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ENERGY PLANNING MODELS ANALYSIS AND THEIR ADAPTABILITY FOR ESTONIAN ENERGY SECTOR

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Overview

The trend of liberalization and changes in the Estonian energy market, related to the European Union's strict technological and environmental requirements, give rise to the need to develop the modeling of new scenarios for the energy sector in Estonia by mitigating the environmental impacts of electricity production and using new, less environment-damaging technology. The easiest way to develop scenarios is to use energy planning modeling.

Modeling is one of the complicated forecasting methods. In recent years, a large number of energy planning models have been developed. Energy planning models often become useful when analyzing complex systems involve a lot of data; they help to understand the relationships between the different parameters and work out development scenarios in any country. Afterwards, the model may serve as a basis for a more accurate model of the country.

Objectives of the study were analysis and evaluation of the existing energy models in the world; development of the selection criteria and selection of the several energy models for the analysis of the energy market in Estonia; practical testing of the applicability of the selected models to Estonia.

The methodological approach of the selection of the energy planning models was substantiated and the selected models are suitable for the analysis of the energy sector in Estonia.

Energy system models classification and comparison of existing models

An overview of the current energy supply in Estonia and future changes of the Estonian energy production system related to the restrictions in technology and environment was given. The major investments in Estonian electricity production system were defined [1].

Energy planning models are built for various purposes and consequently have different characteristics and applications. The nine ways of classification were presented in the study. Selected classification of energy models is helpful for understanding their need, their roles and their specificity in relation to the studies under consideration [2].

In practice, it is not feasible to develop own models for energy planning exercises by energy planners and researchers, more effective to use existing models. According to the model's main characteristics it was suggested the selection criteria of the energy planning models from the point of view of the Estonian energy sector in [3].

We reviewed a wide range of models and it was selected nine existing energy models for the analysis of the energy market in Estonia: EFOM, TIMES, LEAP, MARKAL, MESAP, MESSAGE, MIDAS, PowerPlan, RETScreen and EnergyPlan. The selected energy planning models have the bottom-up or hybrid approach, linear programming and by the methodology are simulation, optimization and toolbox models. The selected energy planning models have been used and applied to various practical cases. Only freely available energy planning models were selected for further analysis of the adaptability of the models: RETScreen, EnergyPlan and LEAP.

Adaptability of energy planning models for Estonian energy sector

The RETScreen and EnergyPlan models were used in the calculations of the heat energy supply alternatives modelling in Narva city. The LEAP model was used for the elaboration of the scenarios of the Estonian energy system's development.

Both of the models (RETScreen, EnergyPlan) could be equally used for the pre-feasibility study of the new capacity planning projects. The results of the reviewed models are marginally different; the models are indicative for the scenarios development and could be useful for comparing the fundamental technological processes [4].

The analysis based on the LEAP model was done across the eight scenarios of the development of the Estonian energy system during the period 2009 2035, and key results across all the scenarios were given. Estonian energy system was simplified with a transparent structure and an overview of the current energy supply in Estonia, future changes and projections of the Estonian energy production system related to the restrictions in technology and environment were given [5].

Conclusions

1. For the analysis of the energy planning models, the classification and the basic distinctions of the types of models were described. During the analysis of the advantages and disadvantages of the energy planning model's main characteristics, from the point of view of the Estonian energy sector, were investigated:
2. The advantage of using two first models is that they allow to get reliable results by using comparatively low input data. The RETScreen energy model has more detailed input requirements of technological characteristics for the new energy capacity planning and the EnergyPlan model is more suitable for the whole country's energy balance planning.
3. The disadvantage of the EnergyPlan model is that it does not have opportunities to calculate the financial feasibility indicators and payback of the projects when modelling the new capacities.
4. Compared to the LEAP model, neither of the models (RETScreen, EnergyPlan) have the possibilities for inputting the external assumption information and data of the sectors such as industry, mining, commercial and residential.
5. The LEAP model, a user-friendly and freely available tool, demonstrated the usage of the model's features in connection with the Estonian electricity system and it could be suitable for elaborating the scenarios for the whole energy sector and for electricity and heat single sectors, including external assumptions.
6. Based on the practical part of this work, it could be concluded that the methodological approach of the selection of energy planning models was substantiated and the selected models are suitable for the analysis of the energy sector in Estonia.

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