



EU SUSTAINABLE ENERGY WEEK

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How to assess employment
impacts of RE deployment?

Outcome of the IEA-RETD
project "EID-Employ"

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HOW TO ASSESS EMPLOYMENT IMPACTS OF RE DEPLOYMENT

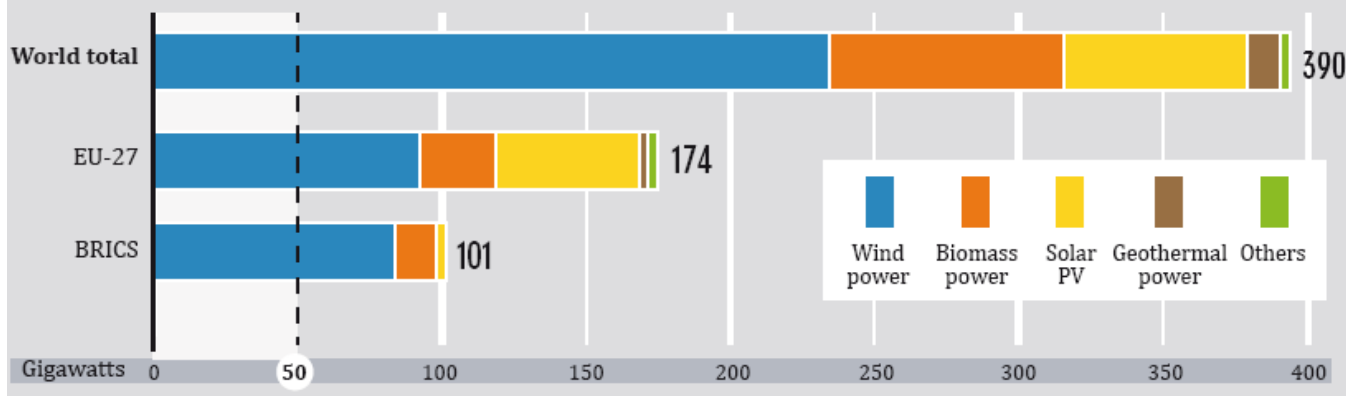


Background

- Tremendous growth of RE capacities worldwide:
 - PV: 74% in 2011 (GSR, REN21 2012)
 - CSP: 35% in 2011 (dito)
 - Wind: 20% in 2011 and 26% between 2006 und 2011 (dito)

- RE power capacities (source: GSR, REN21 2012):

FIGURE 4. RENEWABLE POWER CAPACITIES¹, EU 27, BRICS, AND TOP SEVEN COUNTRIES, 2011



- China 70 GW, USA 68 GW, Germany 61 GW;

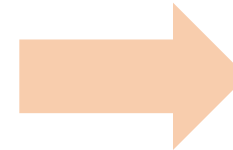
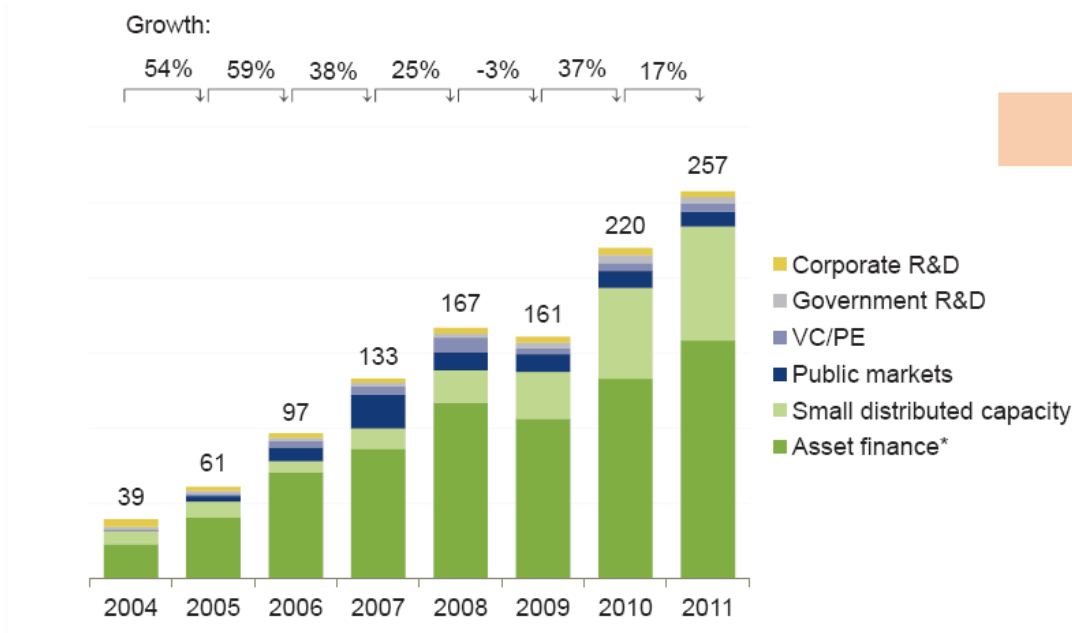
- about 37% of new installed power capacity is from non-hydro-RE in 2011

1 = excl. hydropower; incl. hydropower: 1360 GW



Background

- Investments in RE* in billion \$ (from: Global Trends in RE Investments 2012, UNEP & Frankfurt School 2012):
*including small hydropower



What are the economic implications of investments in or deployment of RE?

*Asset finance volume adjusts for re-invested equity. Total values include estimates for undisclosed deals.

Source: Bloomberg New Energy Finance



Background



To answer this question the IEA-RETD initiated and funded a project:

- The Economic and Industrial Development (EID)-Employ project
 - provide a better understanding of key parameters and mechanisms that determine the contribution of renewable energy to employment;
 - review of employment impact studies and elaboration of guidelines to assess employment impacts. This includes the identification of data sources and other inputs;
 - assess gross employment of RETD countries where data is available by applying the guidelines and document the results of the project via a publishable brochure
- The IEA-RETD's member state countries contributed to data collection
- for further information on the EID-Employ and the IEA-RETD see:
 - <http://iea-retd.org/archives/ongoing/employ>
 - <http://iea-retd.org/>



Overview on different types of employment studies,
Barbara Breitschopf Fh-ISI

HOW TO ASSESS EMPLOYMENT IMPACTS OF RE DEPLOYMENT

Steps and elements in an impact assessment study: the functional chain

Basis of activities are the life cycle phases of RE generation technologies that are broken down into economic activities:

1

activities in RE
(and CE)
technologies

R&D, manufacturing, construction, installation, operation and maintenance, fuel supply, ex/imports, for RE technologies as well as avoided activities in conventional energy (CE)

2

impulses (from
domestic and
foreign
activities

expenditures for investment, O&M, fuel supply and other services; income, cost or price impulse, trade, ...

3

positive &
negative
impact
mechanisms

direct , indirect
and induced
effects

4

impacts

Δ employment



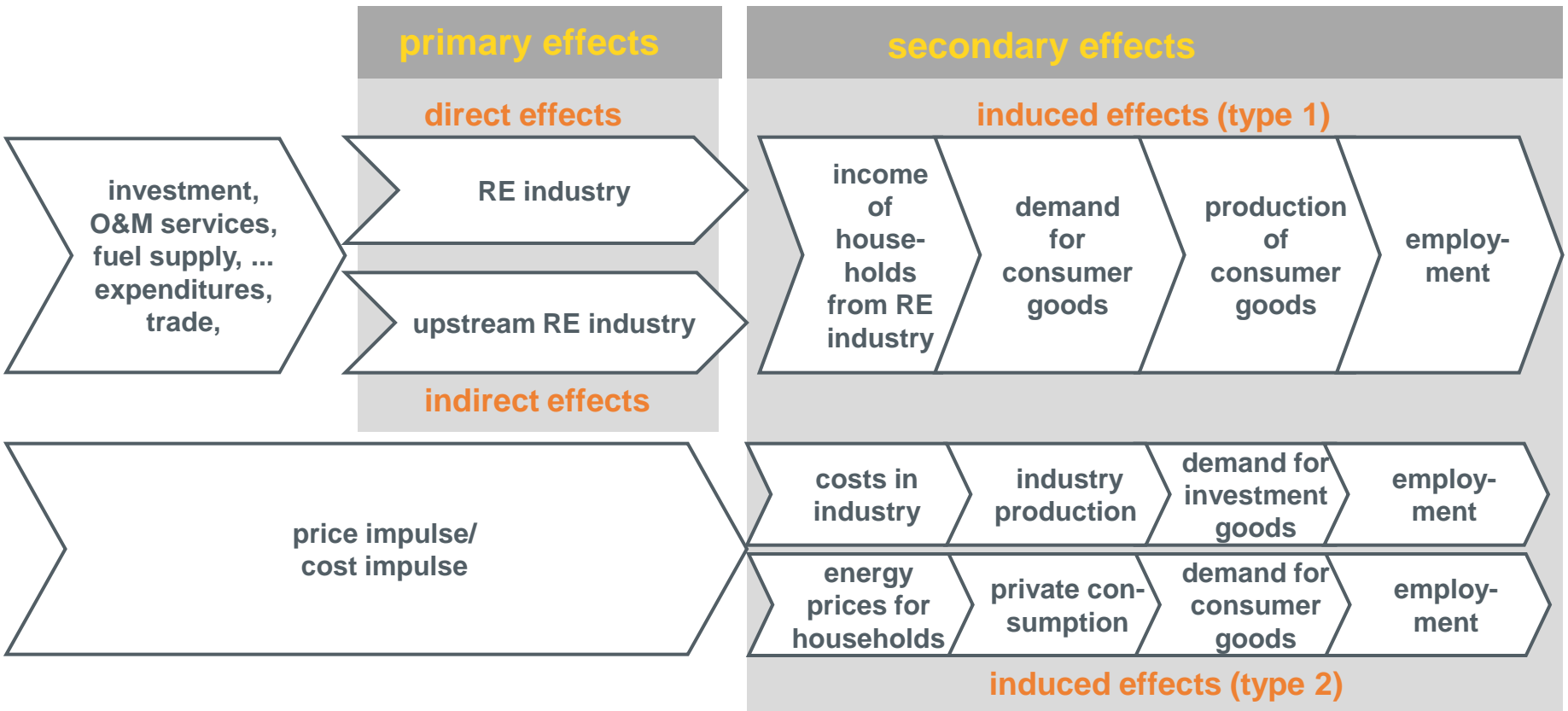
The functional chain

- activities generate economic impulses in form of expenditures for investment, fuel supply, O&M, other services and trade
- further impulses come from electricity prices and income generated in the (RE) industry
- in addition, there are also decreased impulses from the CE industry
- impulses are translated into an economic impact via impact mechanisms that lead to different economic effects
- effects can be
 - direct (within the RE industry)
 - indirect (in the upstream industry of the RE industry)
 - induced via prices and income on sectors beyond the RE industry and its upstream industries
- effects add up to an impact

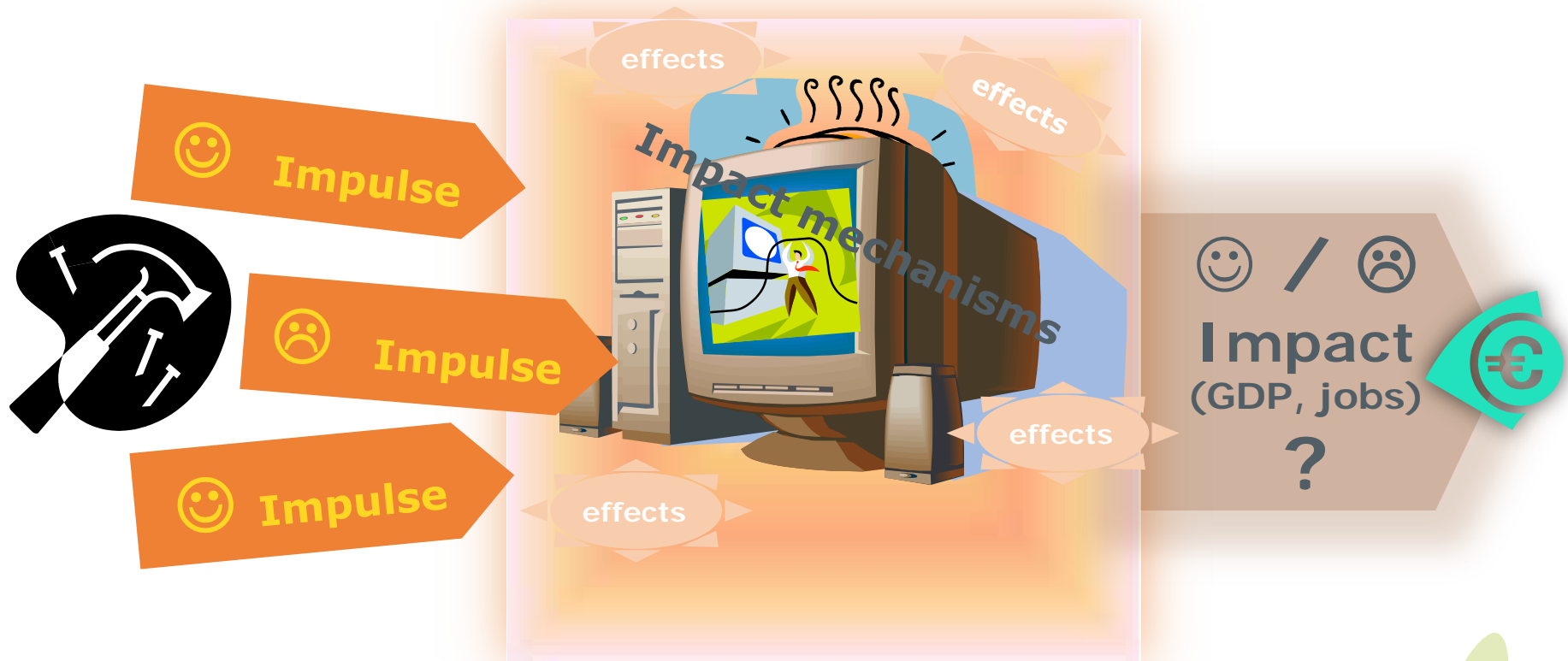


impulses

positive & negative impact mechanisms



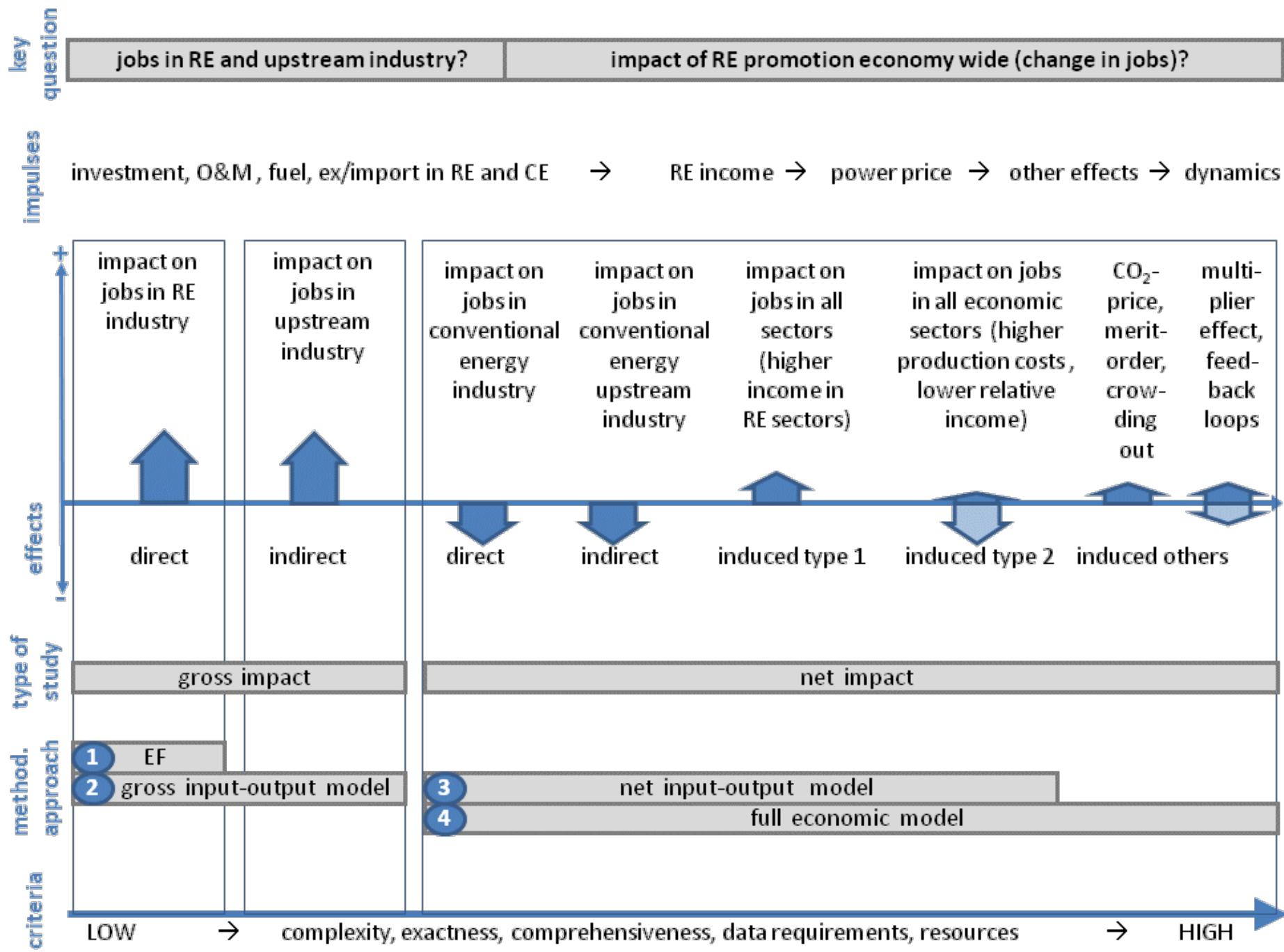
How it should (not) work



Type of impact assessments:

- impact on **RE industry**: assessment of jobs in RE industry = gross impact study
 - provides an idea about relevance and structure (technologies) of this industry,
- impact **economy wide**: assessment of changes in economy wide jobs (all economic sectors) by RE deployment = net impact study
 - requires a comparison between two situations: with RE (advanced RE deployment scenario) and without RE deployment (baseline scenario)
 - provides an idea about the overall economic impact including also negative effects of RE deployment





Conclusions

- distinguish between the type of question to be answered:
 - RE industry jobs
 - economy wide jobs
- decide on the methodological approaches
 - gross impact:
 - employment factor approach
 - gross input-output approach
 - net impact:
 - net input-output approach
 - full economic model (also best suited to assess future impacts)
- take into account your available budget and knowledge:
 - low budget/knowledge → net input-output approach or gross impact study



Gross employment in the RE industry: Guidelines
and results for selected IEA countries,
Carsten Nathani, Rütter+Partner

EMPLOYMENT IMPACTS OF RE DEPLOYMENT



Overview

- Objective of gross employment studies
- System boundaries of the RE industry
- Employment factor approach
- Gross IO modelling approach
- Discussion of approaches
- Country results



Objective of gross employment studies

- To estimate employment in a country that can be related to renewable energy use (“RE industry”)
- To answer questions like e.g.:
 - Which part of total employment in a country is related to RE use?
 - Relevance of domestic RE use vs. RE technology exports for employment?
 - Relevance of various RE technologies?
 - Relevance of indirect employment in industries supplying the RE industry

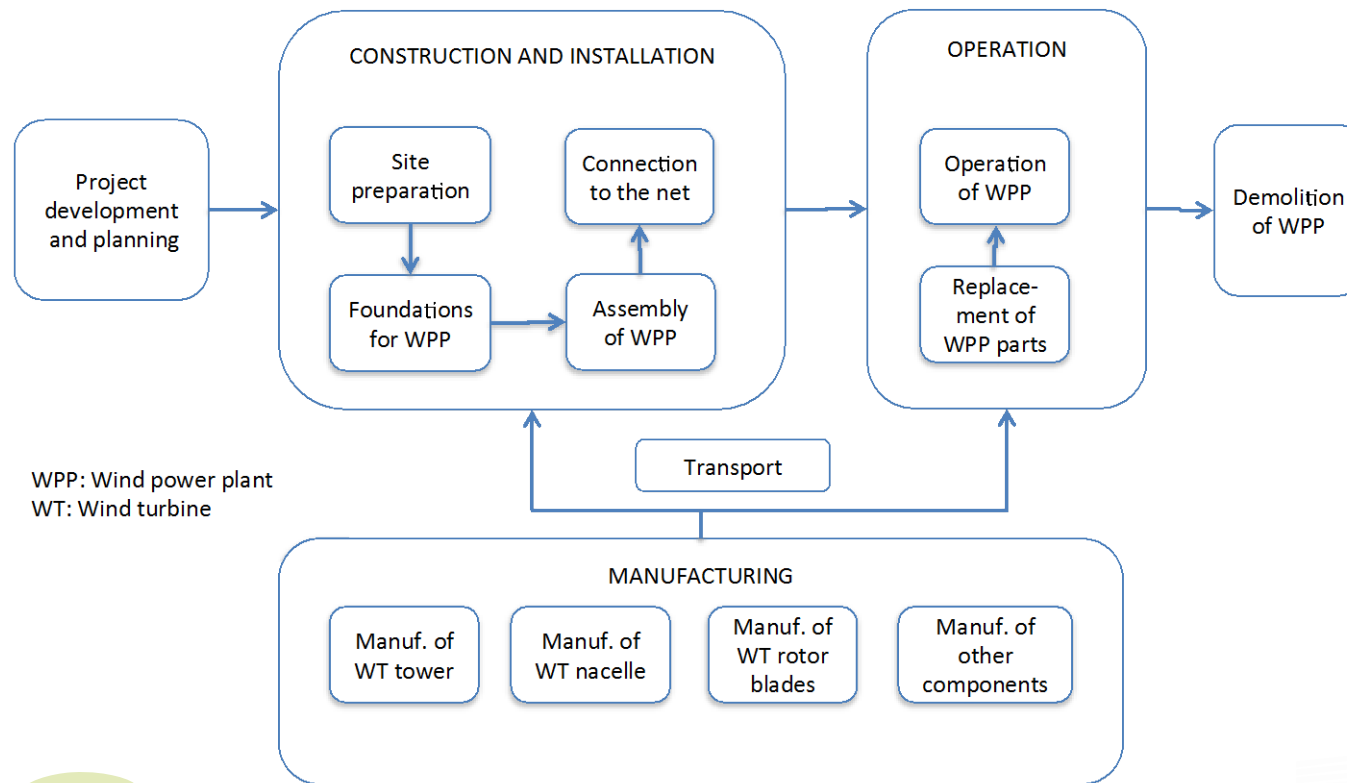


System boundaries of the renewable energy industry

- RE industry: cross-sectional industry that comprises all activities related to RE use
- All life cycle phases of a RE facility:
 - Manufacturing, construction and installation (incl. reinvestment)
 - Operation and maintenance
 - Demolition
- Breakdown of life cycle phases into economic activities (important for capturing imports and exports)



System boundaries of the RE industry: Example wind



1. Employment factor approach: methodology

- Employment factor: employment needed to perform an activity in the RE facility life cycle (e.g. 2 FTE-years per MW wind power plant installed)
- Calculation steps:
 - Determine system boundaries
 - Determine activity values and employment factors
 - Determine domestic activity level by incorporating imports and exports
 - Calculate direct employment
 - Document methodology and results



1. Employment factor approach: data requirements

- Annual data on installed capacities, net capacity increase (MW), biomass fuel input and power generation (GWh) by technology
- Data on import and export (shares) by activity
- Employment factors by technology and activity

1. Employment factor approach: example wind power plant

Activity	Activity level parameter	Activity value	Domestic share (incl. net exports)	Employment factor	Unit
Project development and planning	Net capacity increase	1,500 MW	100%	0.8	(FTE * a) / MW
Manufacture of WT towers	Net capacity increase	1,500 MW	80%	1.2	(FTE * a) / MW
Manufacture of WT nacelles	Net capacity increase	1,500 MW	110%	1.3	(FTE * a) / MW
Manufacture of WT rotor blades	Net capacity increase	1,500 MW	180%	0.7	(FTE * a) / MW
Construction and installation of WPP	Net capacity increase	1,500 MW	100%	3.0	(FTE * a) / MW
Operation of WPP	Total installed capacity	10'000 MW	100%	0.2	FTE / MW

This example shows exemplary employment factors and activity levels for the MCI and the O&M phase of a wind power plant.

Abbreviations:

- WT: Wind turbine
- WPP: Wind power plant
- FTE: Full time equivalent
- a: year
- MCI: Manufacturing, construction and installation



2. Gross IO modelling: methodology

- Combines techno-economic data for RE technologies with economic input-output modelling
- Calculation steps:
 - Determine system boundaries
 - Determine expenditures for RE use, allocate to cost components and industries
 - Calculate domestic output by RE technology and by industry
 - Calculate direct and indirect employment
 - Document methodology and results



2. Gross IO modelling: data requirements

- Annual data on installed capacities, net capacity increase (MW) and power generation (GWh) by technology
- Specific installation, O&M, fuel (and demolition) costs by technology (e.g. EUR/kW or EUR/MWh)
- Cost structures: breakdown of specific costs by cost component / activity
- Allocation of cost components to industries of IOT
- Input-output table (IOT) of a country and sectoral employment data



2. Gross IO modelling approach: example wind power plant

Variable	Unit	Value
Total installed capacity	MW	10,000
Net capacity increase	MW	1,500
Specific installation cost	EUR/MW	1,553
Specific O&M cost	EUR/MW	37
Specific capital cost	EUR/MW	147

This table shows exemplary input data for the calculations



2. Gross IO modelling approach: example wind power plant

This table shows exemplary input data for the calculations

Cost components	Cost shares	Import shares	Export shares	Allocation to industries of IOT
Construction of WPP	100%			
Planning	4%	0%	0%	Business services (74)
Manufacture of WT towers	15%	20%	30%	Man. of metal structures (28)
Manufacture of WT nacelles	37%	20%	100%	Machinery (28)
Manufacture of WT rotor blades	15%	30%	80%	Plastics processing (25)
Transport	4%	0%	0%	Ground transport (60)
Site preparation	3%	0%	0%	Construction works (45)
Foundations of WPP	6%	0%	0%	Construction works (45)
Assembly of WPP	6%	0%	0%	Machinery (28)
Connection to the net	10%	0%	0%	Electrical industry (31)



2. Gross IO modelling approach: example wind power plant

This table shows exemplary results of the calculations

Variable	Unit	Construction of domestic WPP	Operation of domestic WPP	Export	Total
Expenditure	m EUR	2'329	1'834	0	4'163
Domestic output	m EUR	1'982	1'834	1'246	5'062
Direct employment	EP	13'737	3'517	6'689	23'943
Indirect employment	EP	10'820	2'118	6'779	19'718
Total employment	EP	24'557	5'636	13'468	43'661



Discussion: Employment factor approach

- Strengths:
 - Potentially technology-specific, if reliable data available
 - Low-cost approach and easy to use, if employment factors available
 - Good for fast estimates and updates
- Limitations:
 - Reliable sources for country specific employment factors are scarce
 - Exports are difficult to integrate
 - Only direct employment



Discussion: Gross IO modelling

- Strengths:
 - Comprehensive and consistent framework
 - Allows to calculate other economic impacts within the same framework (e.g. value added)
 - Open for integration of results from other sources (e.g. enterprise surveys)
 - Direct and indirect employment
- Limitations:
 - Aggregation bias due to assumption: industries in the IO model are adequate proxies for companies in the RE industry but: detailed technology specific information can be integrated in the framework

Application of gross IO modelling approach to RETD countries

- Aim: to test and demonstrate feasibility of approach
- Input data and results documented in annex to guidelines and excel files
- Simplifying assumptions for some data due to restricted project resources
(esp. on imports and exports of RE technology)



Application of gross IO modelling approach to RETD countries: tentative results

Country	Direct employment	Indirect employment	Total RE related employment	Share of total employment in the country	
	Employed persons	Employed persons	Employed persons	direct employment	direct + indirect employment
Canada	32'000	21'700	53'700	0.2%	0.3%
Denmark	27'200	21'700	48'900	1.0%	1.7%
France	29'800	19'100	48'900	0.1%	0.2%
Germany	149'600	120'700	270'300	0.4%	0.7%
Ireland	2'600	700	3'300	0.1%	0.2%
Japan					
Netherlands	9'200	11'600	20'800	0.1%	0.2%
Norway	10'200	6'200	16'400	0.4%	0.6%
United Kingdom	16'200	11'000	27'200	0.1%	0.1%



Thank you very much for your attention

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IEA-RETD project EID-Employ:

<http://iea-retd.org/archives/ongoing/employ>

