Influence of spillover and national policy on vehicle propulsion preferences in a small open economy exemplified by Norway

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Thomas Martinsen

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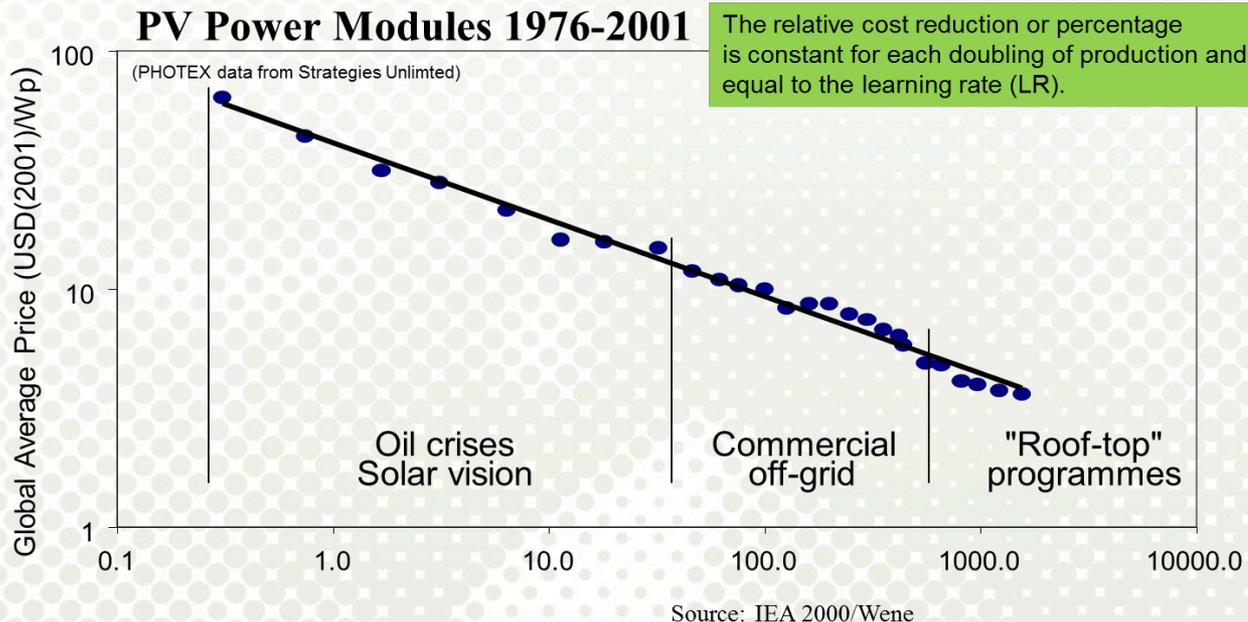NORWEGIAN UNIVERSITY OF LIFE SCIENCES

Introduction

- A few words on technology learning, spillover and how it is modelled

- The influence of national policy, i.e. light duty vehicle purchase tax based on spesific CO_2 emission

  – The framework was developed as part of my PhD. The thesis may be downloaded from: http://urn.kb.se/resolve?urn=urn:nbn:no:ntnu:diva-11857

  – There is also 3 papers:

- Martinsen, T., 2010. Global technology learning and national policy--An incentive scheme for governments to assume the high cost of early deployment exemplified by Norway. Energy Policy 38, 4163-4172.

- Martinsen, T., 2011a. Technology learning in a small open economy - The systems, modeling and exploiting the learning effect. Energy Policy 39, 2361-2372

- Martinsen, T., 2011b. Introducing technology learning for energy technologies in a national CGE model through soft-links to global and national models. Energy Policy 39, 3327-3336

thomas.martinsen0@umb.no

Technology learning and spillover

From the national perspective the cost reductions and efficiency improvements resulting from accumulated global production is seen as spillover of technology learning from the global technology market.

PV Power Modules 1976-2001

(PHOTEX data from Strategies Unlimted)

The relative cost reduction or percentage is constant for each doubling of production and equal to the learning rate (LR).

Global Average Price (USD(2001)/Wp)

Oil crises Solar vision

Commercial off-grid

"Roof-top" programmes

Source: IEA 2000/Wene

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Modelling spillover

- If a technology is available in the global market, global data must be used in the learning curve equation

- Global energy balance must be fulfilled

- technological path dependence should be taken into account
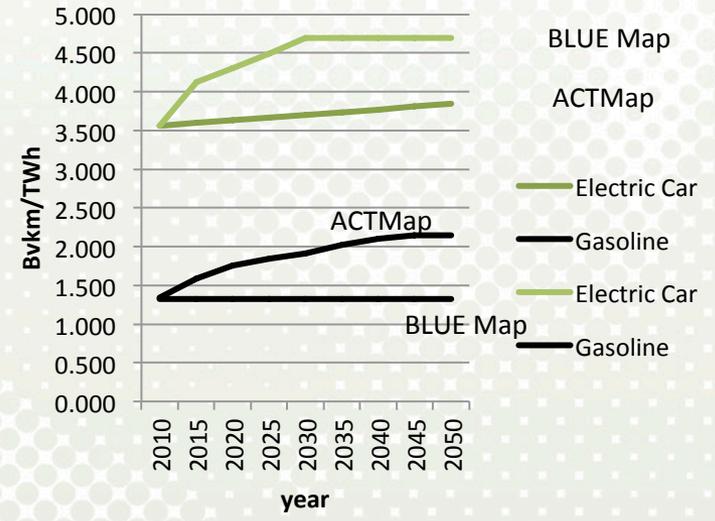
- A global model is called for

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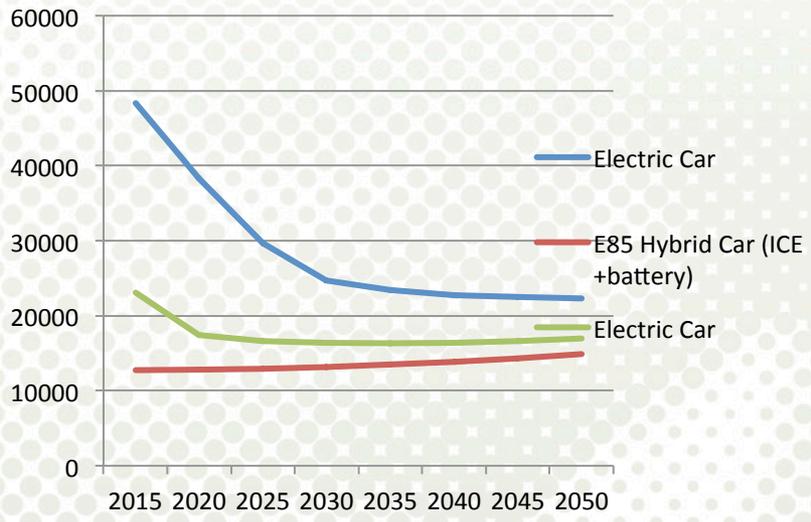
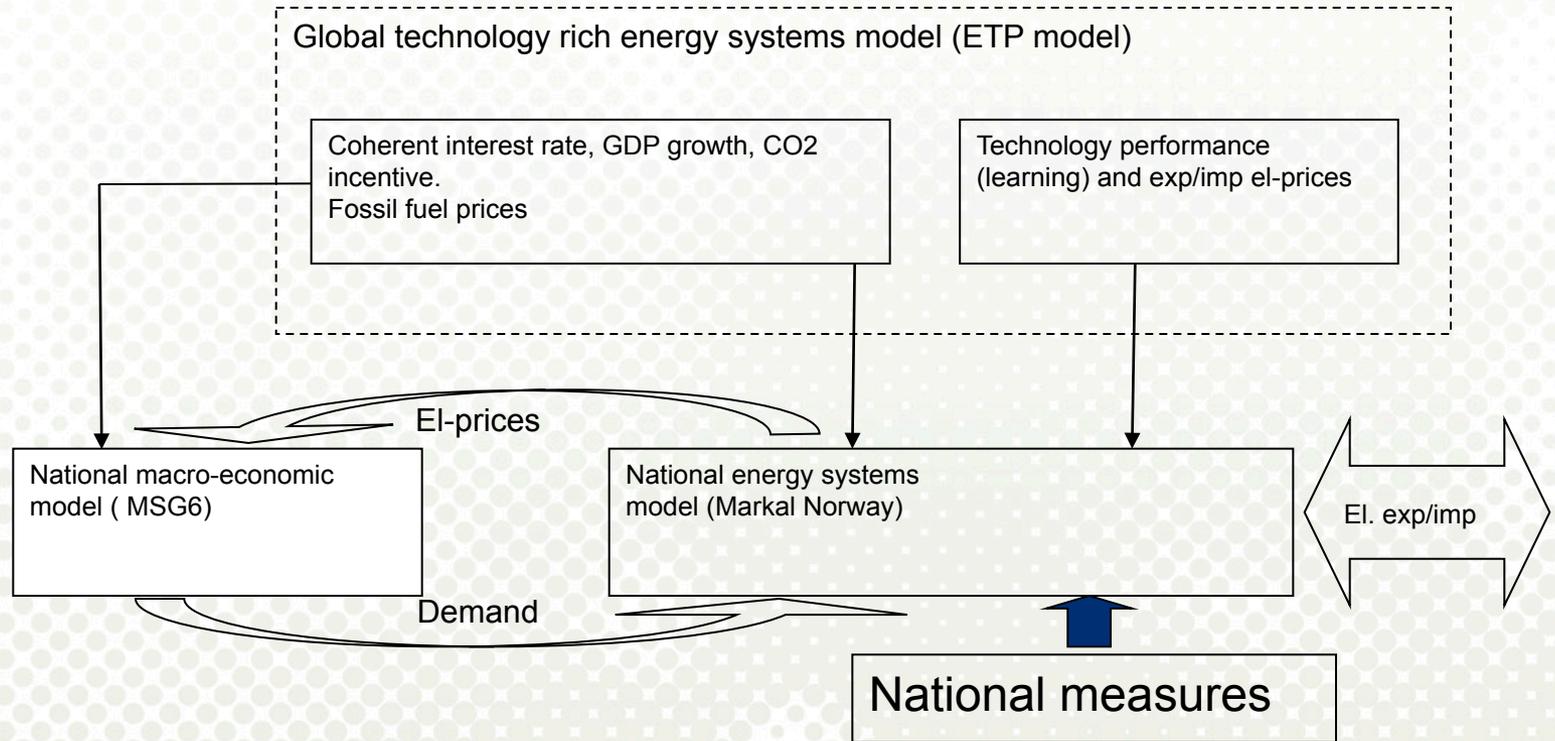NORWEGIAN UNIVERSITY OF LIFE SCIENCES

Modelling spillover

I assume that Norway's influence on the global prices and efficiency is negligible

Then the technology cost and efficiency vs depolyment may be converted to cost and efficinecy vs time

If one technology gains then others cannot, thus they are scenario spesific

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Deployment and spillover

Spillover of technology learning provides a strong incentive for technology change in the national energy system.

Realization of cost reductions through global technology learning depends on national policy implementation.

| Global technology learning | Deployment - always local | Local technology learning |

Do national policies in a small open economy such as Norway contribute to the realization of the technology paths elaborated in the Energy Technology Perspectives study?

The modelling framework

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Global technology rich energy systems model (ETP model)

Coherent interest rate, GDP growth, CO2 incentive.
Fossil fuel prices

Technology performance (learning) and exp/imp el-prices

El-prices

National macro-economic model (MSG6)

National energy systems model (Markal Norway)

El. exp/imp

Demand

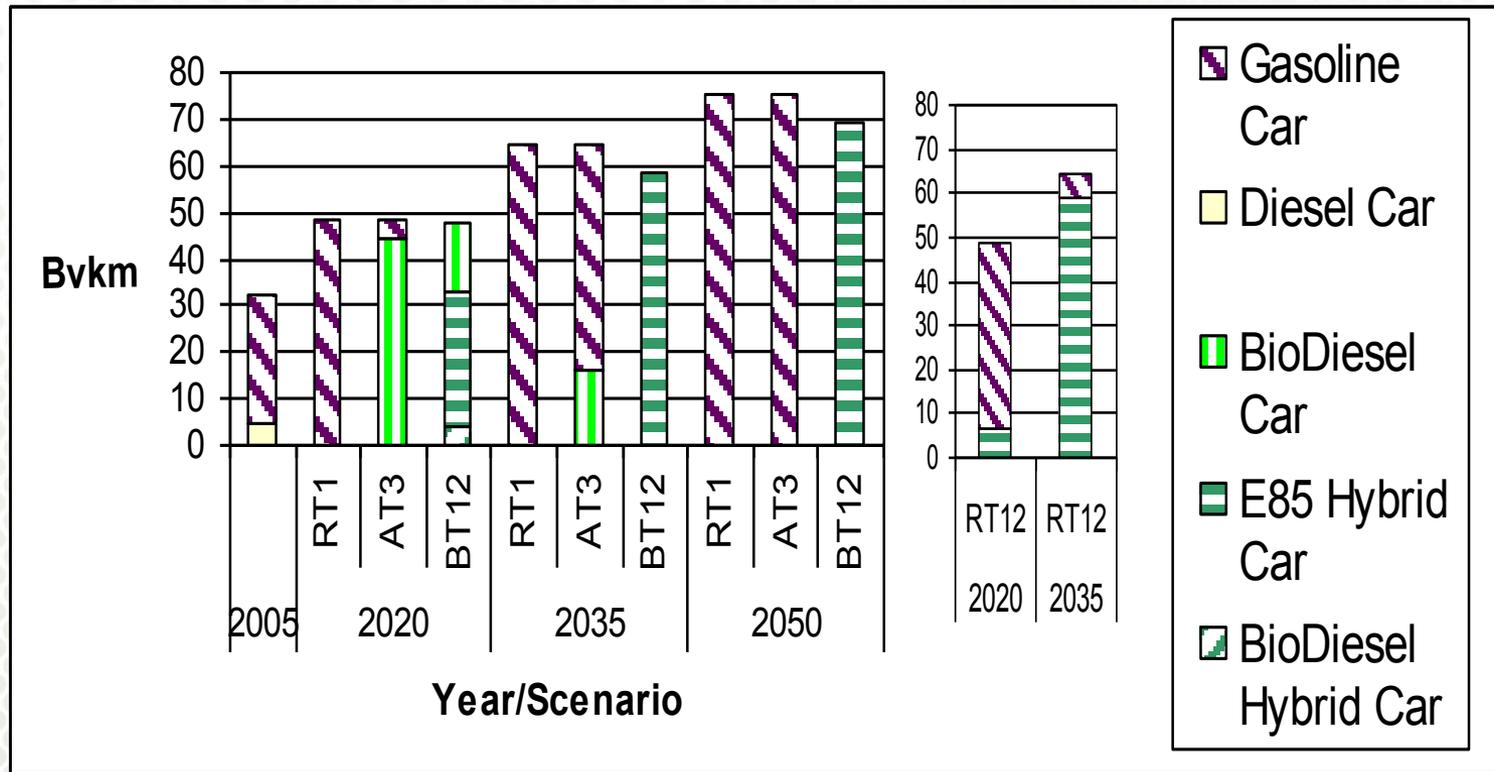National measures

Global scenarios
- technology and fuel development (spillover)

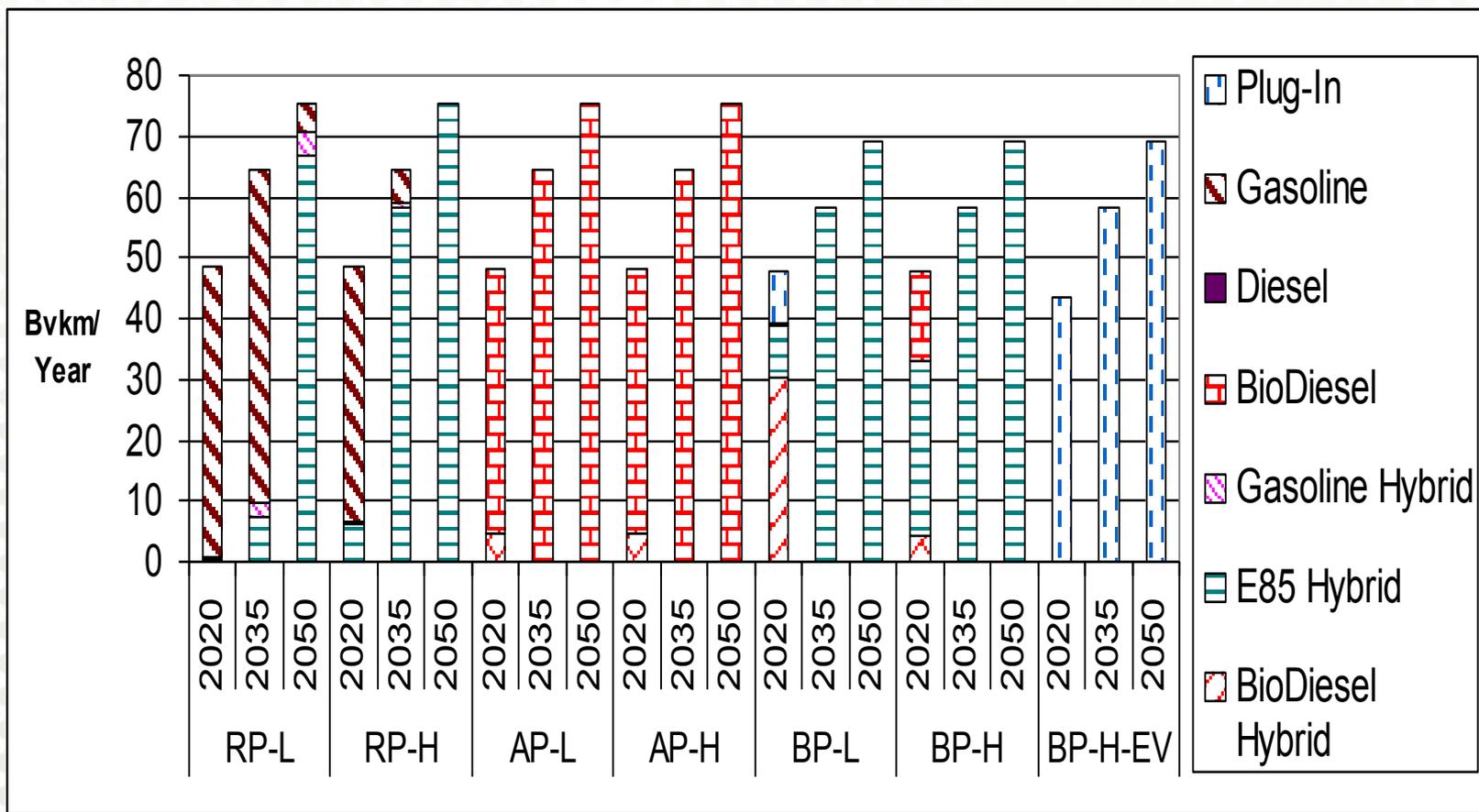|	
REF	10 – 25 % efficiency improvement, mostly gasoline and diesel engines, 5 – 15 % hybrids Biofuel, only 1.generation
ACT Map	50 % efficiency improvement, 75 – 95 % hybrids Biofuel, mostly 2.generation
BLUE Map	70 % efficiency improvement, 35 % hybrids, 60 % Plug-in and EV Biofuel, all 2.generation
BLUE EV Success	70 % efficiency improvement, 10 % hybrids, 75 % Plug-in and EV (EV sales 90 % in 2050) Biofuel, all 2.generation

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National scenarios

RT-1 RT-12 RP-L RP-H	Spillover and CO_2 tax only Spillover and high CO_2 tax + low level purchase tax + high level purchase tax
AT-3 AP-L AP-H	Spillover and CO_2 tax only + low level purchase tax + high level purchase tax
BT-12 BP-L BP-H	Spillover and CO_2 tax only + low level purchase tax + high level purchase tax
BP-H-EV	Spillover and CO_2 tax + high level purchase tax exempt for Plug-in and electric vehicles

Spillover and CO_2 tax only – the baselines

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National scenario results with car purchase tax

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Conclusions

- Strong national policy incentives are required to shift the LDV technology preference to fully support the global technology path under the emission reduction scenarios ACT Map and BLUE Map.

- Retaining the current exempt from purchase tax for Plug-in and electric vehicles together with spillover and CO_2 fuel tax causes a complete shift to Plug-in before 2020. Different assumptions for bio fuel cost may alter the result and requires further studies.

- A shift to Plug-in LDV may provide a double dividend towards compliance with the EU 20/20/20 target by increasing the energy efficiency, increase new renewable energy technology deployment and reduce the CO_2 emissions.