

# D 9.8

## Research Outline

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WIOD Consortium Meeting, Seville,  
25th – 28th June 2011



## Agenda

1

**Introduction**

2

**PACE**

3

**Research Outline for D 9.8**

4

**References**

## 1

# Introduction

## Main Tasks of WP 9

1. Improve existing models by gearing them with new WIOD data.
2. Upgrade existing models by using the new features of the WIOD data (e.g. time series character, detailed intermediate flows, satellite accounts, etc.)

## Research Project for D 9.8

- Policy assessment using PACE geared with WIOD data, e.g. an impact assessment of the Europe initiative - Energy 2020 or the regulation of transport emissions .
- Performance test of the model employing two innovative approaches to model validation.



## Agenda

1

Introduction

2

**PACE**

3

Research Outline for D 9.8

4

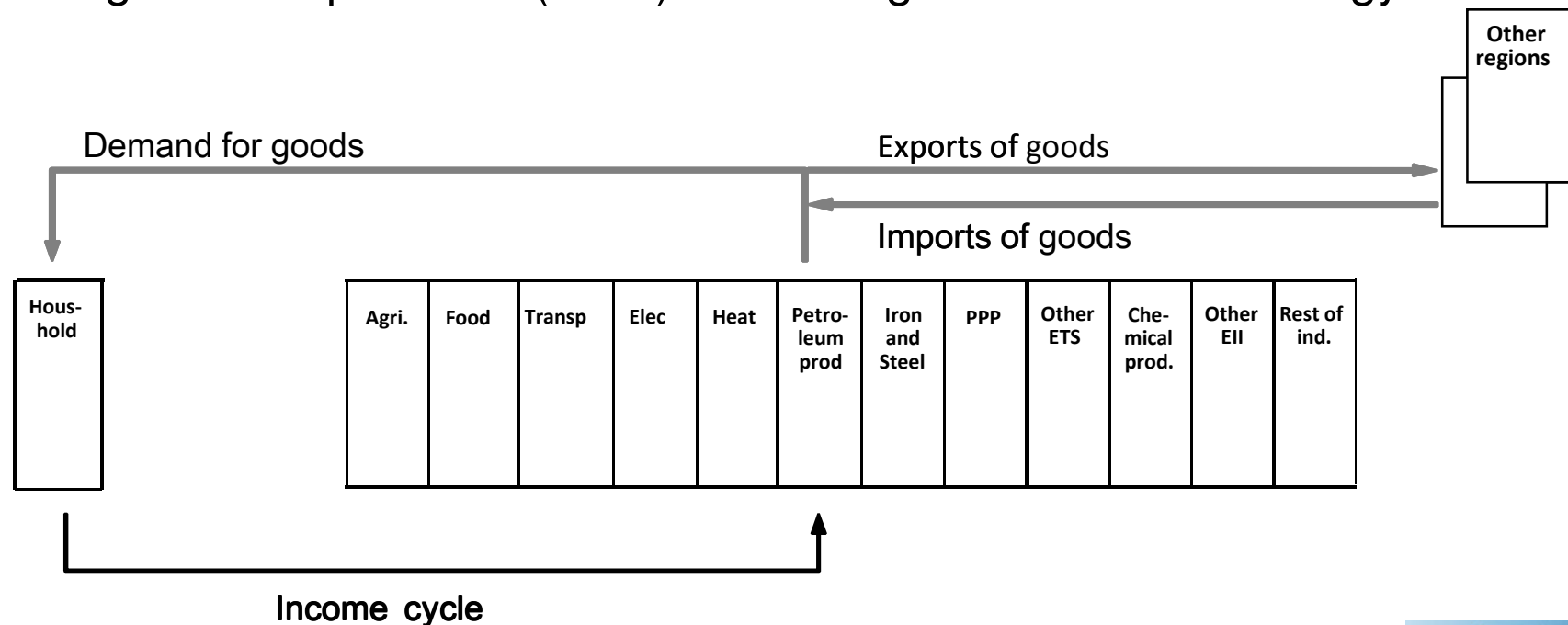
References

2

# PACE

## Model Structure

- Policy Assessment based on Computable Equilibrium
- PACE is an established multi-region, multi-sector computable general equilibrium (CGE) model of global trade and energy use.



- PACE aims at replicating the global production and distribution of commodities.

## 2

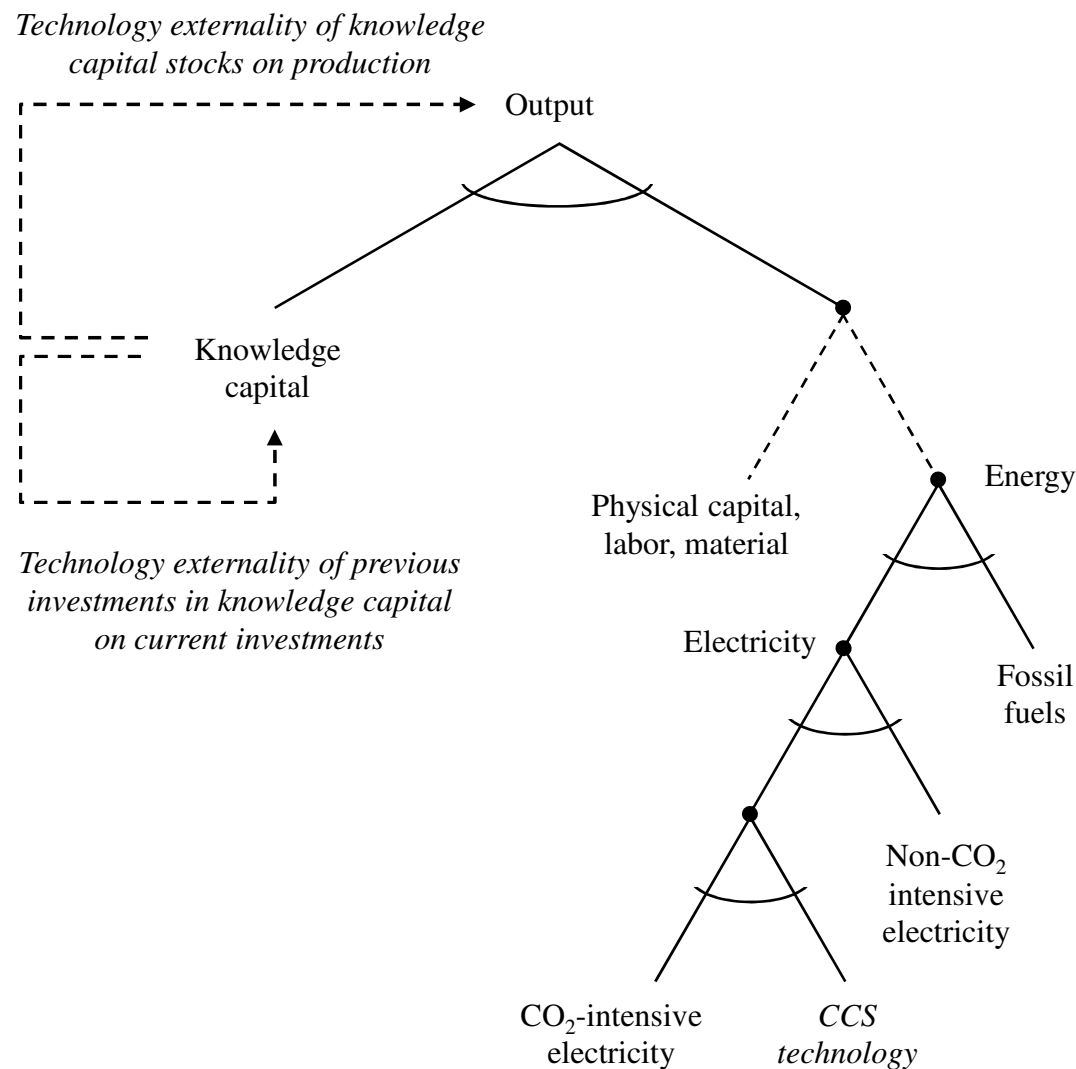
**PACE****Implementation**

- Model is formulated as a mixed complementarity problem (MCP) in GAMS and is written using the MPSGE syntax (Rutherford, 1999). PACE is solved using the solver PATH (Dirkse and Ferris, 1995).
- Model builds on the GTAP7 database (Badri and Walmsley, 2008) and is completed with data from other sources if necessary (e.g. energy data). It differentiates up to ~60 regions and ~80 sectors.
- PACE is designed as a core model with a modular structure, tailored to specific questions. E.g. problem-specific extensions include imperfectly competitive markets, induced technological change, bottom-up representation of electricity production, etc..

2

# PACE - Problem-Specific Extensions

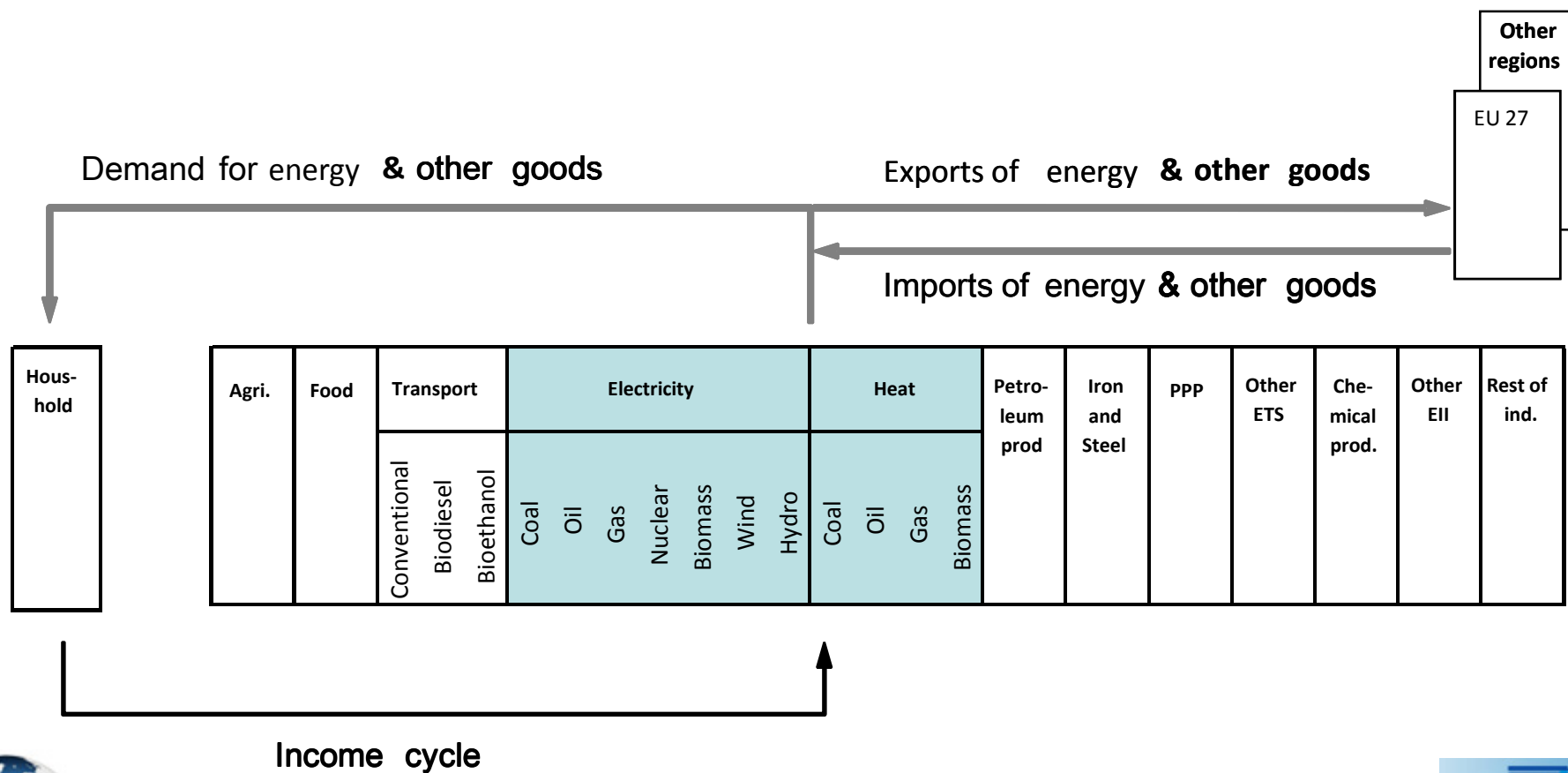
## Induced Technological Change



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# PACE - Problem-Specific Extensions

## Bottom-up Representation of Energy Production



## 2

## PACE – Applications

Different setups of PACE have been used for various applications.

- Climate Policy: Böhringer, C, Löschel, A. and T. F. Rutherford (2007), Decomposing Integrated Assessment of Climate Change, *Journal of Economic Dynamics and Control* 31 (2), 683-702.
- Transport Policy: Mennel, T. and S. Jokisch (forthcoming), Hydrogen in Passenger Transport, *Transport Reviews*.
- Energy Policy: Böhringer, C. and A. Löschel (2006), Promoting Renewable Energy in Europe – A Hybrid CGE Approach, *The Energy Journal*, „Hybrid Modelling: New Answers to Old Challenges”, 123 – 138, 2006.
- Induced TC: Otto, V.M., Löschel, A. and R. Dellink (2007), Energy Biased Technical Change: A CGE Analysis, *Resource and Energy Economics* 29 (2), 137-158.
- Labor Markets: Böhringer, C., Boeters, S. and M. Feil (2005), Taxation and Unemployment: An Applied General Equilibrium Approach for Germany, *Economic Modelling* 22 (1), 81-108.



## Agenda

1

Introduction

2

PACE

3

**Research Outline for D 9.8**

4

References

## 3

## Research Outline for D 9.8

### Part 1 – Policy Assessment

- Run a policy assessment with PACE using the new WIOD data instead of the GTAP data the model usually builds on.
- Idea:           What are the implications of regulating international shipping emissions?
- The International Maritime Organization (IMO) and the EU, are currently discussing various instruments aiming at the reduction of CO<sub>2</sub> emissions of international shipping, in particular market based mechanisms.
- We would like to evaluate the impact of:
  - a maritime carbon tax
  - a maritime emission trading scheme
  - emission standards
- Thereby differentiating between regional and global schemes



## 3

## Research Outline for D 9.8

### Part 1 – Policy Assessment

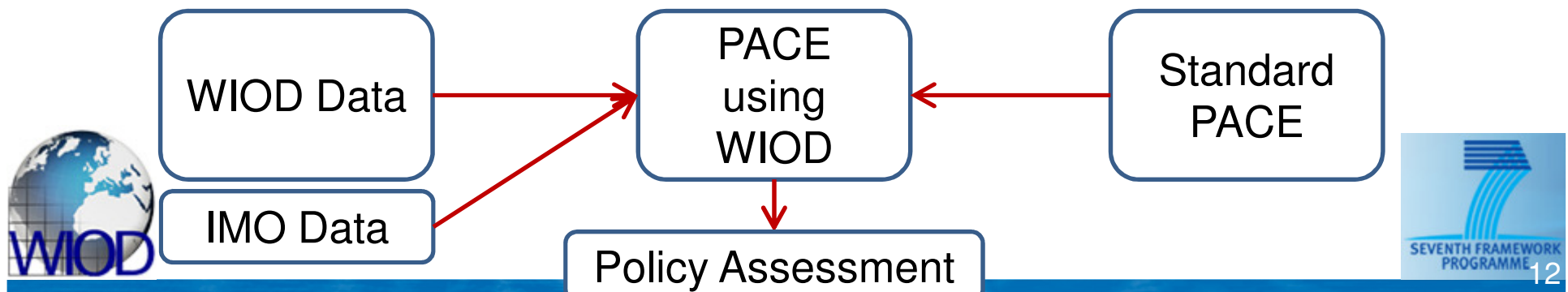
- Adapt WIOD data for the usage in PACE

The WIOD data set feature some elements or level a of detail the standard PACE model is not equipped for (e.g. intermediate flows). Thus part of the WIOD data must be consolidated.

- Adapt PACE so that WIOD data can be implemented

WIOD lacks some of the information, required by PACE e.g. parts of PACE the bottom-up replication of the energy sector must be given up.

- Use IMO data on shipping to differentiate between inland navigation and maritime shipping.



## 3

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### Part 1 – Policy Assessment

- BUT...
  - International transport margins are vital for this analysis, but so far WIOD information is still very preliminary.
  - So far WIOD features no information on CO<sub>2</sub> emissions from ROW.
  - Due to the preliminary status of the data, at present also our research agenda with respect to the policy application is to some extent still work in progress.
  
- Alternatives:
  - Evaluation of other forms of CO<sub>2</sub> regulation or pledges within the global climate negotiations.
  - Environmentally “justified” tariffs



## 3

## Research Outline for D 9.8

### Part 2 – Validation Analysis

- CGE models are frequently criticized due to their poor statistical basis, in particular with respect to the one-point benchmark calibration and their reliance to conglomerated data. (e.g. Jorgenson, 1984; Mc Kitrick, 1998).
- This is a vital discussion as it puts into question the credibility of results generated by CGE models and weakens in particular policy makers confidence in CGE analysis.
- To counter this critique model validation has emerged as an important tool to test model performance.

## 3

## Research Outline for D 9.8

### Part 2 – Validation Analysis

Model validation in the literature:

- Kehoe et al. (1995) contrast the results of a model constructed to predict the impact of a fiscal reform to the changes that have actually taken using ex post data. They conclude that the model performed well in computing changes in relative prices and predicting the allocation of resources. They see no need in adjusting any specifications of the model.
- Kehoe (2003) assesses the performances of three GE models that have been employed to determine the impact of NAFTA, also using historical data. According to him all three models fail to deliver good projections. He relates this to an insufficient accounting of productivity changes
- Other work by for instance by Beckman and Hertel (2010) or Valenzuela et al. (2007)

→ This makes a strong case for the need of model validation.

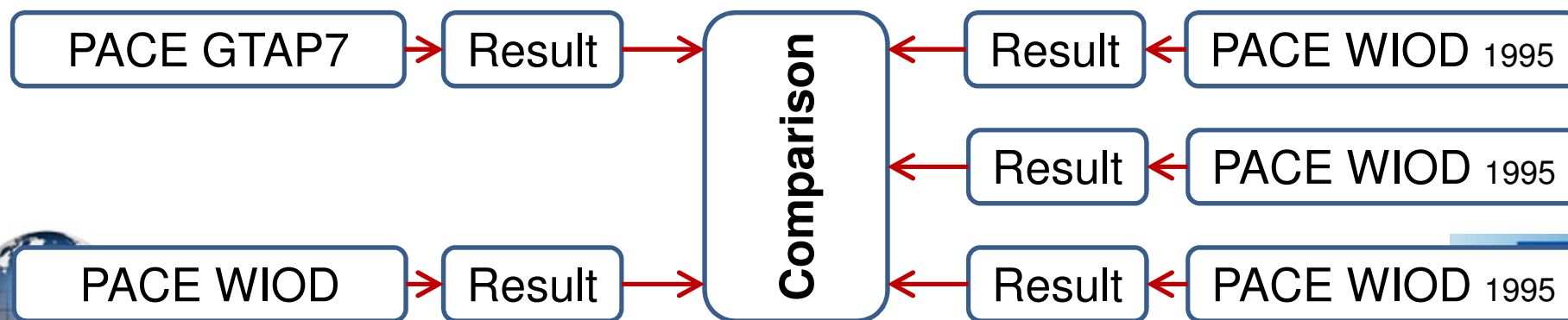


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## Research Outline for D 9.8

### Part 2 – Validation Analysis

- To our knowledge so far all major papers dealing with model validation in the context of general equilibrium models have employed historical data to test model performance.
- WIOD allows us to enlarge the scope of validation and we make use of two new approaches to validation.
  1. Validation using different datasets.
  2. Validation using different benchmark years



## 3

## Research Outline for D 9.8

### Part 2 – Validation Analysis

Benefits of the new approaches to validation:

- No comparison to fragmented data.
  - Allows to truly investigate potential deviations.
  - Comprehensive validation and not just partial aspects.
- No need for historical data.
  - Validation can be performed instantly.

## 3

## Research Outline for D 9.8

### The Way Ahead

1. Identify policy application.
2. Adapt PACE to WIOD data where necessary.
3. Conduct policy assessment.
4. Perform model validation...
  1. ... on the basis of two databases.
  2. ... on the basis of different benchmark years.

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