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Authors	Romain Zissler, Jeffrey S. Cross
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Shaping Japan's Climate and Energy Future by Developing a National Dedicated Repository for Computer Simulation Research

Romain Zissler and Jeffrey S. Cross

Transdisciplinary Science and Engineering, Energy Course, Tokyo Institute of Technology, Meguro-ku, Tokyo, Japan
e-mail: zissler.r.aa@m.titech.ac.jp

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I. INTRODUCTION

On October 26, 2020, new Prime Minister Yoshihide Suga announced that Japan will pursue the objective of carbon neutrality by 2050 [1]. This ambitious and necessary goal requires efficient climate and energy strategic planning. The future is by definition uncertain, but it is possible to explore it more or less accurately thanks to computer simulation. Computer simulation is a resource intensive engineering research work. Two main challenges are to be addressed in this enterprise: on the one hand data input, on the other hand data processing. This extended abstract focuses on the need to improve data input accessibility and transparency to enhance the quality of energy modelling, in particular of power systems, as a key tool to shape Japan's climate and energy future.

A. Key Observations

In Japan in 2019, the power sector accounted for 47% of the country's total carbon dioxide emissions, because of a heavy dependence on fossil fuels, especially coal and natural gas power which shares in electricity generation were 32% and 34%, respectively [2]. Thus, progressing towards carbon neutrality implies decarbonizing the power sector in priority.

This priority has been recognized in Japan for some time now. Indeed, before announcing pursuing carbon neutrality, the country in 2015 already advanced the 2030 commitments of reducing its greenhouse gas emissions by 26% (compared to 2013), notably by increasing the shares of renewable energy and nuclear in electricity generation to the detriments of fossils [3].

B. Roles of Computer Simulation and Validity Check Procedure

Computer simulation enables to explore decarbonization pathways by developing different scenarios to the discretion of researchers. Before reaching this advanced stage, it is, however, necessary to ensure correctness of data input & processing and model output. In this regard, proceeding to tests under the current situation is a critical starting point.

Tests under the current situation is a critical starting point because it allows to check the validity of computer simulation input and output. For example, in the case of the modelling of power systems in Japan, such validity check procedure may consist in comparing theoretical power system prices with those empirical provided by the Japan Electric Power Exchange.

II. FINDINGS

A. Main Results

The validity check procedure is an energy and time-consuming effort especially when an issue occurs and it is not straightforward to identify. It may be caused either by an incorrect data input or data processing. Data processing is related to engineering science and there is no quick fix for issues occurring on this side of the computer simulation. In contrast, data input may be greatly improved.

Data input may require some knowledge, but does not require specific technical skills compared to data processing elaboration. Yet, it is equally important to deliver meaningful research results. When modelling Japan power system, one of the major issues researchers face is initial data collection. Indeed, it is necessary to dig into multiple resources to find relevant information for power plants, regional electricity consumption profiles, fuel costs, or electrical grids. Also, there is no guarantee that information found is consistently presented.

This hurdle may be cleared by developing and keeping up-to-date a national repository for power system computer simulation research. This repository could be made available for free and may be developed at an academic level with partnerships between universities, public and private research institutes, and stakeholders of the power industry. Once operational it could ease and accelerate research in this field by avoiding the repetition of isolated efforts without significant added value.

B. Discussions and Future Work

Organizing the creation of the suggested repository would require a substantial initial effort, and continuous efforts to keep it up-to-date afterwards. Identifying interested in participants is another challenge.

Based on feedback received this proposal may be strengthened, including other energy sectors, and more actively promoted.

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