

# *EUSUSTEL*

*European Sustainable Electricity;  
Comprehensive Analysis of Future European Demand and Generation of  
European Electricity and its Security of Supply*

## *Work Package 5.1 - Static Cost Calculations*

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# Work Package 5

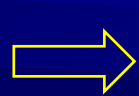
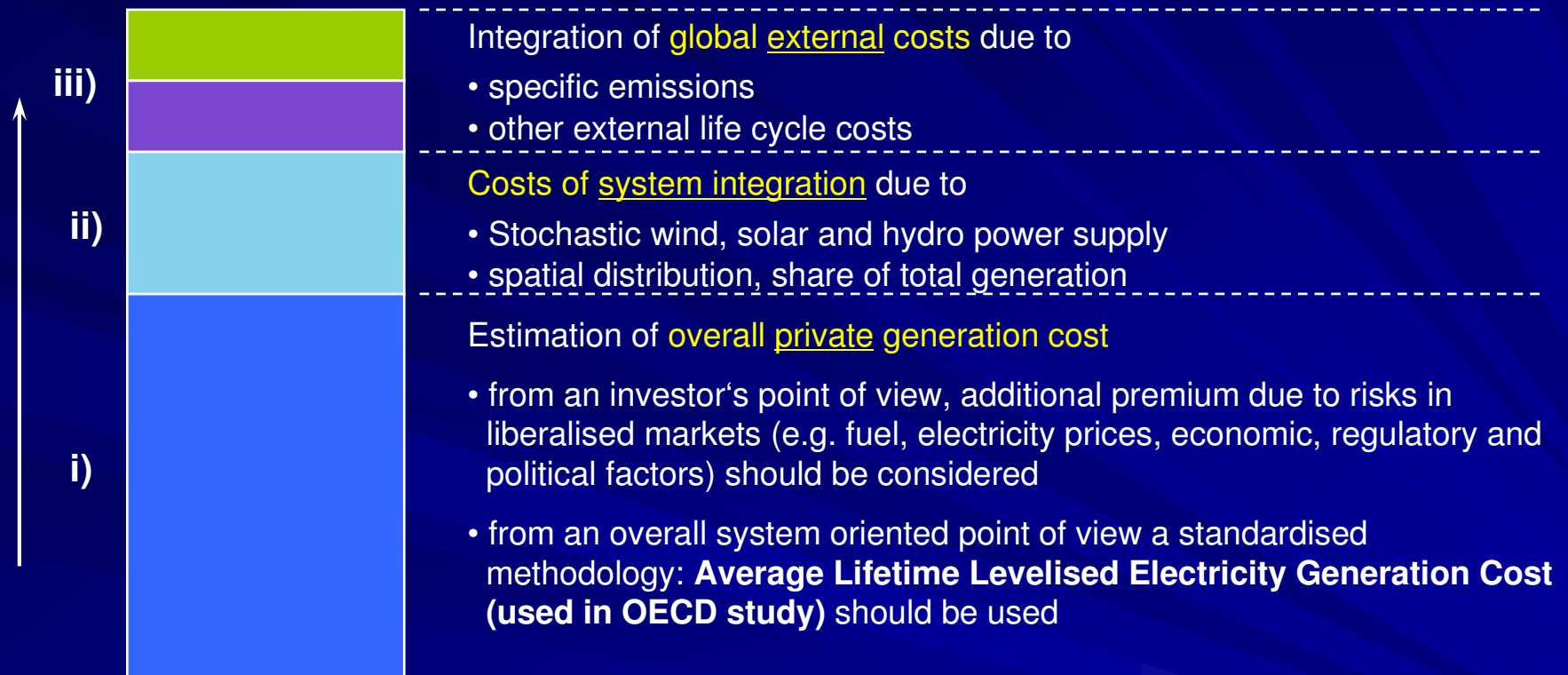
## ■ Objective

- Determine the total social cost for electricity generation
  - Static calculation
  - Taking into account system interactions
- Run scenarios to determine the 'most optimal solution' for electricity provision in the EU

# Description of Work Package 5.1

- Work Package 5.1
  - Determination of the overall **static social cost** for electricity
    - Subtask 5.1.1
      - Summarize private cost for generation technologies
        - *For each generic electricity supply technology*
        - *For the years 2005, 2010, 2020 and 2030*
        - *Based on input data provided in WP 3*
        - *For at least two different fuel price projections*
    - Subtask 5.1.2
      - Considerations on 'shadow costs' such as back-up costs, risk premium...
    - Subtask 5.1.3
      - Identification of differences in CO<sub>2</sub> emissions due to electricity generation
        - Depending on the different generation systems in the EU-25 countries
    - Subtask 5.1.4
      - Determination of global external costs
- Work Package 5.2
  - Comparison and evaluation of simulation models & codes and existing scenarios for electricity generation
- Work Package 5.3
  - Performing and interpretation of four (contrasting) scenarios

# Static Social Cost



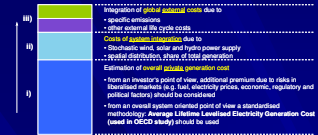
*For determination of the overall static cost, input is needed from WP3 „Electricity generation technologies and system integration“*

# Subtask 5.1.1 – Private Generation Cost

## Private Cost Calculation – Methodology

### Based on OECD study

- *Projected Costs of generating Electricity – Update 2005*
- Average Lifetime Levelised Electricity Generation Cost  $\bar{p}$ 
  - Solve for the price that makes costs equal to revenue over the lifetime of the project

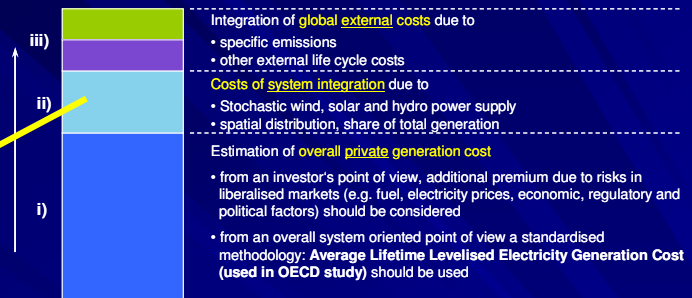


$$\sum_{t=0}^T \frac{\bar{p} \times E_t}{(1+r)^t} - \sum_{t=0}^T \frac{[I_t + M_t + F_t]}{(1+r)^t} = 0$$

$$\bar{p} = \frac{\sum_{t=0}^T \frac{[I_t + M_t + F_t]}{(1+r)^t}}{\sum_{t=0}^T \frac{[E_t]}{(1+r)^t}}$$

$I_t$  = Investment expenditures in the year t  
 $M_t$  = Operations and maintenance expenditures in the year t  
 $F_t$  = Fuel expenditures in the year t  
 $E_t$  = Electricity generation in the year t  
 $r$  = Discount rate

# Subtask 5.1.2 – System Integration Costs



ii)

Costs of system integration due to

- stochastic wind, solar and hydro power supply
- existing electricity generation system,
- the spatial distribution of wind and hydro resources
- and the share of wind, solar and hydro of total generation

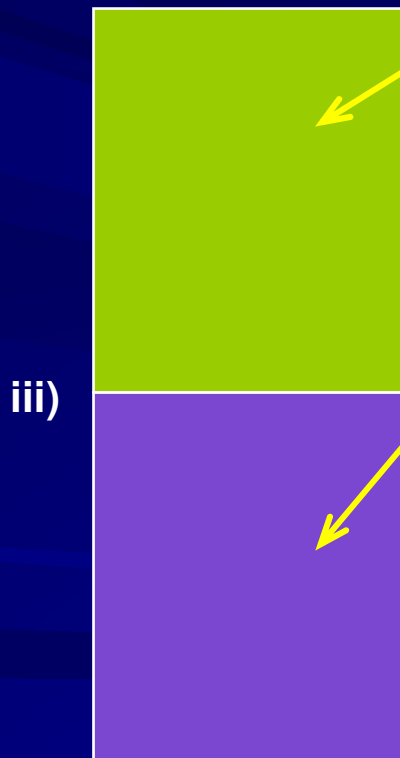
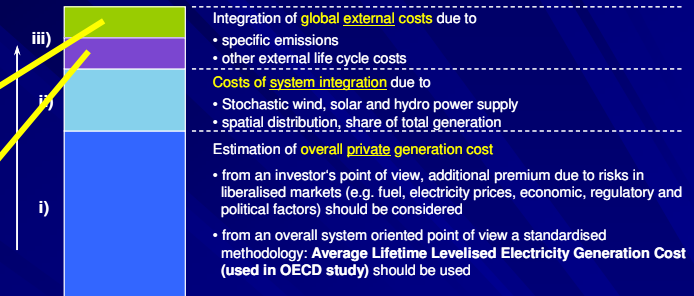
⇒ *Representative values should be based on WP 3.4*

# *Subtask 5.1.2 – System Integration Costs*

- System integration cost
  - Different types of costs/benefits
    - Capacity credits
    - Ancillary services
    - Balancing
    - Grid expansion
    - System stability
    - Cross border flows
  - See report of Work Package 3.4
  - Other relevant literature
    - Nabe, C., Kennedy, S. , ETSO, Czisch, G and Ernst, B, Ostergaard, P A, Lund, H



# Subtask 5.1.4 – External Costs



## Calculation of **direct generation related externalities**

- for each technology
- based on emission coefficients [t emission/kWh]
- based on cost per unit of emission [€/t emission]

## Calculation of **other external life cycle investment and operation costs**

- for each technology and its improvement over time
- based on EU electricity generation mix
- and projected changes in generation mix to 2030



## *Subtask 5.1.3 – Differences In CO<sub>2</sub> Emissions*

- Idea
  - Provide information on CO<sub>2</sub> emissions related to electricity generation for each country
- Essentially not a part of the overall static social cost calculations
  - Static cost calculations are technology oriented, not country-oriented
- Evaluation will be based e.g. on the country reports of WP 1

# *Reporting*

- Work Package finalized by the end of March 2006

