognizing these systems are deeply interconnected and interdependent, considering linkages such as water for energy, energy for water, land for energy, energy for land, land for water, land for climate.
MinFin	**Is the least-cost energy expansion plan financially viable for the country?** MinFin is an emerging tool designed by CCG to examine national-level climate financing strategies to facilitate discussions with Ministries of Finance by translating energy investment plans into financing strategies. Users can determine the viability of implementing a financing strategy in a country, based on recent history and forward-looking projections.
FinPlan	**How should individual energy projects be financially structured?** FinPlan, created by IAEA, is a tool to assess the financial viability of projects, considering different technical and financial factors such as plant size, electricity generation, investment costs, discount rates, and so on. FinPlan uses these to calculate projected cash flows, financial ratios, shareholders' returns, and other financial indicators.
OSeMOBILITY	**What are the implications of alternative decarbonisation pathways for transport?** Work is currently underway within CCG to develop a plug-in model to OSeMOSYS that will allow for a deeper analysis of transport sector decarbonisation pathways in LMICs, while feeding into the overall energy system representation.
Carbon Calculator	**How does the energy expansion plan affect the evolution of the carbon footprint?** Work is currently underway within CCG to develop an interactive web-based tool based on the MacKay Carbon Calculator. The purpose of the tool is to enable users to explore different scenarios for national energy consumption and production. By choosing 'levels of ambition' for decarbonising different sub-sectors of the energy sector, users can visualise the potential impacts of different energy choices on the national carbon footprint, and chart potential carbon trajectories.

Table 1: Overview of CCG modelling tools