MACROECONOMIC EFFECTS OF A FOSSIL FUEL INDEPENDENT VEHICLE FLEET IN SWEDEN

GREAT and HyER seminar, Brussels

2018-01-31

Research Institutes of Sweden
INTRODUCTION

▪ Background
  ▪ 1/3 of CO₂ emissions originate from the transport sector
  ▪ 80% of oil consumption is used in road transport
  ▪ Political agreement on goals:
    ▪ Reduce CO₂ impact from domestic transports by 70% until 2030
    ▪ Fossil fuel independency by 2045

▪ Project
  ▪ Explores different technology pathways for fossil independency for the Swedish vehicle fleet and their effects on the Swedish economy

Research questions:
▪ What technology pathways are possible?
▪ What are their effects on Swedish economy?
**THE MODELS**

- **Vehicle Stock Model**
  - Partial model, based on annual vehicle cohort
  - Includes passenger cars, buses and heavy goods vehicles
  - Assumptions on future development of technology, power trains and fuel types

- **E3ME**
  - Econometric (non-equilibrium) model
  - Input/output model
  - Complete integration of energy and economy modules
  - 53 regions, 77 economic sectors
GENERAL ASSUMPTIONS

- New vehicle sales are kept constant at 2015 year’s level
- Vehicle life time is calibrated from historical data
- Sweden’s competitiveness regarding vehicles is assumed constant vs the rest of the world
- All expenses are financed by “the market”.
  - Public finances always in balance
- Investments do not crowd out other investments
- Assumptions regarding oil prices and electricity price and mix are based on external sources

- There will be a full list of assumptions in the Project report
METHOD

1. Three technology scenarios, which reduce CO₂ impact by 80% (targets from an earlier report)
   - BIO – Biofuel based
   - ELEC – Battery electricity based
   - FCV – Fuel cell based

2. Update to Swedish policy development
   - ELEC_BB – ”Biofuel quota” policy and 70% reduction target
   - Addition MaaS/car sharing
   - Sensitivity analysis - oil and electricity price
   - Sensitivity analysis - import of biofuels

- All scenarios are based on biofuels, which can be mixed with fossil fuels (drop in fuels)
ASSUMPTIONS FOR "BIOFUEL QUOTA" AND 70 % TARGET

- **CO₂ reduction per year according to "Biofuel quota"**

<table>
<thead>
<tr>
<th>Year</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
<th>2024</th>
<th>2025</th>
<th>2026</th>
<th>2027</th>
<th>2028</th>
<th>2029</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>Petrol:</td>
<td>3%</td>
<td>3%</td>
<td>4%</td>
<td>4%</td>
<td>5%</td>
<td>8%</td>
<td>10%</td>
<td>15%</td>
<td>20%</td>
<td>25%</td>
<td>30%</td>
<td>35%</td>
<td>38%</td>
<td>40%</td>
</tr>
<tr>
<td>Diesel:</td>
<td>17%</td>
<td>19%</td>
<td>20%</td>
<td>21%</td>
<td>24%</td>
<td>26%</td>
<td>28%</td>
<td>30%</td>
<td>32%</td>
<td>34%</td>
<td>36%</td>
<td>38%</td>
<td>39%</td>
<td>40%</td>
</tr>
</tbody>
</table>

- **NECESSARY pace of electrification (BEV + PHEV + HEV) per vehicle type**

% of new car sales | 2020 | 2030 | 2050
---|---|---|---
**Cars** | 60 | 90 | 100
**Buses** | 50 | 70 | 80
**Vans** | 50 | 100 | 100
**LHGVs** | 50 | 100 | 100
**MHGVs** | 12 | 25 | 55
**HHGVs** | 0 | 0 | 0
ALTERNATIVE PATHWAYS TO 70% TARGET – ELECTRIFICATION PACE

- “Biofuel quota” levels
- More biofuel - less electrification
- Less biofuel - more electrification
MACROECONOMIC RESULTS – "BIOFUEL QUOTA" AND 70 % TARGET

- **Results**
  - Positive results for both GDP, consumption, employment and investments, compared to CPI

- **Rational**
  - Imported fossil fuels are replaced by domestically produced fuel (electricity, biofuel)
  - Lower TCO for car owners results in increased consumer expenditure and increased economic activity across the economy
  - More investments in new infrastructure drive the demand side of the economy
SENSITIVITY ANALYSIS – OIL AND ELECTRICITY PRICE

Method
- Adjust the oil (1) and electricity (2) price upward and downward by 30%

Results
- Effects of (1), in terms of GDP

- Standard scenario – based on IEA’s forecast
- Electricity price changes give the opposite results from oil price changes
SENSITIVITY ANALYSIS – BIOFUELS

- Method
  - 80% import (as today) has been compared to 100% Swedish production

- Results
  - Domestic production results in increased positive economic effects, compared to import (assuming equal cost structure)

- Swedish production of biofuels is needed!
LIMITATIONS

- Behavioural and societal changes
  - Reducing road transport overall would help the transition
- Rebound effects – CO₂
  - Total GDP growth is more important for CO₂ emissions than the rebound effects from the measures in our study
  - It is important to reduce the CO₂ intensity in all sectors
- Potential technologies
  - Autonomous vehicles, hydrogen/fuel cells, electric roads, electro fuels
SUMMARY

- It is possible to reach the targets!
  - A very speedy uptake of new technologies and new power trains is needed
  - Drop in biofuels are needed – to impact the current vehicle stock
- The effects can be positive for Swedish economy
  - Technology development, cost efficient mobility and replacement of imported fossil fuels are driving this
  - The price of oil and electricity impact how positive the results will be
  - The level of import and the price of biofuel will also impact how positive the results will be

- Action is needed now!