

# Report on Bachelor / Master Thesis

Institute of Economic Studies, Faculty of Social Sciences, Charles University in Prague

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|-----------------------------|---|
| <b>Student:</b>             | <b>Jan Malek</b>  |
| <b>Advisor:</b>             | <b>Karel Janda</b>  |
| <b>Title of the thesis:</b> | <b>Influence of renewable energy sources on transmission networks in Central Europe</b> |

## **OVERALL ASSESSMENT** *(provided in English, Czech, or Slovak):*

This is a report provided by the Bachelor Thesis Advisor.

This is exceptionally well executed bachelor thesis dealing with one of prime areas of sustainable development – the area of renewable energy resources and their impact on general management of energy resources. The student focuses on renewable electricity sources (mainly photovoltaics and onshore and offshore electricity wind generators) and investigates how the European (especially German) public policies leading to massive subsidization and promotion of these renewable energy resources impact on the overall electricity energy policy and management development in Central Europe. From the policy point of view, the author investigates two contradictory policy directions of EU: on one side creating a unified energy market, on the other side promoting renewable energy, where the problems with accommodation of renewable electricity in electricity transmission networks provide strong policy incentives to close the national networks and to refuse the transfer of electricity from other nations during high-production events. This thesis therefore belongs to the Green Paradoxes stream of literature dealing with unintended harmful consequences of public policies aimed to the noble goal of promoting renewable energy resources.

The author successfully solved many research challenges presented by this interdisciplinary thesis which to a large degree goes beyond the usual economic analysis covered in bachelor thesis at IES. As I already mentioned, important part of the thesis is dealing with energy related public policies of EU and relevant countries (mainly Czech Republic and Germany, but in a lesser degree also Austria, Slovakia and Poland). Dealing with electricity transmission networks in clearly defined Central European region required from the student to understand relevant concepts from international territorial studies, since the international conflicts of interests are in the heart of the complicated problems of management of Central European electricity transmission networks. For this particular bachelor thesis the technical expertise and understanding of technical aspects of electricity production and transmission was also necessary since the central model used in the thesis is a technically based bottom-up model combining electrical engineering and economics.

The core of the paper is an application of the most suitable state-of-the art non-linear optimization model ELMOD which maximizes social welfare under a number of constraints. In order to be able to work with ELMOD, the author had to learn the GAMS, which is an achievement well above the standard curriculum of IES economic students not only on bachelor level but also on master's level. GAMS is a high-level modelling system for mathematical programming problems and it is modelling language often used in formulating and solving policy relevant computable general equilibrium (CGE) problems. In this thesis the ELMOD is used to obtain the predictions of border profile electricity flows under several different scenarios.

While the excellently provided descriptive and policy analysis of the problem (photovoltaic, wind, hydro and nuclear energy issues in Central Europe, electricity

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transmission networks in Central Europe and the complex public policies issues) would be already enough for bachelor thesis graded as Excellent, the application of ELMOD model brings this thesis to the rank of extraordinary IES theses.

During the defense the student should focus on the interpretation of the modelling results provided in the section 5 Scenarios and Results and on his original research contribution. What new did we learn from his modelling effort? How much are his results reliable given the fact that the model is not able to exactly replicate the real-life electricity flows over the considered border profiles? How much are the data used in the model reflecting current situation, as of the end of 2015?

The results of the ELMOD analysis provided in this thesis will be of wider policy interest and after some adjustments they should lead to a paper submitted to some high-quality field journal like Energy Policy. In particular the result that German nuclear-phase out does not significantly contribute to the electricity transmission capacity demand is quite interesting.

As a conclusion, I recommend this thesis for the defense and I recommend the grade Excellent (grade 1). I also encourage both the author and the Defense Committee to propose this thesis for relevant awards and relevant research competitions.

**SUMMARY OF POINTS AWARDED** (for details, see below):

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| <b>CATEGORY</b>                         | <b>POINTS</b> |
|---|---------------|
| <i>Literature</i> (max. 20 points)      | 19            |
| <i>Methods</i> (max. 30 points)         | 30            |
| <i>Contribution</i> (max. 30 points)    | 29            |
| <i>Manuscript Form</i> (max. 20 points) | 18            |
| <b>TOTAL POINTS</b> (max. 100 points)   | <b>96</b>     |
| <b>GRADE</b> (1 – 2 – 3 – 4)            | <b>1</b>      |

**NAME OF THE REFEREE:** *Karel Janda*

**DATE OF EVALUATION:** *May 21, 2016*

*Karel Janda*

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*Referee Signature*

**EXPLANATION OF CATEGORIES AND SCALE:**

**LITERATURE REVIEW:** *The thesis demonstrates author's full understanding and command of recent literature. The author quotes relevant literature in a proper way.*

Strong                  Average                  Weak  
20                          10                          0

**METHODS:** *The tools used are relevant to the research question being investigated, and adequate to the author's level of studies. The thesis topic is comprehensively analyzed.*

Strong                  Average                  Weak  
30                          15                          0

**CONTRIBUTION:** *The author presents original ideas on the topic demonstrating critical thinking and ability to draw conclusions based on the knowledge of relevant theory and empirics. There is a distinct value added of the thesis.*

Strong                  Average                  Weak  
30                          15                          0

**MANUSCRIPT FORM:** *The thesis is well structured. The student uses appropriate language and style, including academic format for graphs and tables. The text effectively refers to graphs and tables and disposes with a complete bibliography.*

Strong                  Average                  Weak  
20                          10                          0

**Overall grading:**

| TOTAL POINTS | GRADE    |                |                           |
|--------------|----------|----------------|---------------------------|
| 81 – 100     | <b>1</b> | = excellent    | = výborně                 |
| 61 – 80      | <b>2</b> | = good         | = velmi dobře             |
| 41 – 60      | <b>3</b> | = satisfactory | = dobře                   |
| 0 – 40       | <b>4</b> | = fail         | = nedoporučuji k obhajobě |