

Geosci. Model Dev. Discuss., referee comment RC2
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Comment on gmd-2021-359

Oliver Broad (Referee)

Referee comment on "TIM: modelling pathways to meet Ireland's long-term energy system challenges with the TIMES-Ireland Model (v1.0)" by Olexandr Balyk et al., Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2021-359-RC2>, 2022

General comments: Initial paragraph or section evaluating the overall quality of the preprint

- This paper provides a very welcome and well written example of what openness and transparency in modelling should look like. It clarifies how the model was developed, refers to an online and freely available repository of the model itself, goes in relative detail through the different sectors and parts of the model to highlight their structure and how they were built.
- The model itself constitutes an integral "rebuild" of the existing TIMES model for the Republic of Ireland. It takes a new, flexible approach to the representation of both time-slices and regionality, and assesses the impact of deep penetration of VRE. It is a clear step forward and should offer robust and very much needed support in representing the government's new and ambitious targets.
- In this context, the comments below should be considered minor and are aimed at further improving the high quality of the paper.

Specific comments: addressing individual scientific questions/issues

- The space and importance given to the agricultural and land use sectors seems slightly on the light side. The authors note the importance of the sector for emissions in the country, as well as its complexity but do not describe it. While another paper is highlighted for the reader to refer to, additional detail and clarity on how the sector is treated & linked to other sectors in the model would be useful here too. Note, in addition, that some statements are confusing. The Abstract suggest that the authors /

model will cover "transport, buildings, industry and agriculture" while those on the contents of the paper p3 line 69 describe the sections of the paper as covering "supply, power, transport, residential, and industry"; and some sectoral paragraphs (e.g. supply) make statements about agricultural sector commodities.

- The authors suggest in that their approach considers the inclusion of equity in the model but do not explain this at any stage - while presumably linked to the residential sector "banding", this statement could be upheld in the sectoral discussions or otherwise clarified.
- On key feature of the model is its ability to consider flexibility between different levels of temporal and geographical detail. Considering the importance of this statement, the reader could expect to find additional information or a dedicated description of how this has been considered and how the authors ensure that energy balances, and transmission and distribution technologies are always aligned between versions.
- Consistency of demand drivers - an additional word explaining whether economic growth assumptions described in 2.5.2 are internally consistent would be useful. This also applies in other parts of the paper that discuss driver assumptions e.g. in relation to the housing demand estimates driven from Garcia Rodriguez (2020).
- Supply sector - the authors state that attention to "best practice coding conventions" in section 3.1.2 but do not clarify the approach that is used, what it implies or what reference (if one exists) their approach is based on. A short additional paragraph would be useful here.
- Bioenergy - future uses of bioenergy are gaining importance across increasing numbers of national and global modelling exercises. One key question that can raise significant difficulties is one of biomass sustainability. The current version of the paper / model seems to assume that biomass is carbon neutral. It would be useful to clarify this assumption, suggest why it is appropriate, clarify what definition of "biomass sustainability" is used (in broad terms at least) and consider if future versions of the model might usefully include the explicit representation of emissions linked to the use of different biomass commodities.
- Power sector - the authors suggest that the model is designed to take account of high levels of penetration of VRE, however the Power Sector description does not clarify what - if any - storage options are included in the model and how these are linked to VRE options to ensure system reliability. Could a paragraph to this effect be added?
- Transport - while detailed, the current description of the relationship between demand calculation, technology shares, changes of technology data over time vs. data considered constant over time (describing technology characteristics) is confusing and could be clarified. In particular, how the total demand is calculated and split across modes and what modal shifting is and is not possible, and under what conditions (i.e. in the core model or under particular scenarios), could be improved.
- Residential - the BER rating system is stated to assume that living and non-living areas of buildings are heated to 21 or 18C respectively. Table 9 highlights how BER ratings C and below have significantly different internal temperature assumptions. It is not clear however how this links to modelling assumptions around lower technology or envelope efficiency. Is not clear if the lower grade buildings are expected to use the same amount of energy just delivering a poorer service than the higher grade ones? Or whether they instead also require higher levels of energy consumption to provide the lower temperatures?
- Section 4.2 states "Integration with key national data sources [...] is a key strength of TIM". This suggests that the model can now be easily updated when new versions of key government publications are put forward. Is that the case? And if so, could this be stated more clearly?

Technical corrections: a compact listing of purely technical corrections at the very end

- Please refer to the attached pdf with suggestions available in comments.

Please also note the supplement to this comment:

<https://gmd.copernicus.org/preprints/gmd-2021-359/gmd-2021-359-RC2-supplement.pdf>