Roadmap to a low carbon energy sector in Hungary
- research agenda -

Péter Kaderják

Regional Centre for Energy Policy Research
Corvinus University of Budapest

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Building blocks of REKK's research proposal

1. Electricity market modelling to represent the impacts of massive RES-E integration in a regional context
2. Regulatory reform for the electricity grid in Hungary
3. Promoting e-mobility
4. Greening the district heating market
5. Innovation for a low carbon energy sector in Hungary
6. GHG abatement cost assessment for alternative public policies in Hungary

1. Electricity market modelling

Electricity market modelling

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- A consistent modelling of the regional electricity market has turned out to be useful in the context of developing the new Energy Policy for Hungary in 2011
- It helped to quantify the outcomes *(prices, emissions, CAPEX needs, implied gas consumption, net import position)* of different policy choices and fuel mix scenarios
- Extension of the modelling effort is needed to assess the impacts of large-scale integration of intermittent renewables on the Hungarian and regional electricity market

The decarbonisation path estimated by the 2011 modelling

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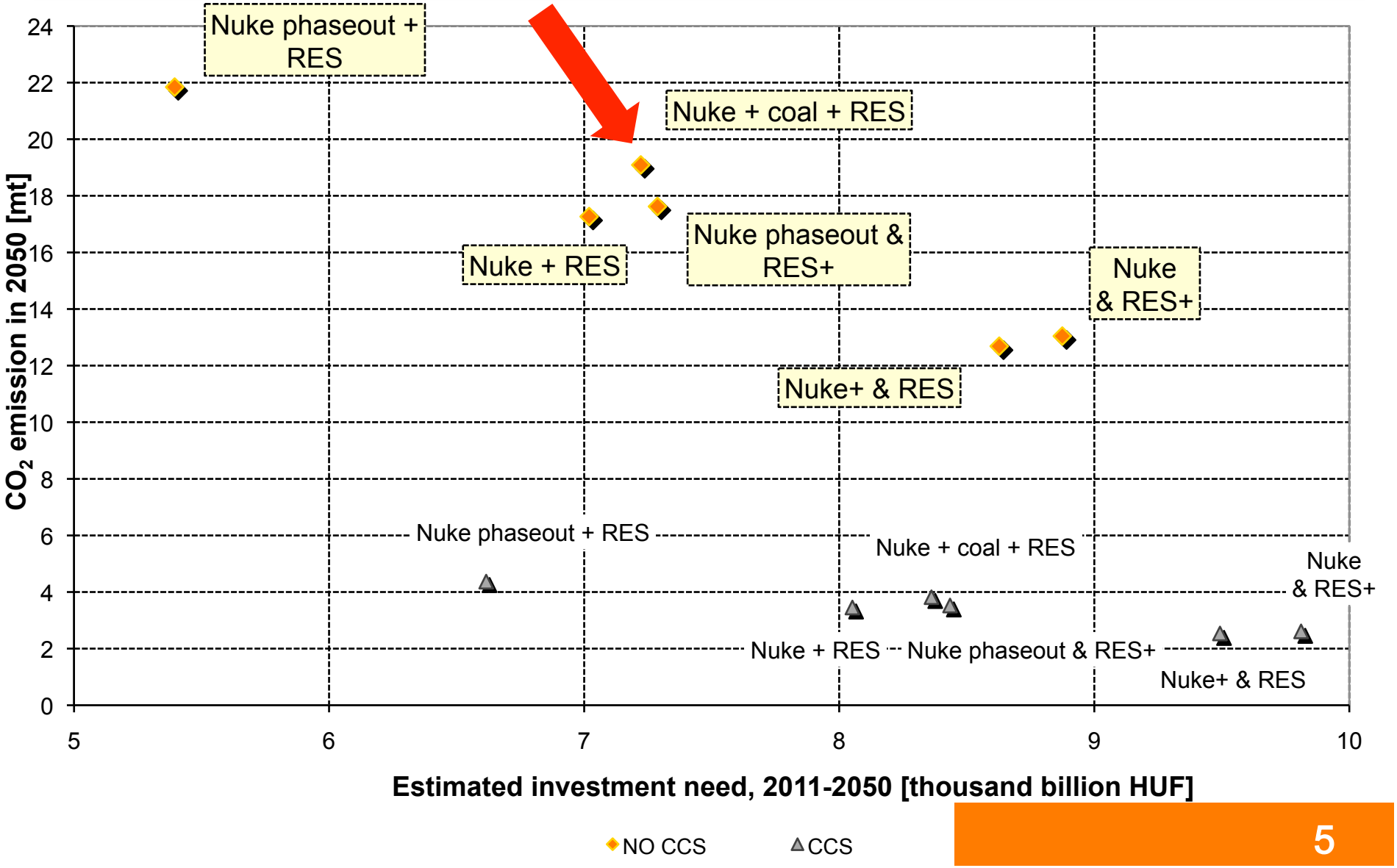

Motivation and method of extending market modelling

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- Motivation:
  - Large-scale intermittent generation will have profound effects on the conventional power market and power prices.
  - The aim of the research is to better understand these effects in a regional context using quantitative modeling.
- Method:
  - REKK has developed a short-run, multi-country electricity market model covering 15 countries in Central and South-East Europe with the following characteristics:
    - dispatch of generators is based on short-term production costs of running each unit,
    - intermittency of wind and solar power is represented by a lower capacity factor
  - This model will be extended by
    - incorporating ramping and part-load constraints and start-up costs, and
    - including a better representation of the intermittent nature of renewable energy sources

Expected output

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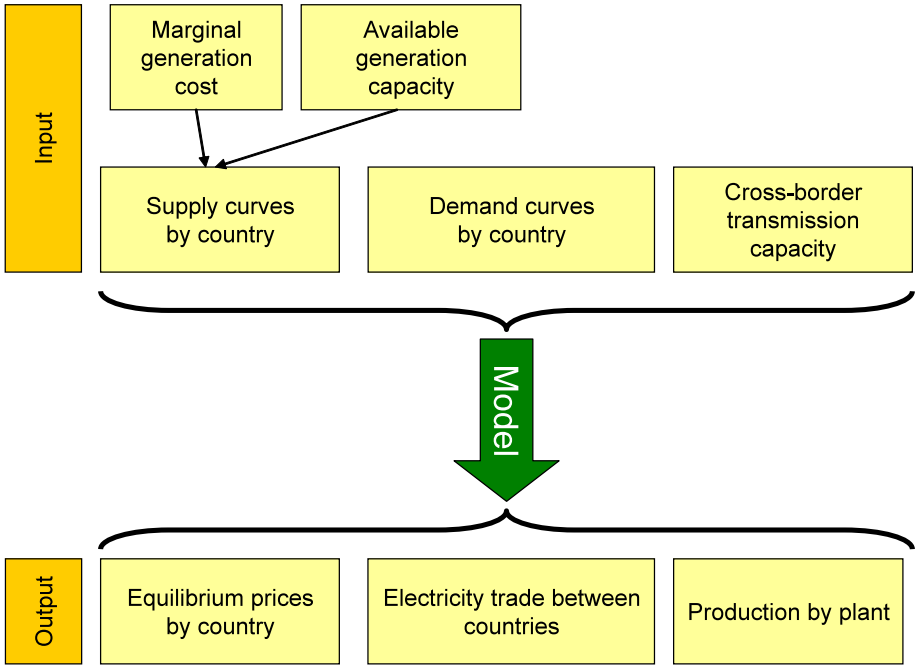
- The resulting model will allow to analyze the effects of large scale intermittent generation on
  - the demand for baseload/peakload plants, and
  - price formation
- Such analysis can inform:
  - investment decisions on power generation/ transmission capacities, and
  - energy policies such as nuclear energy development policy, renewable energy policy or GHG emission reduction policies

REKK's CSEE Power Price Model

Main inputs and outputs of the model

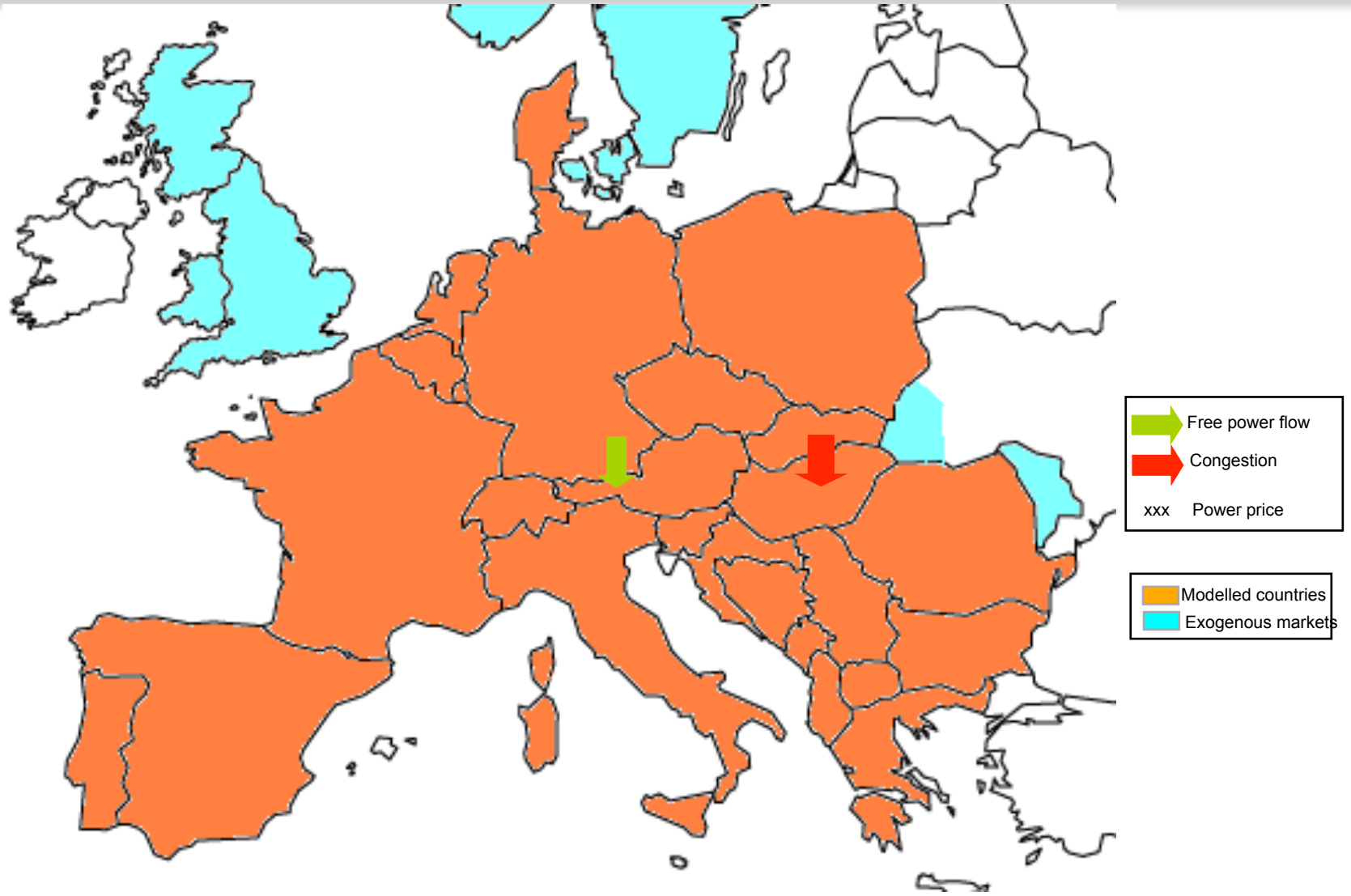


- The model calculates regional power supply – demand balance at certain capacity and import/export constraints
- Demand evolution, power plant capacities, availability and cross border power flow defines market price
- Fuel prices are based on available information

Main model assumptions

- The applied model is a partial equilibrium microeconomic model in which a homogeneous product is traded in several neighboring markets.
- Production and trade are perfectly competitive, there is no capacity withholding by market players.
- Production takes place in capacity-constrained plants with marginal costs and no fixed cost.
- Electricity flows are modeled as bilateral commercial arrangements between markets with a special spatial structure.
- Power flows on an interconnector are limited by NTC values in each direction.
- Fuel prices reflect power plant gate prices, transportation/ transmission costs are taken into consideration.
- Only ETS countries buy CO_2 allowances

The European Power Price Model: the joint project of JRC and REKK



Another extension: CO_2 price simulation

- With the European Power Price Model the CO_2 abatement cost curve of the European electricity sector can be estimated
- CO_2 abatement options in the electricity sector
  - Technology-based abatement (e.g. CCS, IGCC, etc.)
  - Efficiency improvement
  - Fuel switch
- Fuel switch (short term option) is endogenous, the other two options are exogenous to the model
- The following scenarios will be analyzed:
  - The impact of the different levels of RES electricity generation on the CO_2 price
  - The impacts of faster/slower nuclear phase out programs on the CO_2 price
  - Various fuel prices impacts on the CO_2 price

2. Regulatory reform for the electricity grid

Grid regulation – the issues

- Distribution system operator level (DSO)
  - Large scale integration of distributed, intermittent and micro generation
  - Electric cars
  - Large scale application of demand side management and energy efficiency projects
  - Smart solutions for metering and communication
- Several counter-incentives included in the present regulation

Grid regulation – research agenda

- Objective of analysis and research is to prepare a DSO regulatory reform proposal for Hungary
- Activities
  - Analysis of incentives of the present DSO regulatory environment from a LC transition perspective
  - Developing a DSO business model that is compatible with a low carbon transformation
  - Building a DSO model to analyse the impacts of alternative regulatory schemes that balance the incentives to host massive amounts of distributed generation, invest into smart grid solutions and keep promoting operational efficiency of DSOs
  - Developing a DSO regulatory reform proposal

3. Promoting e-mobility

Electric cars and the power system

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- Technological changes in transport (penetration of electric plug-in cars) pose challenges and business opportunities to the whole power system and to new entrants as well.

- What should be the strategy (push or pull) and the tasks of market participants and the regulation in a small open economy, such as Hungary? In which areas we should deviate from pursuing a ‘follower’ or ‘wait and see’ attitude in this development?

- Is there a clear trend to expect in this development and what is the optimal timing of the various steps in the process (e.g. in pricing, network and metering developments)?

Electric cars – main research questions

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- What type of impact we can expect on the electricity demand from the penetration of electric cars in short and medium term?
- What are the main characteristics of this ‘new’ demand from economic point of view? And from GHG emissions point of view?
- What type of changes this development requires on the utility regulation side and on the development of a smart electricity network in order to make price signals effective on consumers’ demand?

Methodology: expert interviews with main stakeholders, literature review and regulatory analysis

4. Greening the district heating market

District Heating (DH)

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Why district heat?

- realizing renewable targets (increasing the share of renewable resources in heating)
- mitigating climate change (curbing carbon emmission)
- improving air quality in urban areas
- increasing security of supply (reducing fossil fuel dependence)

Market failures and others frustrating DH

- distorted fuel prices (not reflecting externalities)
- administrative barriers/burdens
- financing high capital investment
- building heat demand and securing anchor load

District Heating – research agenda

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- Assessment of external costs and benefit of district heat
- Exploring market distortion and market failures on heat market
- Estimating socially optimal share of DH in heat market
- Possibilities/potentials of DH – converting private heating and increasing renewable use in district heating
- Survey of regulatory tools: fixing market failures (internalize externalities and getting the prices right) and removing administrative burdens
- Lessons to learn: experiences in Scandinavia (capitalize on empirical evidences)
- Role of municipalities and central government: heat planning and setting market enabling framework
- Non-conventional tools: nourishing cooperation and building (public-private) partnership

5. Scope for success in innovation for a low carbon energy sector

Low carbon innovation (LCI) – the issue

- A transformation to a low carbon energy sector requires massive innovation
- How the national economy could benefit most from this transformation?
- Our understanding of innovation into low carbon technologies is very much limited
- Main questions for Hungarian LCI:
  - Understanding drivers for innovation through adaptation of technology resulting from international R&D
  - Understanding drivers for domestic low carbon R&D

Low carbon innovation – research agenda

- Evaluation of the domestic R&D regulatory environment
  - patents, financing
- Empirical analysis of the R&D activity of Hungarian companies
  - R&D tax utilization, EU Community Innovation Survey analysis, survey of Hungarian multinationals
- Key success factors for a Hungarian innovation
- How a Hungarian Low-Carbon Innovation Risk Fund could be structured?
  - Renewable heating technologies? Agricultural waste utilization? Energy plantations? Second generation biofuels? Car engineering? Innovative architecture?...
- Success and failure in Hungarian low carbon innovation: case analyses

6. Unit GHG abatement cost assessment for alternative public policies

GHG abatement cost assessment

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- There are several policy initiatives in place to abate GHG emissions
  - subsidies, standards and tax incentives to promote energy efficiency, RES, etc)
- There should be a wide range in the marginal (unit) GHG abatement cost of those different policies
- We miss a systematic understanding and assessment of the costs of those policies

GHG abatement cost assessment – research agenda

- REKK will estimate the unit GHG abatement cost of relevant public policies
  - Building retrofit program, biofuel program, …
- Completion and publishing of a relevant data base and a quantitative model to estimate policy related abatement costs
- Cooperation with public authorities is a precondition
- Dissemination through workshops and publications

Policy and regulatory relevance

Research tasks

- Market modelling, GHG abatement cost assessment
- Greening district heating
- Grid regulatory reform, E-mobility
- Innovation

Releveant policy/regulatory initiatives

- Roadmap 2050 project (NFM)
- DH Action Plan (NFM)
- Smart grid pilot projects (MEH)
- METAR (new feed-in support regulatory proposal: MEH+NFM)

Research outcomes, timing, budget

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- A detailed project outcome list is completed after consultations with interested parties
- Workshops, research reports, book
- Timing: 2 years starting in June, 2012 the latest
- Budget: € 320-350k

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THANK YOU FOR YOUR ATTENTION!

pkaderjak@uni-corvinus.hu

www.rekk.eu

+36 1 482 7071