eCooking:

Planning and Modelling Tools

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MECS lead for modelling

Aims of this part

- What are Planning and Modelling?
- Approaches for integrating eCooking into energy planning
- Some tools available

What do we mean by “modelling”

- Modelling:

“devise a representation, especially a mathematical one, of (a phenomenon or system)” (source, Oxford Languages)

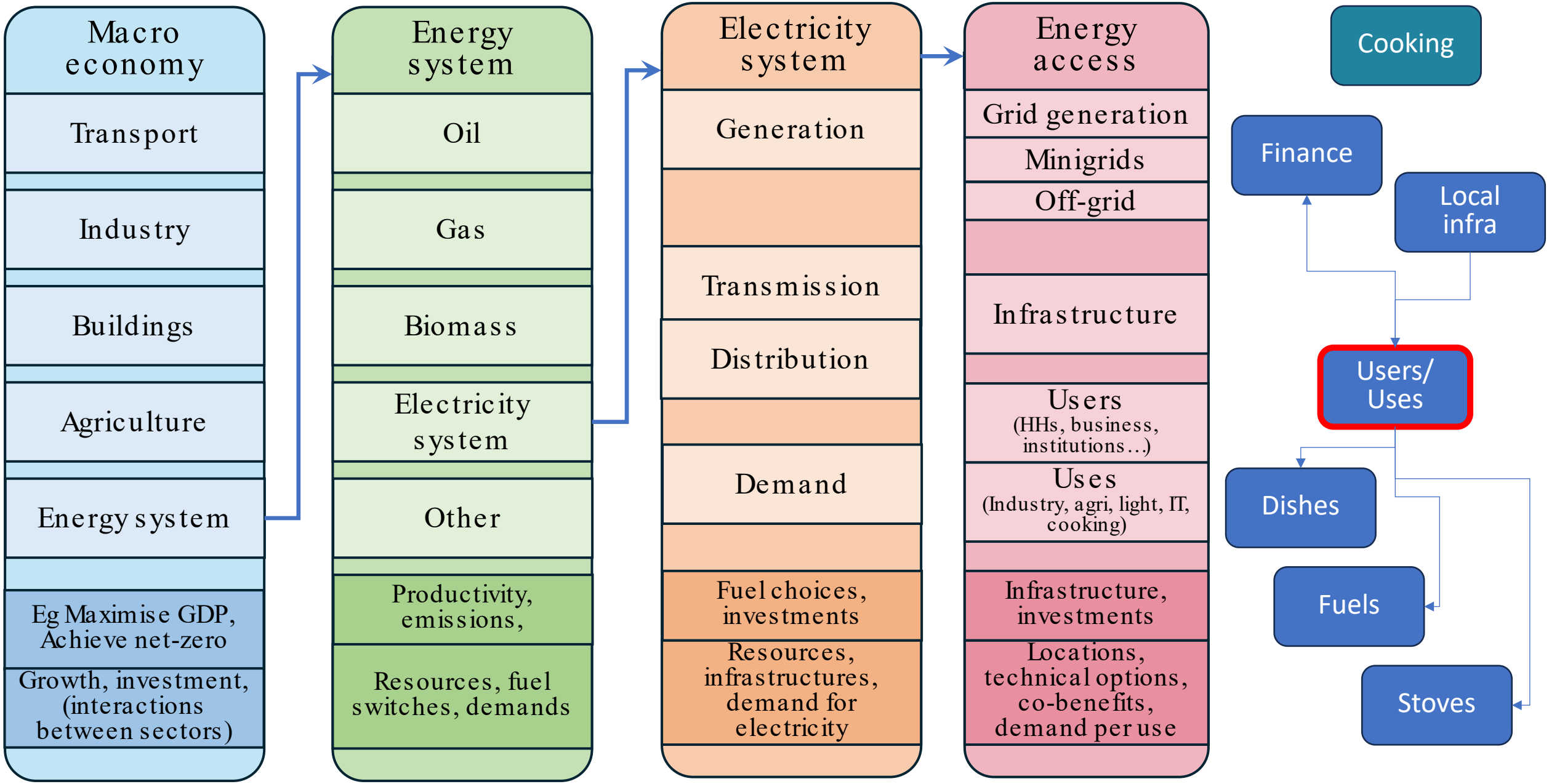
To support cooking, models are used to:

- describe the system under consideration
- allow us to try out different assumptions
- to make comparisons between different options or scenarios

Ideally, have one model for whole economy, with all the detail of every level…

- In practice have ‘bottom up’ models with local detail, and more ‘top-down’ models with simplifications. And increasing attention to linking these
- Plus growing interest in in Geographic Information System (GIS) tools: quite detailed data about a place, and replicate that for every location through data layers

Clean cooking and energy planning



Cooking in detail & scenarios:

TiMeC
THE IMPLICATIONS MODEL FOR eCOOKING

User Inputs

Scale
- Household size, cooking style, etc…

Cooking profiles
- Meals, devices, fuels, durations, timings, etc…

Fuel details
- Costs & emissions for using, importing, distributing, etc…

Device details
- Costs & emissions for devices

Big picture details
- Infrastructure state, grants and subsidies

Filters applied…
Adjusted for household size, device performance, fuel quality, transition success, etc…

Filters applied…
fNRB, emissions factors, payment schemes, etc…

Filters applied…
Adjusted transition success, inclusion costs, etc…

Model Estimate
- Fuel consumption

Model Estimate
- Fuel costs
- Cooking timings
- Emissions

Model Estimate
- Scenario impact

Outputs

Cost
- Fuel cost
- All 'cooking' costs
- Subsidy impact on lifetime cost
- Infrastructure

Time
- Fuel use time
- Cook-committed time

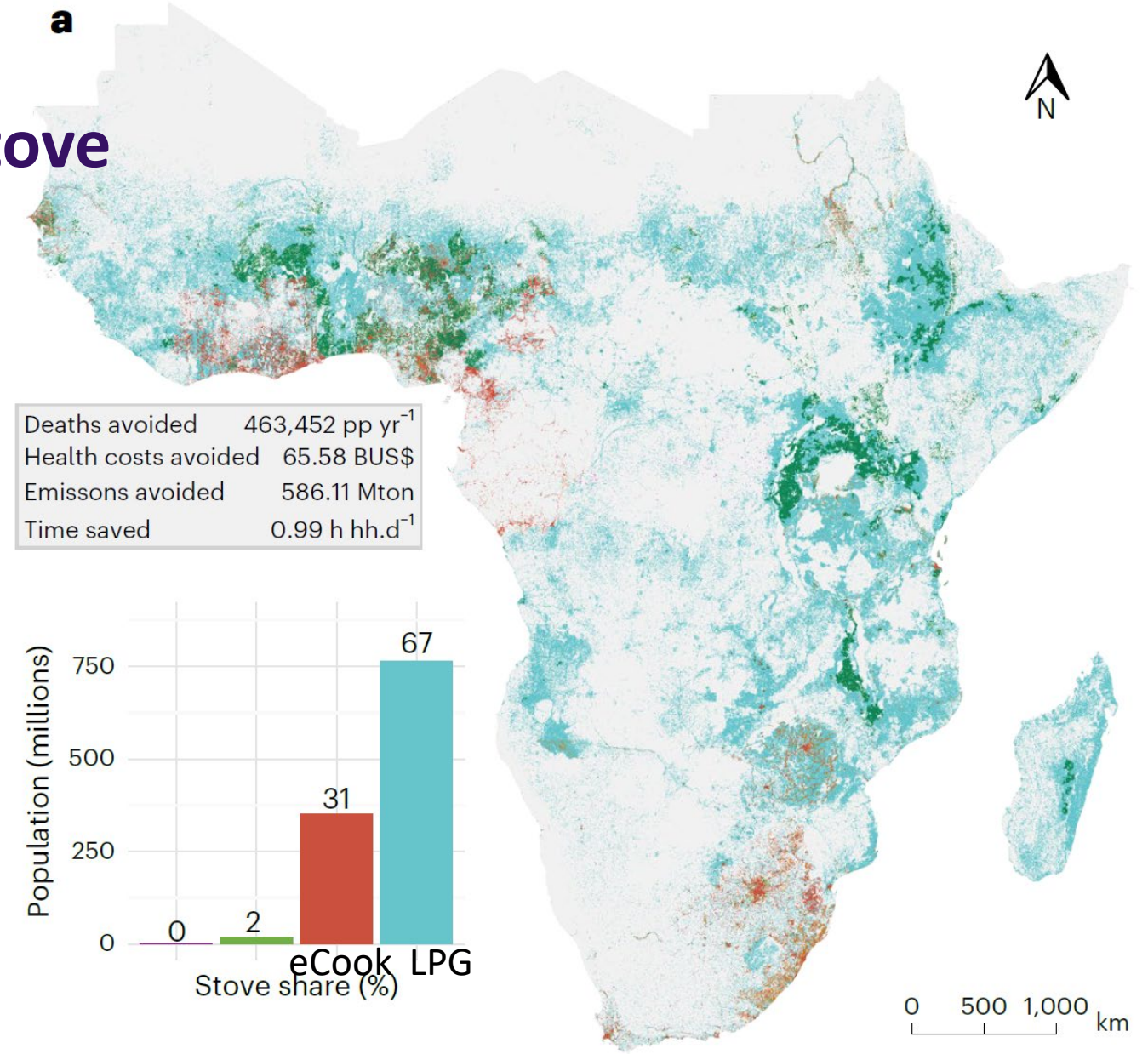
Emissions (E)
- Culprit fuel % E
- Total health E
- Total CO_2e E

National grid
- Load profile (*data & graphic*)

https://mecs.org.uk/tools/the-implications-model-for-ecooking-timec/

Cooking in some detail: GIS for locations => OnStove

- Data layers defining many factors per unit area: eg number of people, cooking per person, fuel & grid availability etc
- => calculates spatial distribution of the stove types with the highest net-benefits across SSA
  - A social net-benefits perspective
- Now can be linked to an electricity system model (eg OnSSET) to explore whether adding eCooking in a location changes the best way to bring electricity access to that location



LPG | Biogas and LPG | Biogas | Biomass ICS (ND) | Charcoal ICS | Biomass ICS (FD)
Electricity | Electricity and LPG | Biogas and Biomass ICS (FD) | Biogas and Charcoal ICS

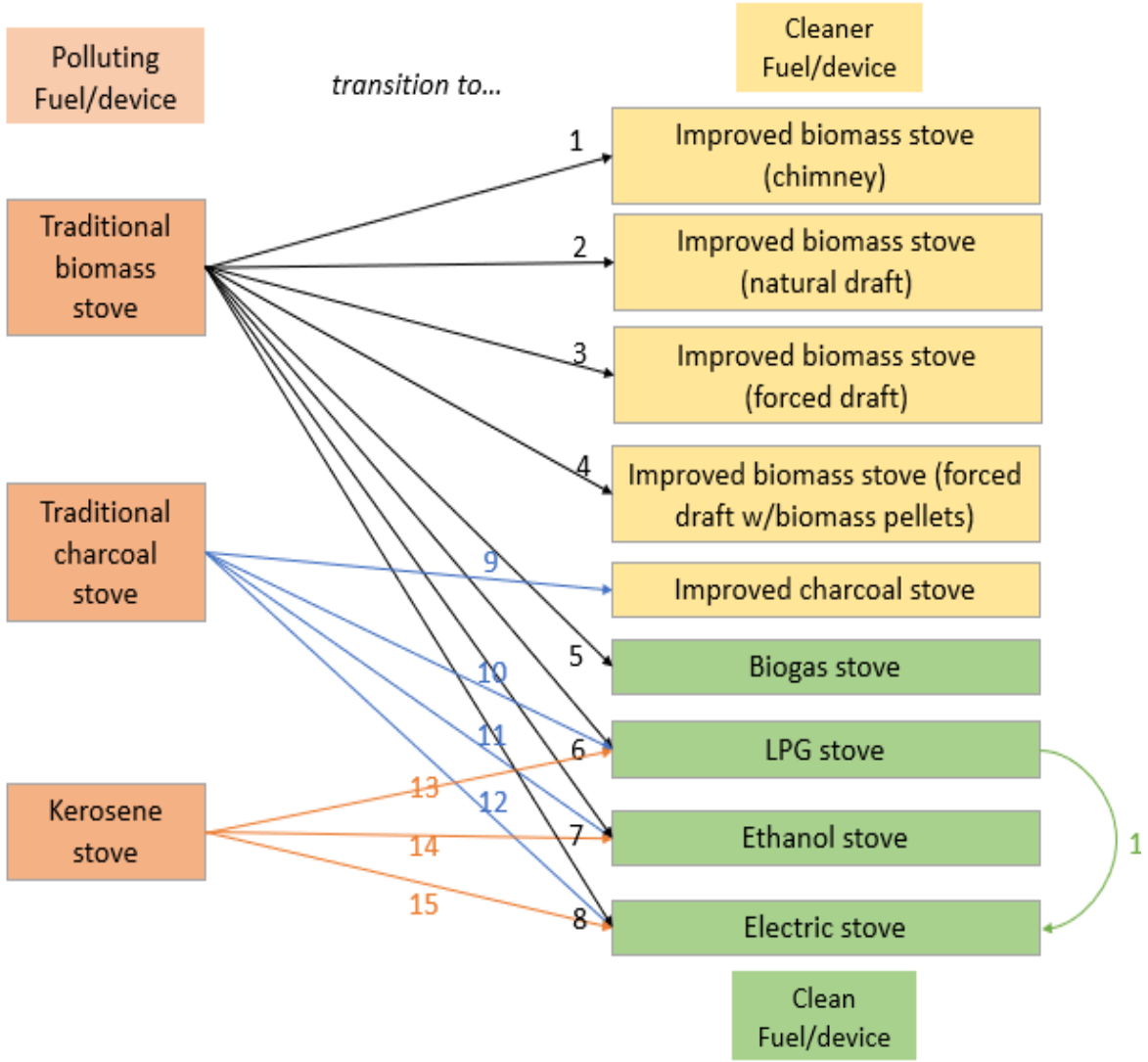
Loughborough University

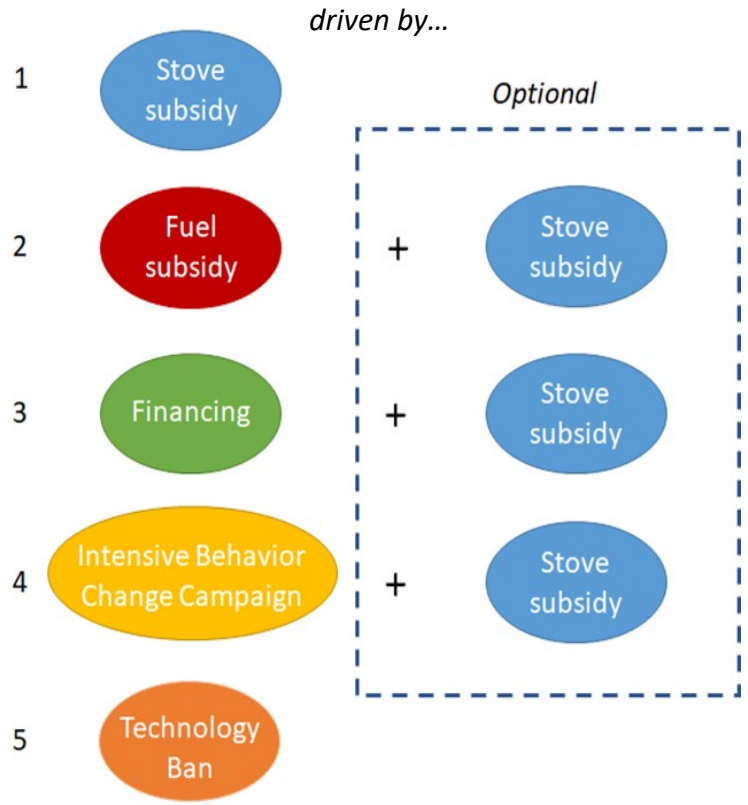
ESMAP Energy Sector Management Assistance Program

UKaid from the British people

Impacts: The WHO BAR-HAP model

WHO: "BAR-HAP tool is a planning tool for assessing the costs and benefits of different interventions that aim to reduce cooking-related household air pollution"
https://www.who.int/tools/benefits-of-action-to-reduce-household-air-pollution-tool





Outputs:

- Direct costs by party

Other impacts, physical units & monetised impacts:

- Health (Dalys)
- Time saved
- Unsustainable wood harvest
- GHG emissions

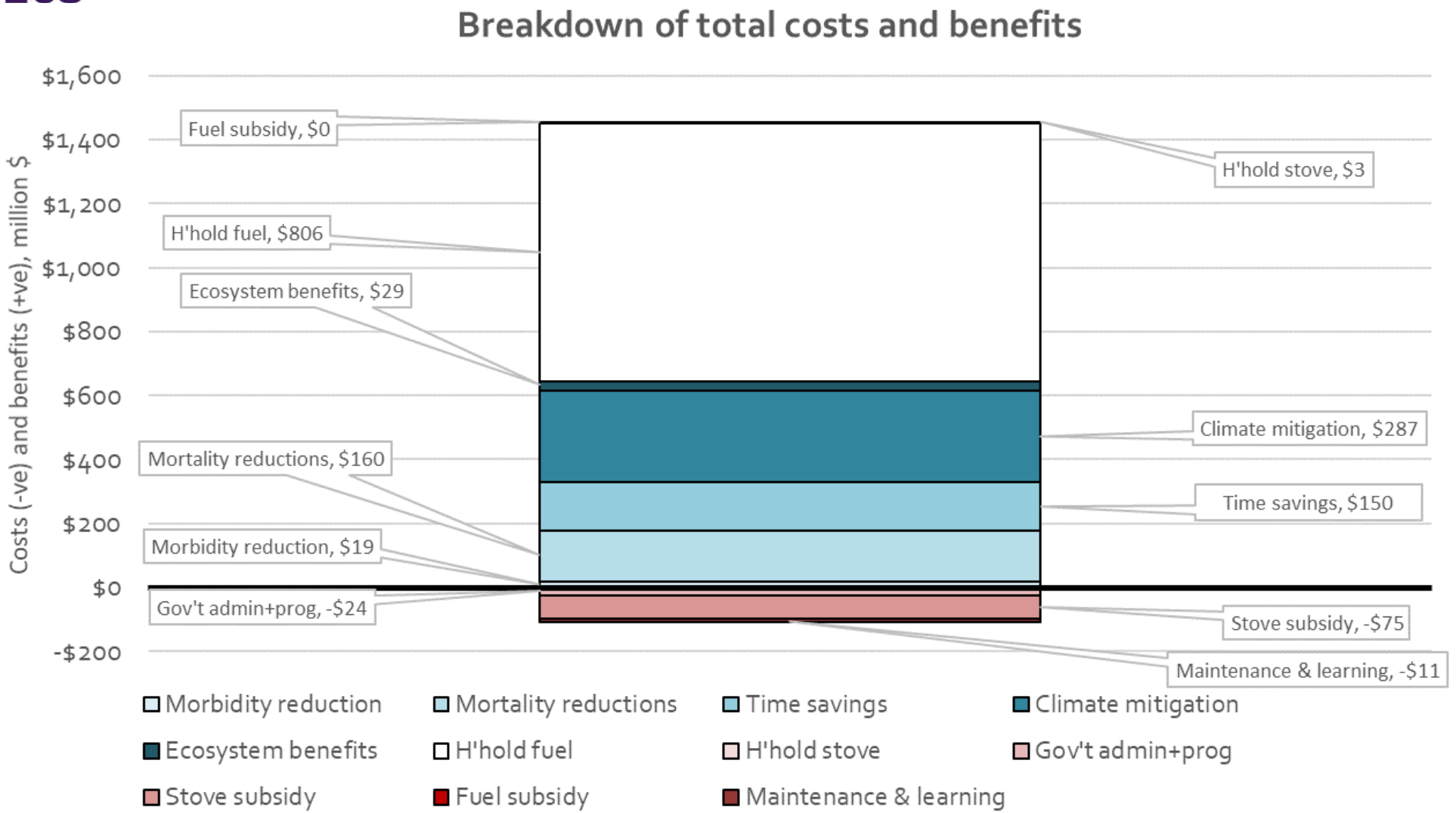
BAR-HAP "Physical" outputs: potential impacts of scaled uptake in most viable market segment in Kenya

If 40% of Kenya's grid-connected charcoal users (2.6m ppl, 0.7m HHs) switched to eCooking:

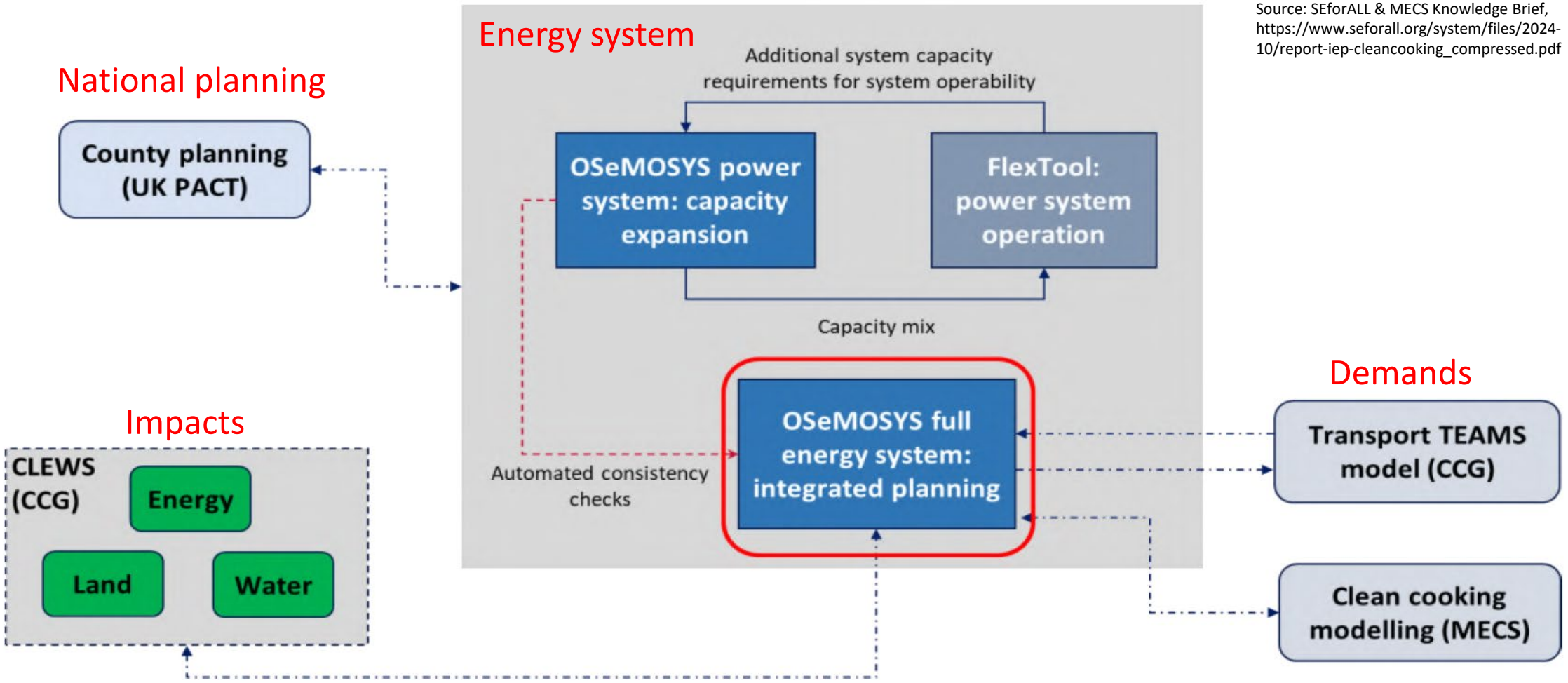
- 1,203 DALYs/yr avoided
- 1.9m tonnes/yr CO2eq emissions reduced
- 0.4m tonnes/yr reduction unsustainable wood harvest
- 191m hrs/yr of women's time saved (258hrs/HH/yr)
- 9 months payback for eCooking appliances ($80/HH upfront cost, $110/HH/yr savings on fuel energy costs)
- 422 GWh demand for electricity stimulated

Monetised outputs

If 40% of Kenya's grid-connected charcoal users (2.6m ppl, 0.7m HHs) switched to eCooking:



Energy system as the starting point: eg CCG's Kenya modelling toolkit



Source: SEforALL & MECS Knowledge Brief, https://www.seforall.org/system/files/2024-10/report-iep-cleancooking_compressed.pdf

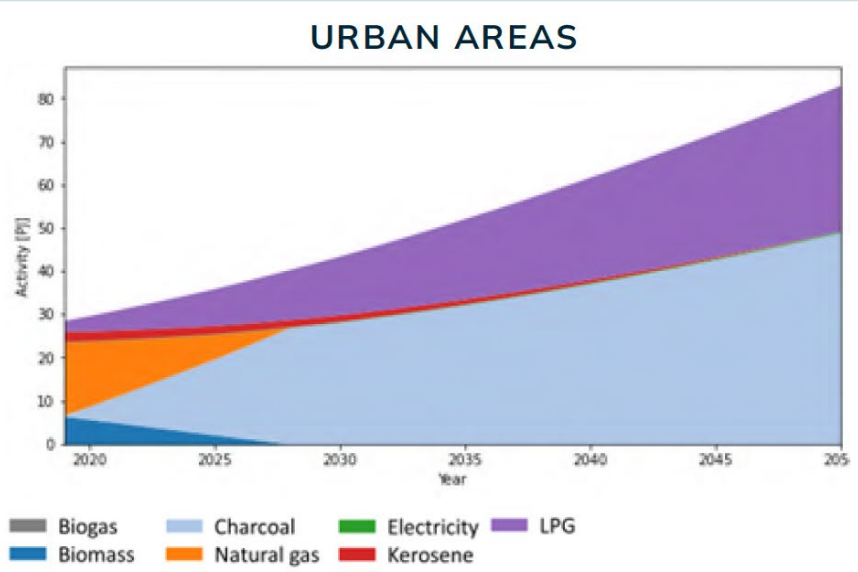
- Define the demands for cooking service as inputs
- Energy system model finds optimal (least cost) mix of fuels and technologies to meet demands
- But in practice need to provide constraints on realistic level of each, otherwise 'the cheapest' would take 100% of cooking

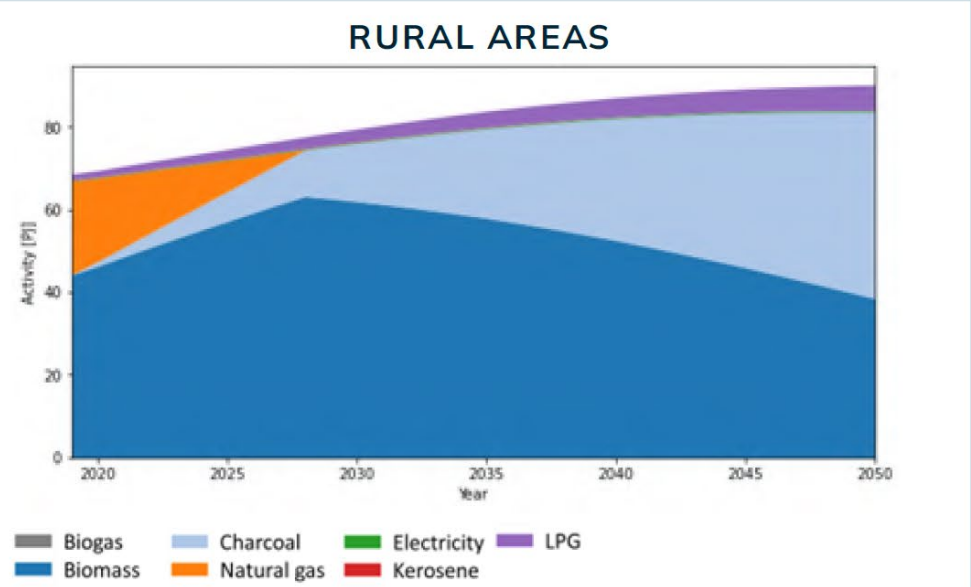
MECS

Example of OSeMOSYS used in in Kenya: scenarios and their impact on the clean cooking mix

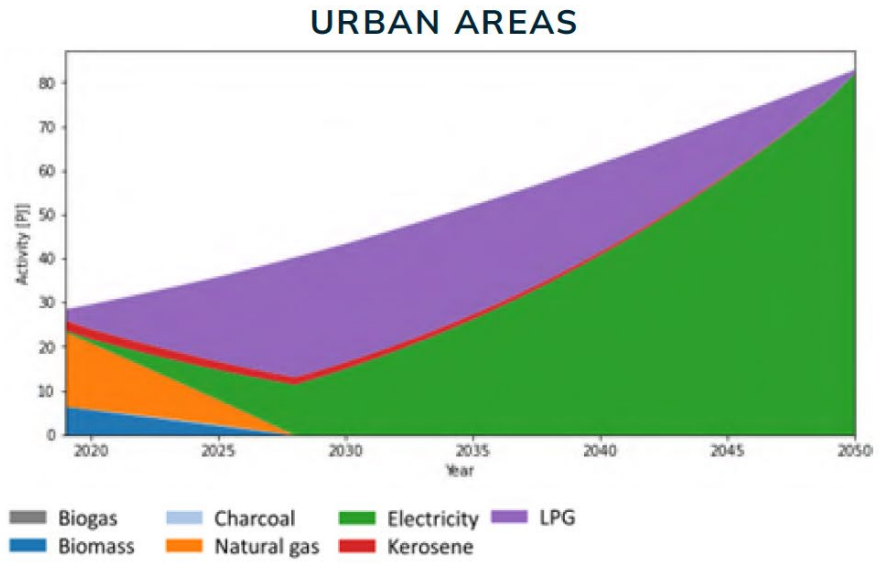
Typically only regional, not more place-specific

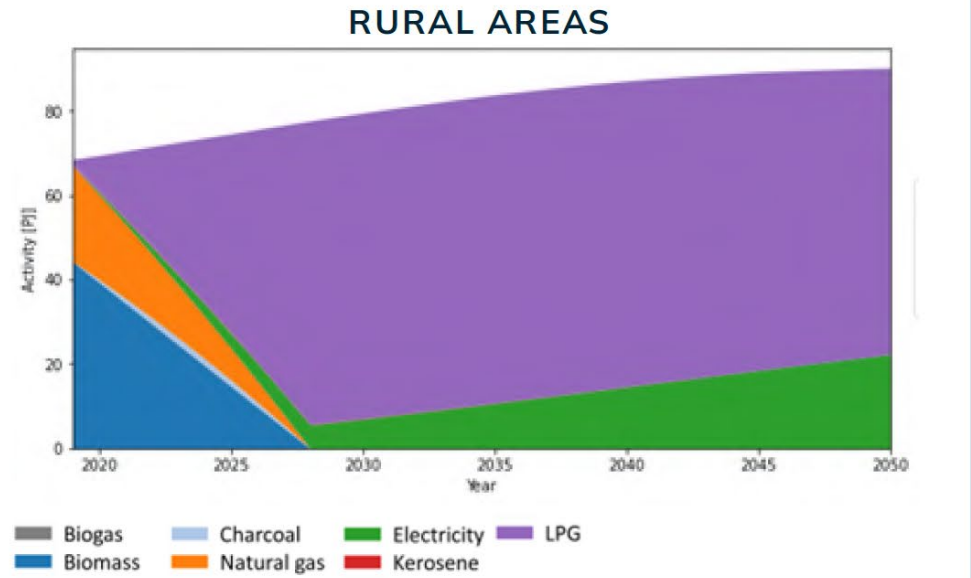
Business-as-usual (BAU) scenario: Continuation of historical trends and adjustment of baseline to the current use of technologies/fuels





High-electrification scenario: 100% of urban demand and 25% of rural demand is met by e-stoves





Importance of data

Platforms	Organisations	Notes
Electrification only		
Global Electrification Platform	World Bank, KTH, Development Seed, WRI, Derilinx, Google, Uni. Of Cambridge	Open access, online platform for overview of electrification investment scenarios for a selection of countries
Clean cooking only		
Clean Cooking Planning tool	World Bank, MECS	Visualisation potential transition pathways for universal access to clean cooking, incl e-cooking
Electrification and clean cooking		
EnergyData.Info, Multi-Tier Framework	World Bank	Open data platform providing access to datasets and data analytics that are relevant to the energy sector, including electrification and clean cooking
Energy Access Explorer[1]	WRI	Open-source, interactive platform mapping of state of energy access, including electrification and clean cooking
SEforALL Universal Integrated Energy Planning Tools	SEforALL, GEAPP, Rockefeller Foundation	Interactive data visualisation platform displaying several layers of data, including results from extensive geospatial modelling and optimisation, including electrification and clean cooking

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Final comments

- Tools for every occasion…and growing efforts to integrate
- Many are open source, but integrated tools become complex
- So need to be clear what questions you want to answer…
- Some starting points:
  - Demand and scenario analysis of clean cooking, for specific users or for large segment without too much detail…TIMeC
  - More detailed analysis for variation by location (GIS-based): OnStove
  - Impact analysis of clean cooking: BAR-HAP
  - Integrated electricity access + cooking: several tools (eg SEforALL, CCG, ESMAP to come), but likely need specialist support