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Aim and Scope of DEFINE, Objectives for this Workshop

Presentation at the DEFINE Technical Modelling Workshop

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Aim of DEFINE I

Electromobility is often seen as the solution to combining an individual transportation system with ecologically sustainable development.

However, DEFINE will be defined broader, analysing an anticipated *change in the mobility paradigm* from a fossil fuel-based individual transportation system to one relying on electromobility, public transport and in-between solutions.

Thus, DEFINE aims at:

- Estimating and assessing the **full economic costs** associated with a higher share of electric mobility, taking account of the impact on electricity grids, the provision of electric energy and environmental externalities such as GHGs.
- The development of an **evaluation framework**, with a hybrid CGE model and two electricity market models as its core, to meet this end.

Aim of DEFINE II

- Models are constructed in a way that allows for mutual inputs between the models (not necessarily a soft link), where results of the one model e.g. enter the other as exogenous (e.g. scenario) parameters.
- Comparable scenarios are simulated in the various models, with different foci and outcomes. Evaluation Framework for Austria and Germany is extended to Poland.
- Integrated, comparative studies on the impact of a large-scale shift to electromobility for Austria, Germany and Poland are the result.
- The environmental impacts (costs and benefits) are quantified according to the outcomes of the modelling framework.
- Policy briefs by various partners and a policy guide (The “Path to Electromobility”) are published at the end of the project.

Scope of DEFINE: Evaluation Framework I

DEFINE is focused on the development of an **evaluation framework** for a higher share of electromobility, the envisaged components of which are:

- A *hybrid top-down bottom up CGE model*, with a detailed depiction of both the mobility behaviour of households and the electricity sector.
- Two detailed *electricity market models*, providing a more detailed view on the electricity market, the production of electricity, the electricity grid and electric vehicles as storage devices for electric energy.
- *Scenario data* on the development of vehicle technology (e.g. vehicle stock projections), market potential of EVs, potential user groups and typical usage patterns, etc., enter models for simulation purposes.
- *Emission reduction potential* of electric mobility and the *quantification of environmental costs and benefits* conclude the evaluation framework.

Scope of DEFINE: Evaluation Framework II

A consumer survey and subsequent micro-estimation for Austria and Poland furthermore provide

- An empirical basis for the CGE model and
- Allow for the construction of detailed micro models (discrete choice models on household level) depicting mode choices and the take-on of electric vehicles by consumers.
- Parameters and outcomes from the micro model can enter the CGE model as exogenous parameters, and vice versa.
- A link between the micro and macro models might be constructed.

Model Building - Scientific Publishing

The CGE Model will be collaborative work that will be jointly available for scientific publishing.

- IHS will do most of the programming work and Austrian data.
- German/Polish data from DIW/CASE.
- Senior expertise from DEFINE workshop 2 (now) and workshop 4 (fall 2013), and bilateral collaboration.
- Until now, IHS has made no major modifications to model developed by Böhringer and Rutherford (2008) comparable to extensions envisaged in DEFINE.
- “We are the workers/learners, you are the experts.” ☺

Points of Intersection in DEFINE I: Hybrid CGE Model (WPs 1, 6)

- Collaboration regarding development of hybrid CGE model.
- Input of data and price-demand elasticities from WPs 3,8.
- Input of scenario data (WP 4), development of model in view of scenarios.
- Interaction between CGE model and electricity market models (WPs 2,7).
- Provision of German and Polish Macro-Data (WPs 6, 10), in the form of a SAM (Social Accounting Matrix).
- Application of hybrid CGE model to Germany (WP 6) and Poland (WP 10).

Points of Intersection in DEFINE II: Electricity Market Models (WPs 2, 7)

- Collaboration regarding the development of the two electricity market models.
- Input of scenario data (WP 4), development of model in view of scenarios.
- Interaction between electricity market models and CGE model (WPs 1,6).
- Application of German electricity market model to Poland (WP 10).

Points of Intersection in DEFINE III: Consumer Survey and Micro-Estimation (WPs 3, 8)

- Data requirements of CGE model are discussed at Kickoff Workshop.
- Survey design is elaborated until Workshop 3 (Scenario Building and Data Implementation, month 10, February/March 2013).
- Survey design is presented at Workshop 3.

Points of Intersection in DEFINE IV: Scenarios (WPs 4, 6, 7)

- Scenario building for transport and energy in WP 4.
- Implementation of scenarios developed in WP 4 into hybrid CGE model (WP 6).
- Implementation of scenarios developed in WP 4 into electricity market models (WP 7).

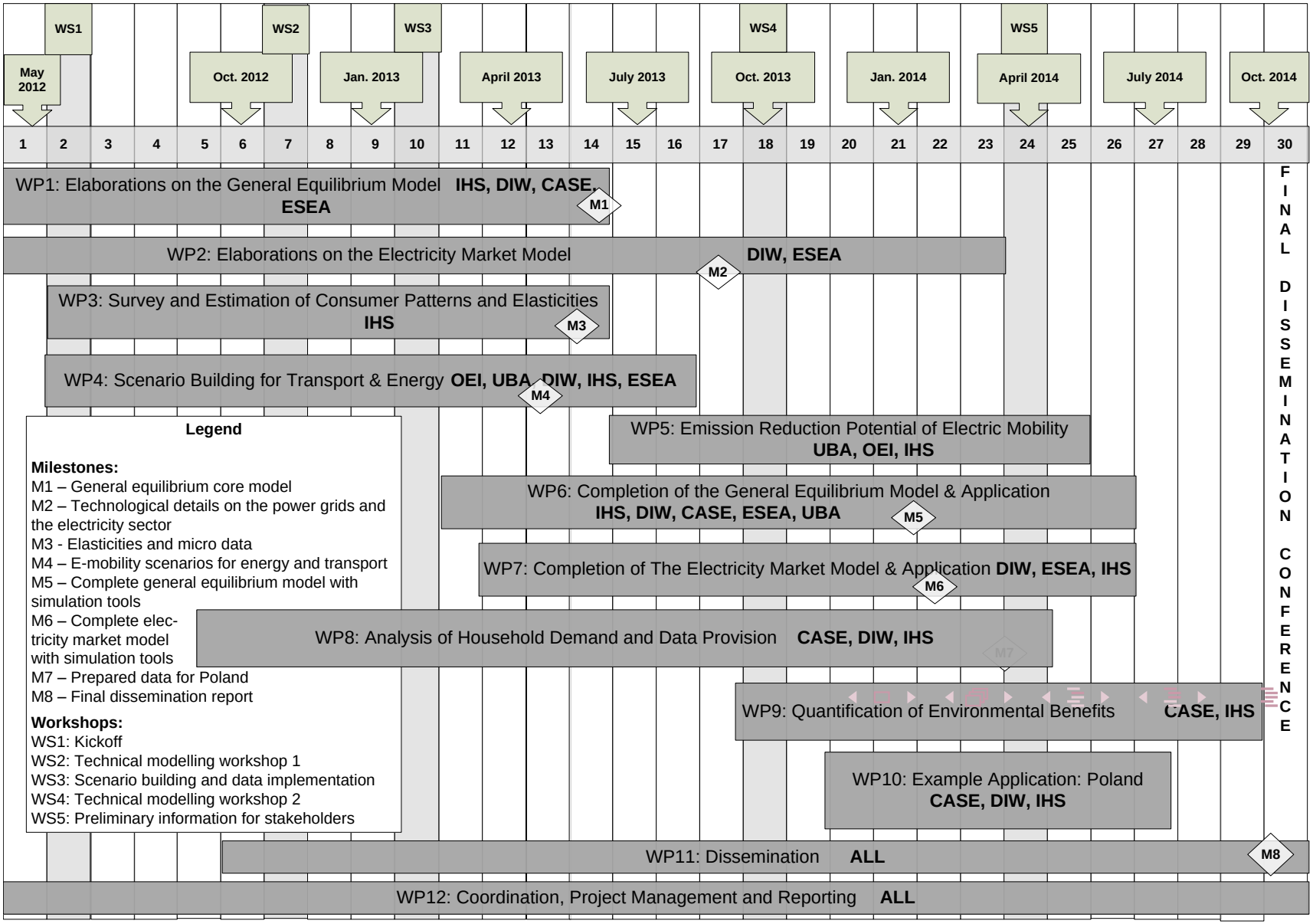
Points of Intersection in DEFINE V: Emission Reduction Potential (WP 5)

- Inputs from WPs 2, 4, 7 to calculate emission factors of additional electricity demand for electric vehicles.
- Comparison of scenarios as input for quantification of impact on e-mobility on GHG emissions.

Points of Intersection in DEFINE VI: Application to Poland (WP 10)

- Provision of Polish price-demand elasticities for CGE model (WP 8).
- Provision of Polish data for CGE model, calibration (WPs 6, 8).
- Provision of Polish data for German electricity market model, calibration (WP 7).
- Transformation of Austrian and German scenarios into “Polish” scenario, application in CGE model and German electricity market model.

Timeline of DEFINE



Modelling Objectives for CGE Model in DEFINE

- Inclusion of mobility good in SAM/nesting structure, endogenous decision on transport mode and vehicle purchase/use by household,
- Stock-Flow Consistency for vehicle technologies, substituting a stock of conventional vehicles (CVs) with electric vehicles (EVs) and PHEVs (Plug-In Hybrids),
- Modelling the interaction between changes in **mode choices**, **vehicle purchase choices** and the **energy system** (mostly in regard to the electricity producing system),
- Reconciling the CGE model with input from vehicle stock projection models (OEI/UBA) and electricity market models (DIW/TUW),
- Capability to analyse costs/benefits of shift in mobility paradigm to public transport/inter-operability, etc., including shift to electromobility.

Objectives for this Workshop

The IHS dynamic CGE model has been mainly adapted from the literature, Böhringer and Rutherford (2008). Adaptions so far, among others:

- Extension to several sectors,
- Fitted to Austrian data,
- Elaborate government agent, equipped with various endogenous taxes and refinancing instruments,
- Scenario instruments (endogenous investment subsidies), renewable-quota scenario, etc.

The changes necessary for DEFINE, however, will go deeper than the adaptations above. Thus, the goal for this workshop is to lay the foundation for the major extensions of the CGE model mentioned on the previous slide.

'Electromobility' in a Broader Sense

- Modelling mobility in a way that allows for the assessment of the economic costs/benefits of a large-scale shift to electromobility, considering interactions with the energy system.
- However, a sole shift to electric cars, not altering current behaviour and intensity of use regarding individual transportation by cars, might not be a sustainable solution, especially considering different properties of electric cars (limited range, dependence on rare earth elements, etc.)
- Thus, it is definitely desirable to incorporate also a shift to public transport, combined with an increased uptake of EVs and hybrids.
- More individual transport-oriented scenarios could be compared with at least one scenario concentrating on a *change in the mobility paradigm* to inter-operability between individual and public transport, extension of public transport, etc.

Approach and Method of the Workshop

Since the extensions to be implemented in the dynamic CGE Model go beyond what has been currently implemented, this workshop shall pave the way for the further modelling efforts in DEFINE, providing first solutions and a clear direction to go into. Therefore,

- We want to encourage a creative, outgoing atmosphere with brainstorming on different problem sets posed in the DEFINE project.
- Work on the Model itself in GAMS, trying to find ways to implement the necessary model features.
- Collect the inputs and experience from renowned experts (you!) in the field to help us meet the project goals.

Selected Milestones

- M1 - General equilibrium core model (WP 1): June 2013
- M3 - Elasticities and micro data (WP 3): June 2013
- M4 - E-mobility scenarios for transport and energy (WP 4): May 2013
- M5 - Complete general equilibrium model with simulation tools (WP 6): February 2014

References

Böhringer, C. and Rutherford, T. (2008). Combining bottom-up and top down. *Energy Economics, 30*, 2:574–596.

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Thank you for your attention!

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