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Models for policy makers: Contents

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1. Policy maker's perspective
   i. Generalist not specialist
   ii. Need to satisfy multiple stakeholders with different objectives and values
   iii. Satisfies political masters
2. Benefits of integrated models for policy makers
3. Difficulties with integrated models
4. Possible solutions
   i. Hierarchical modelling
   ii. Separating objective function and constraints from optimiser

Who am I?

- Review of DECC 2050 calculator
- Long term emissions modelling for INDCs (countries' initial offers for COP21 in Paris in December)
- Simulation modelling (e.g. agent-based model of electricity markets)
- Marginal Abatement Cost Modelling (as modeller and policy maker)

- Work typically done for policy makers
- Who are policy makers and what do they want?

How can energy models be made more useful to, and accepted by, energy policy makers?

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- Energy policy makers are inevitably generalists, not specialists. They must understand the economics, the engineering, and the political aspects of the energy system.
- They don't think purely (or even primarily) about cost. Co-benefits, hard to quantify aspects may be of significant importance.
- Impossible to optimise:
  - policy makers may not all have the same value systems/ weightings of criteria
  - Satisfactory/ good enough/ minimal objection scenarios may be preferred
- They must convince multiple stakeholders (e.g. other departments).
- What are the political priorities?

- Much of this makes hybrid and whole-system models attractive

What do energy policy makers say about models?

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- Why did changing that input make such a difference to the results?
- If there's a conflict between models and your intuition, go with your intuition
- How does the model deal with consumer investment behaviour?
- Where is project/ asset X shown in the model?
- Why isn't the model showing as much of technology Y as expected?
- What are the impacts on land use/ water/ air pollution?
- Why is it showing a different result to other analysis/ my other model(s)?

An energy model, and modeller, needs to deal with these

What does the ideal energy model look like?

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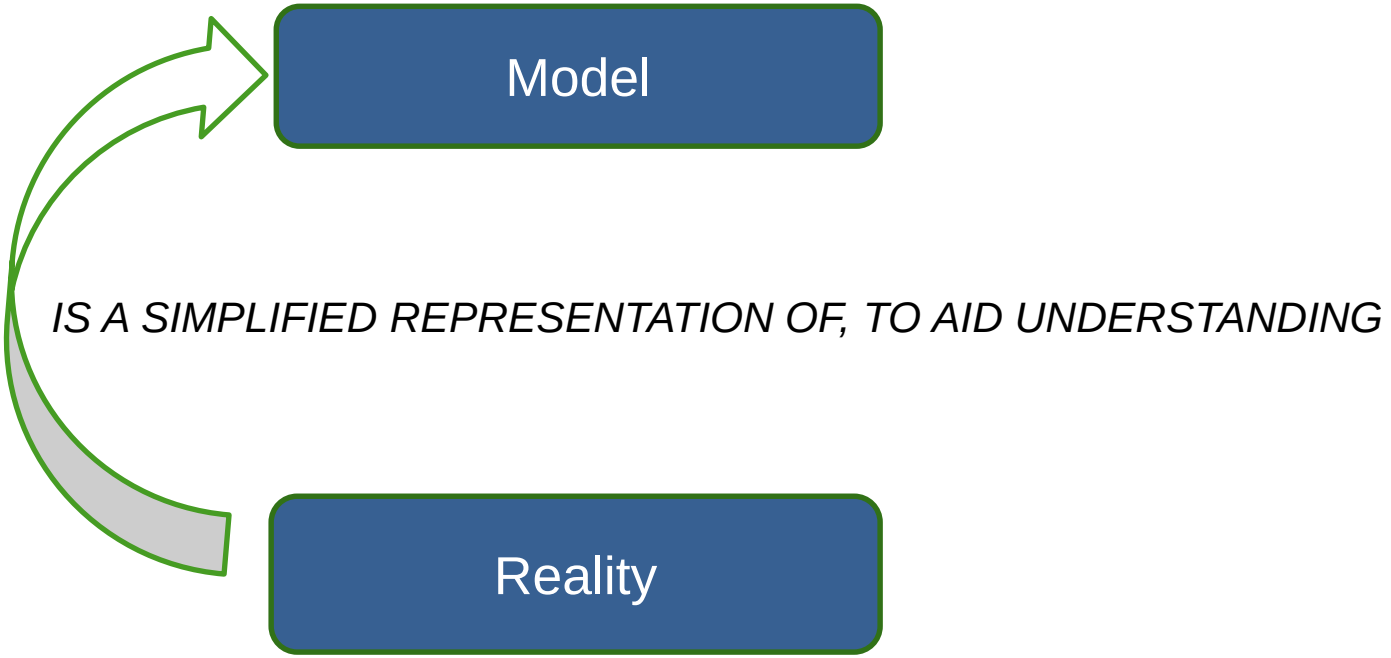
1. **Comprehensive**: cover all impacts of energy systems
2. **Detailed**: policy maker's favourite policies should appear clearly
3. **Consistent** with other analysis/ models, including by the policy maker
4. **Simple:** the policy maker wants to be able to understand it
5. **Transparent:** to answer the "why does the model do X" questions

Clearly, no real model is ideal

What happens when a model falls short of the ideal?

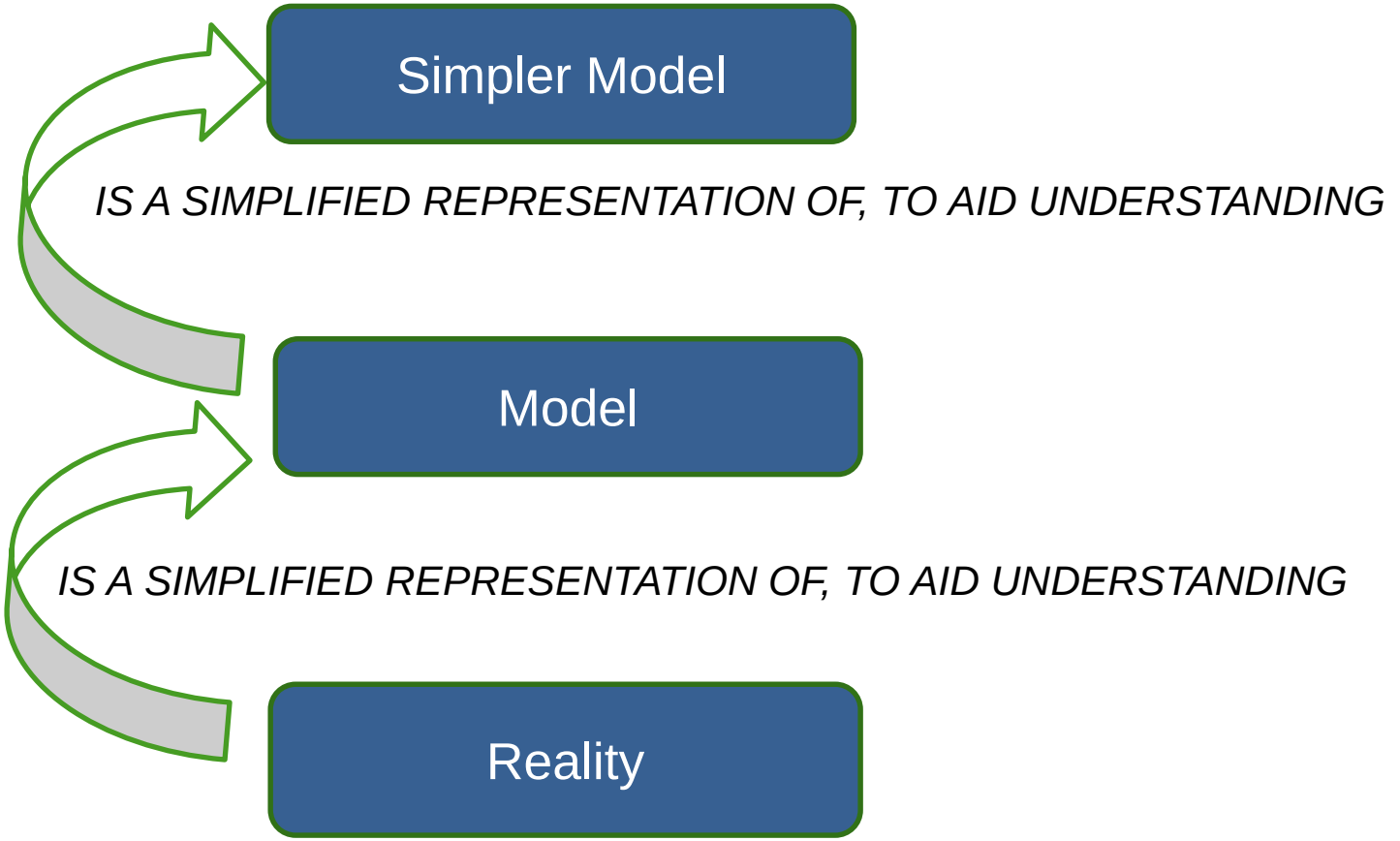
Comprehensive	Policy makers resort to qualitative analysis
Detailed	• Model dismissed as simplistic • Model cannot replicate history, reducing credibility
Consistent	Model loses credibility
Simple	• Policy makers don't understand the model, missing out on the learning it provides • Lots of time spent trying to understand changes in results between different scenarios
Transparent	• Model cannot be challenged • Model loses credibility as soon as it produces a result that the policy maker cannot easily understand

One solution to lack of simplicity – hierarchical models



WHY NOT ITERATE

Can have multiple layers of model – like a game where you choose the level of difficulty…

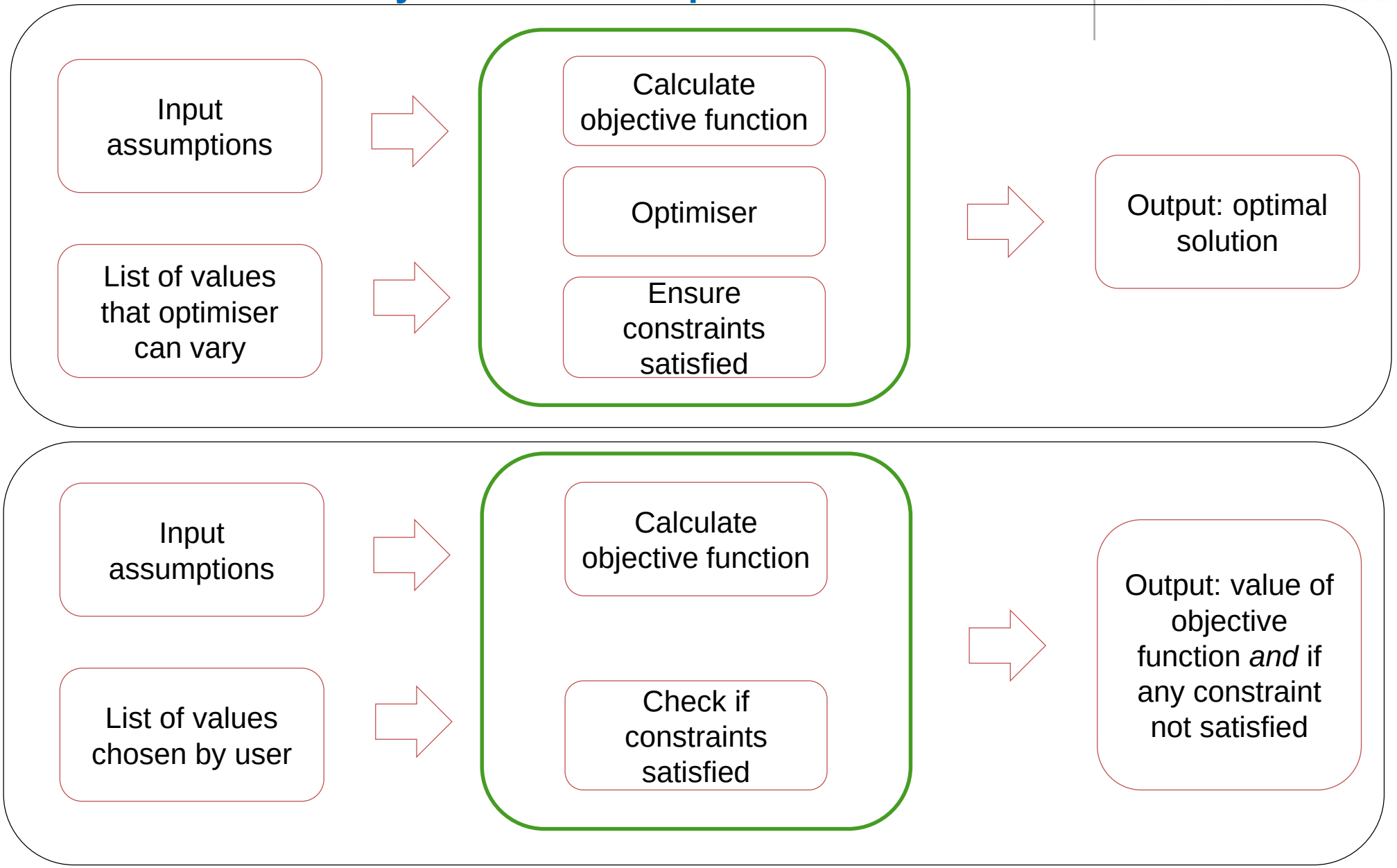


Could be done in same model, rather than separately as now?

Transparency – separate issue

- Complex models necessarily written in technical language
- Optimisation, or statistical/ econometric analysis, can be black box
- Suggestion: allow user to look for a better solution than the model's proposed optimum
- Optimisation models contain:
  - Objective function
  - Constraints
  - Optimiser
- Suggestion:
  - create separate model that allows user to take role of optimiser. Contains objective function and constraints
  - For given set of inputs, report values of objective function and whether any constraint(s) breached

The models share many but not all components…



Benefits of separating optimisation

- Policy maker can check whether her policy alternative has better results (shouldn't, of course, if optimisation has been done properly!)
- Policy maker can gain understanding of system by seeing effect of changing inputs
- Can check the costs of adding some additional, previously unspoken, constraint
- Can lead to requirement for new constraints

Should work for statistical analysis too

- If fitting using least squares, objective function is mean squared error
- Model without optimiser can report total error, and show which points in training dataset have largest error. Can see if results are being skewed by outlier/ possible erroneous data

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