

Methodological Guidelines for Estimating the Employment Impact of using RE Sources in Electricity Generation

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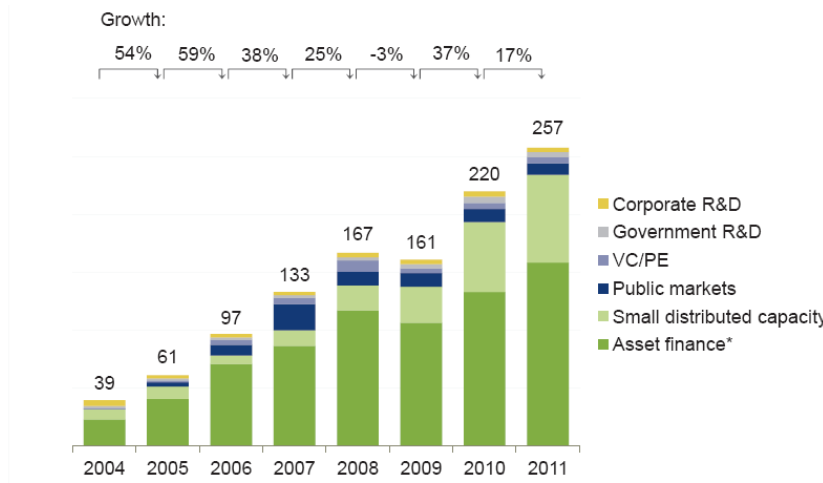
How to assess employment impacts of RE deployment – methodology

Content

- **Background information**
- Principal approach
- Types of impact assessment studies
- Conclusion

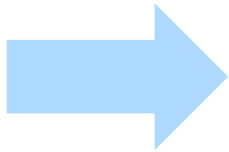
Background

- 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)
 - about 37% of newly installed power capacity is from non-hydro-RE in 2011
- Investments in RE* in billion \$ (from: Global Trends in RE Investments 2012, UNEP & Frankfurt School 2012):



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

Background



Many impact studies have been conducted but with diverging results due to different methodological approaches, system boundaries and assumptions

→the IEA-RETD* initiated and funded a project:

* (Renewable Energy Technology Deployment with its current members Canada, Denmark, France, Germany, Ireland, Japan, Netherlands, Norway, and United Kingdom).

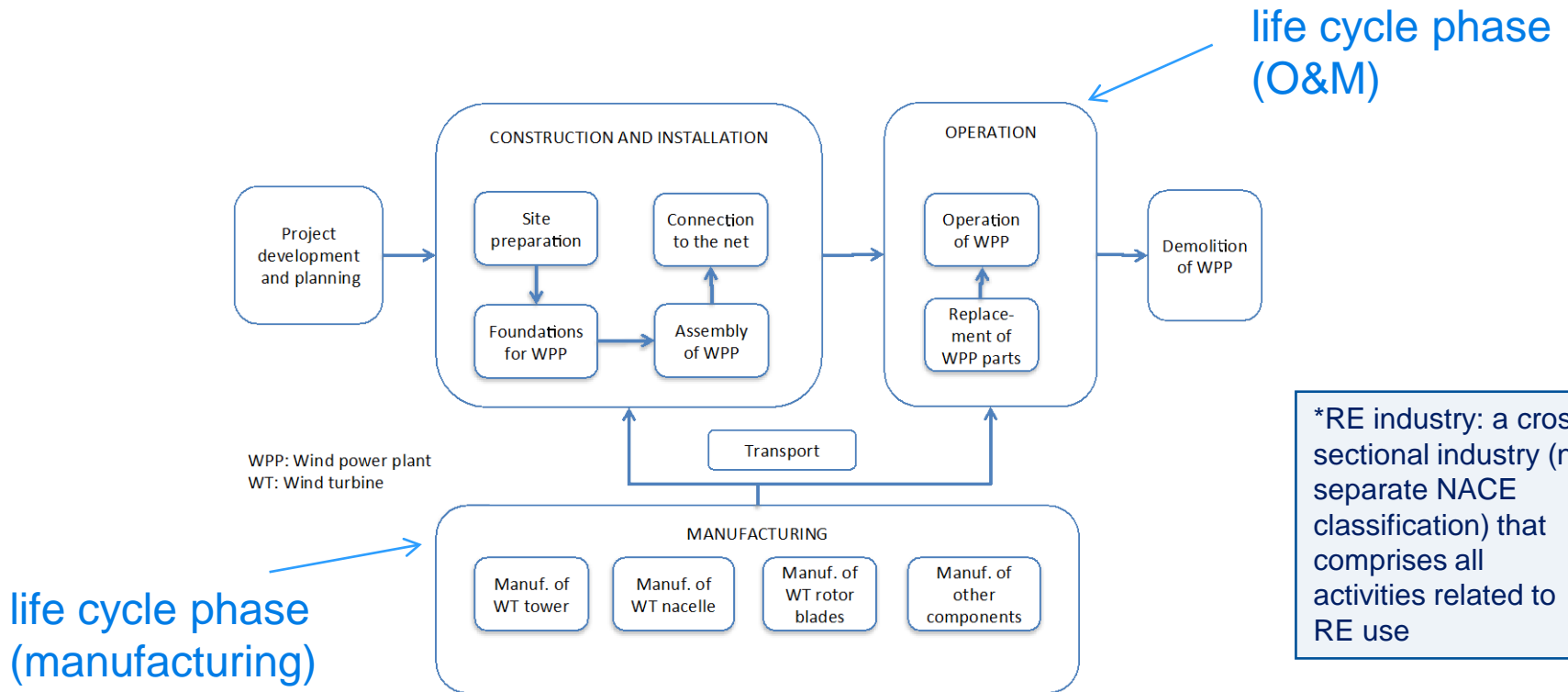
- The Economic and Industrial Development (EID)-Employ project:
 - provide a better understanding of **key parameters and mechanisms** that determine/influence the impacts of RE on employment;
 - **review** employment impact studies and **elaborate guidelines** to assess employment impacts. This includes 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
- for further information on the EID-Employ see:
 - <http://iea-retd.org/archives/ongoing/employ>

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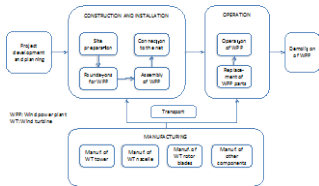
Principal approach: At what we are looking? - define boundaries of the RE industry*

(example wind power plant (WPP))

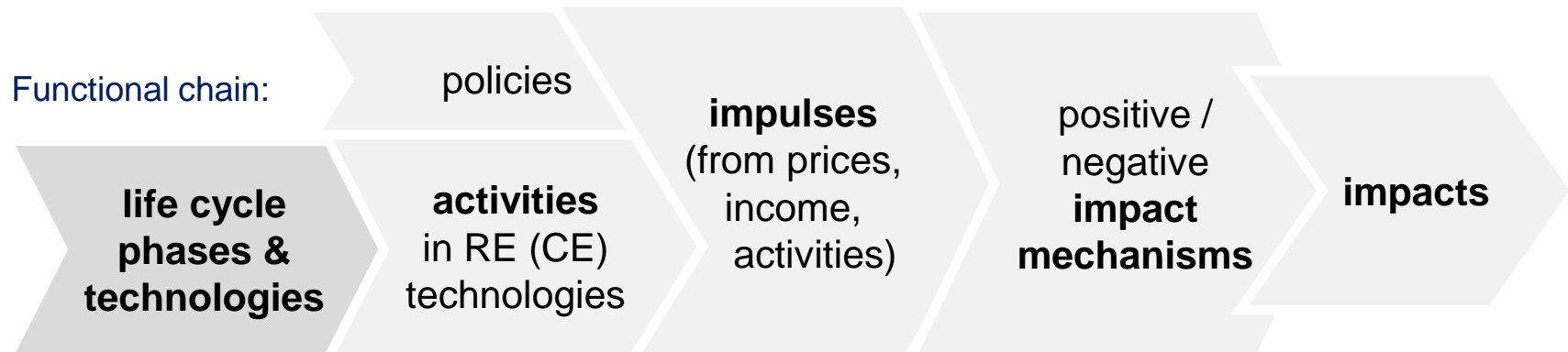


→ the basis of the assessment approaches are the life cycle phases of RE generation technologies

Principal approach: Steps and elements - the functional chain



→ The life cycle of RE generation technologies is broken down into life cycle phases:



Examples:

P&D,
MCI,O&M, fuel
supply,
ex/imports, ...

expenditures
for investment,
O&M, fuel
income from
RE,
prices for
power, ...

direct, indirect
and induced
effects

Δ employment

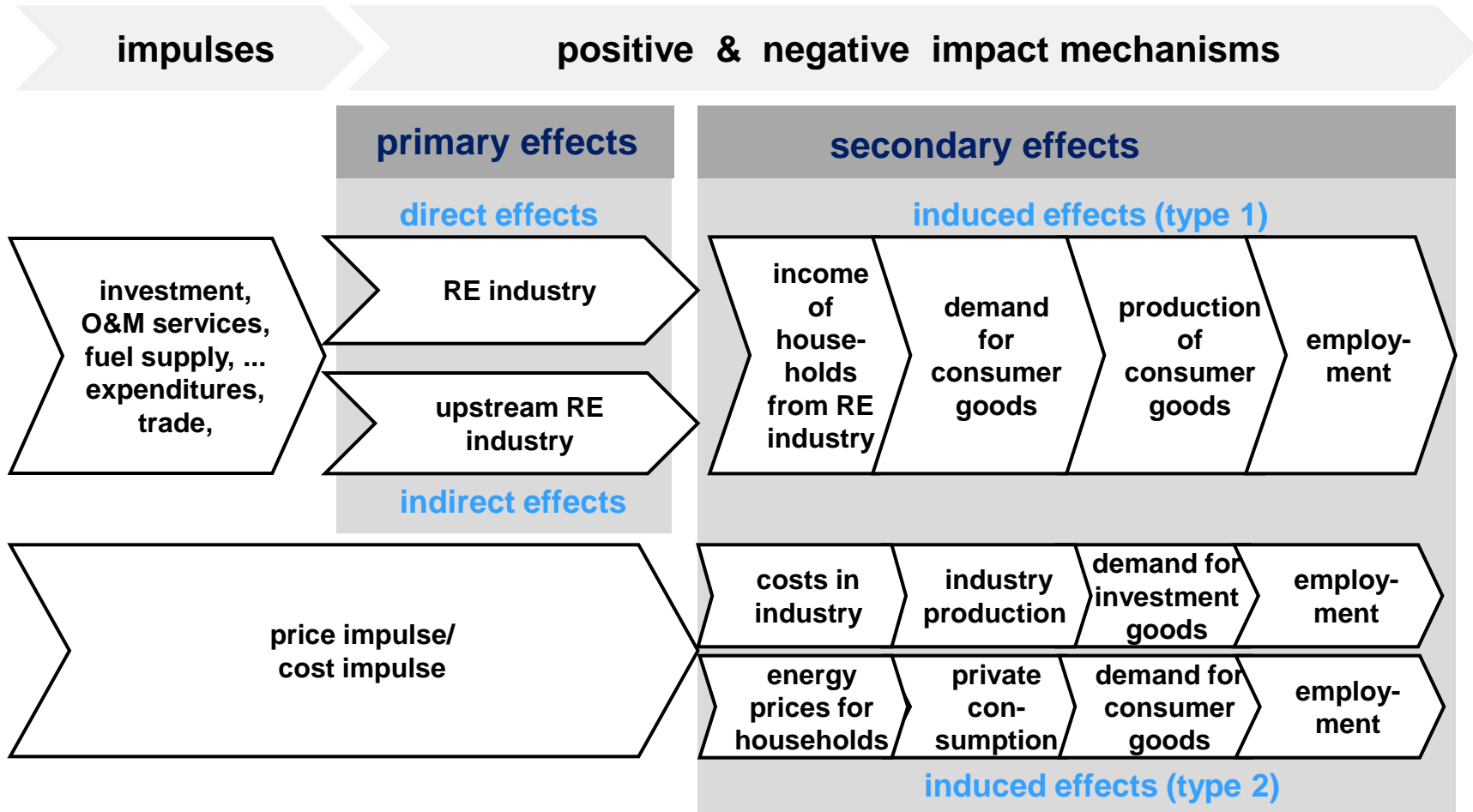
Principal approach: Steps and elements when conducting an impact assessment study

- activities generate economic impulses in form of expenditures for investment, fuel supply, O&M, other services and trade or, alternatively, from generation and capacities (for approaches without a model)
- further impulses could come from electricity prices and income generated in the (RE) industry*
- in addition, there could also be decreased impulses from the CE industry**
- impulses are translated into different economic effects via impact mechanisms
- effects can be
 - direct (within the RE industry*)
 - indirect (in the upstream industry of the RE industry*)
 - induced via prices and income from RE industry on sectors beyond the RE industry and its upstream industries
- effects add up to an impact

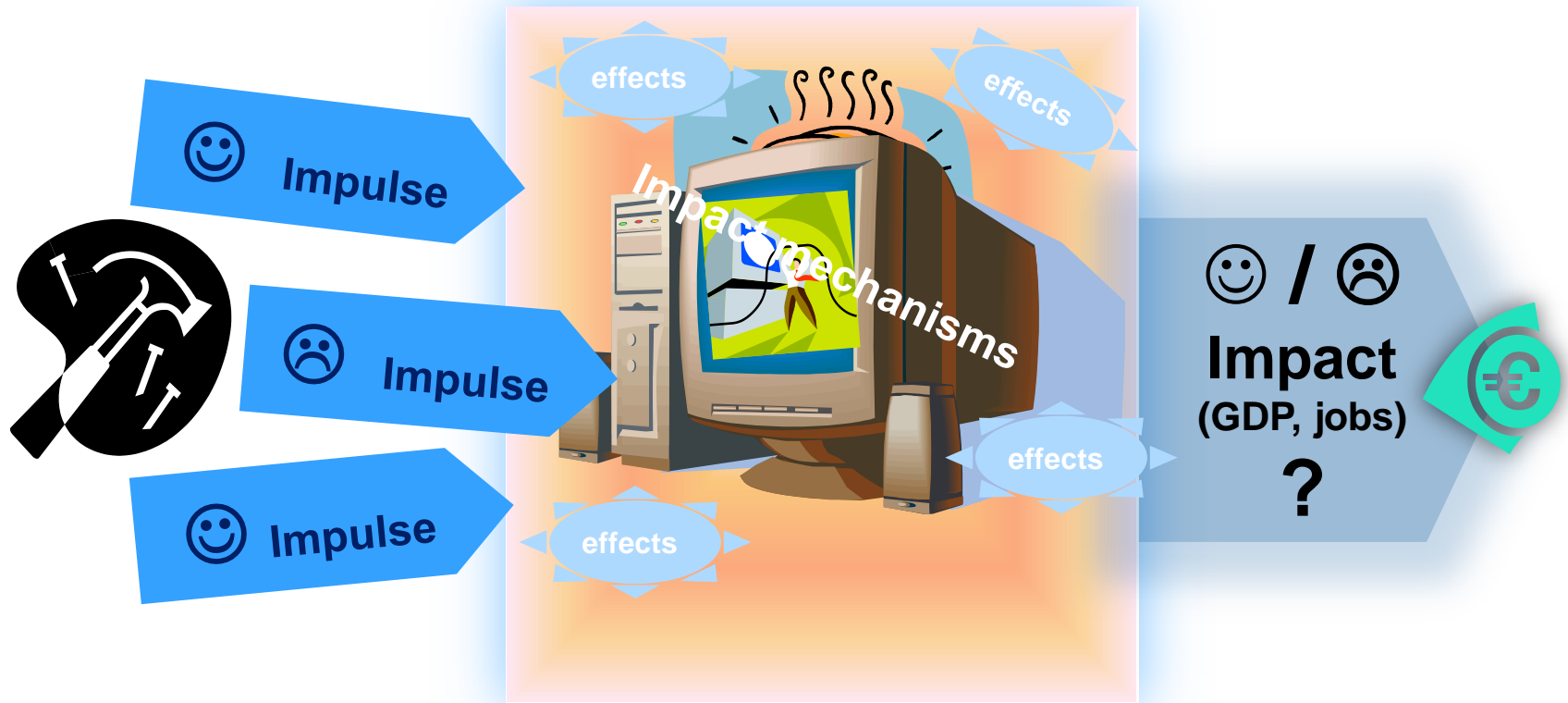
*RE industry: a cross-sectional industry (no separate NACE classification) that comprises all activities related to RE use

** CE industry: cross-sectional industry that comprises all activities related to CE generation

Principal approach: What are direct, indirect and induced effects?



How it should (not) work



→ Based on the effects, we can distinguish between two main types of impact studies

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Type of impact assessment studies:

for policy makers:

- relative labour intensive RE power generation vs CE

- shift to domestic production (value added)

→ **“co-benefit” of RE (part/facet of the whole picture)**



- negative effect of high energy prices

- job losses in CE industry

→ **“net benefit” of RE (whole picture)**



impact assessment studies

RE-industry jobs

- effects: positive, in/direct
- impact: gross

Economy-wide jobs

- effects: positive & negative, in/direct and induced
- impact: net

Type of impact assessment studies (gross)

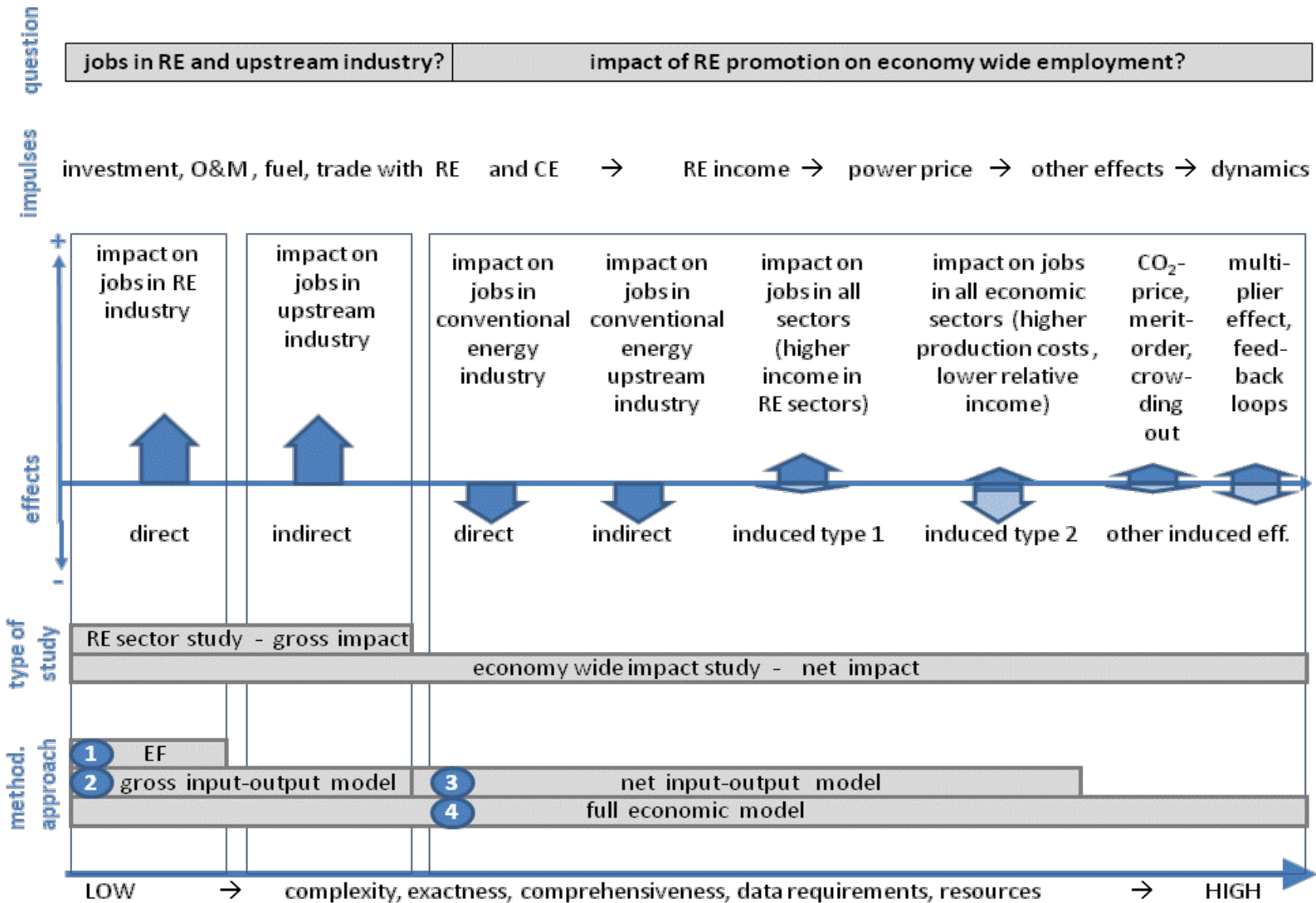
1. Sectoral impact – impact on **RE industry**: assessment of jobs in RE industry = **gross impact study**
 - provides an idea about relevance and structure (technologies) of this industry (RE),
 - the following questions can be answered:
 - Which part of total employment in a country is related to RE 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
 - looks at positive effects of RE deployment

Type of impact assessment studies (net)

2. **economy-wide impact:** assessment of changes in economy wide jobs (all economic sectors) by RE deployment = **net impact study**
 - answers the question: what is the economy wide impact of RE deployment on jobs (change of jobs e.g. in consumer goods industry)
 - takes into account (should) effects at all levels: technology system, micro-level (actors like private and public households, firms or sectors, trade) and macro-economic level
 - includes induced and negative effects of RE deployment → reflects a kind of net benefit of RE deployment (for the entire economy)
 - represents the best approach for an overall cost-benefit assessment (future)

Type of impact assessment studies (net)

- requires a comparison between two situations: with RE (advanced RE deployment scenario) and without RE deployment (baseline scenario); both include domestic and world-wide economic developments as well as technology developments
- impacts on employment depend on assumptions about the following (relevant) issues:
 - fossil energy prices
 - exports
 - technology costs (learning curves), productivity
 - RE deployment status of baseline scenario
 - domestic biomass supply
 - and others ...



Type of impact assessment studies: selected approaches

impact assessment studies

RE-industry jobs

- effects: positive, in/direct
- impact: gross

Economy-wide jobs

- effects: positive & negative; in/direct and induced
- impact: net

EF-approach:

- data: employment factors (EF), capacity and generation
- complexity: low (direct effects)

gross IO-model:

- data: IO-coefficients, cost structures, investments, O&M
- complexity: moderate (direct & indirect effects)

net IO-model:

- data: IO coefficient, cost structures, MCI, O&M, electricity price
- complexity: direct, indirect & induced effects, simple scenarios

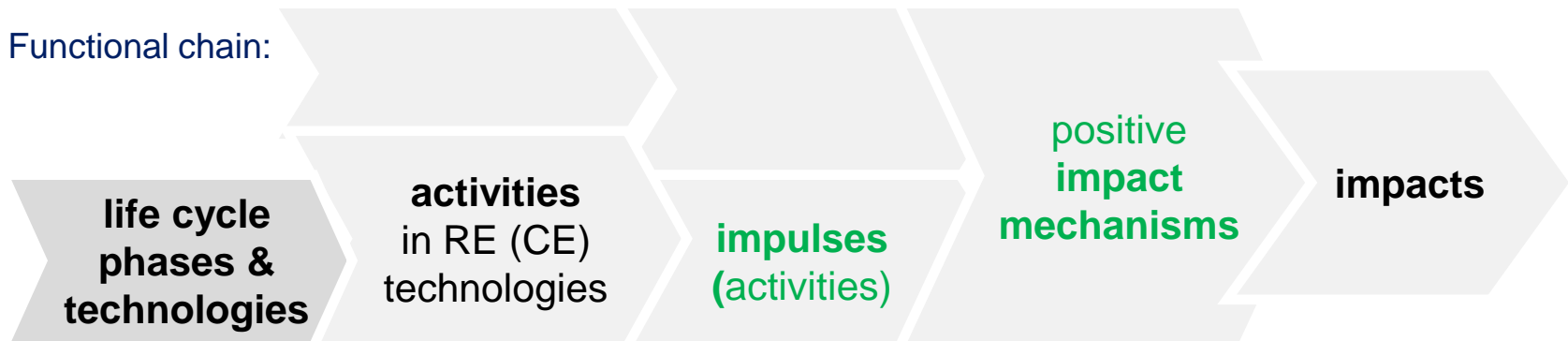
full economic model:

- data:
 - macro-economic
 - energy sector
 - trade
- complexity: direct, indirect & induced effects, scenarios

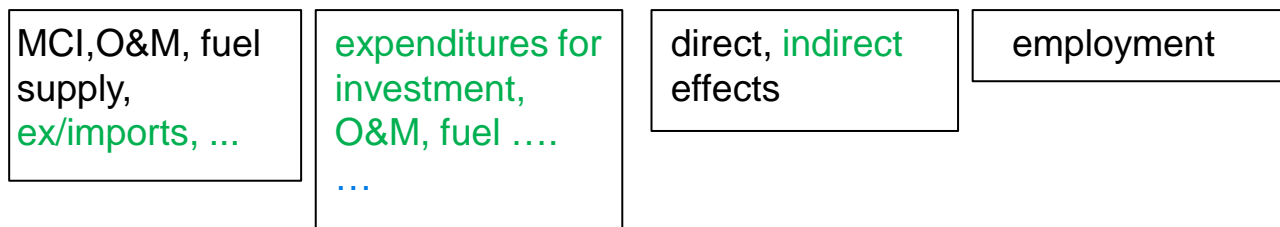
IO: input-output; MCI: manufacturing, construction, installation; O&M: operation and maintenance

Type of impact assessment studies: Employment Factor and gross IO approach

Functional chain:



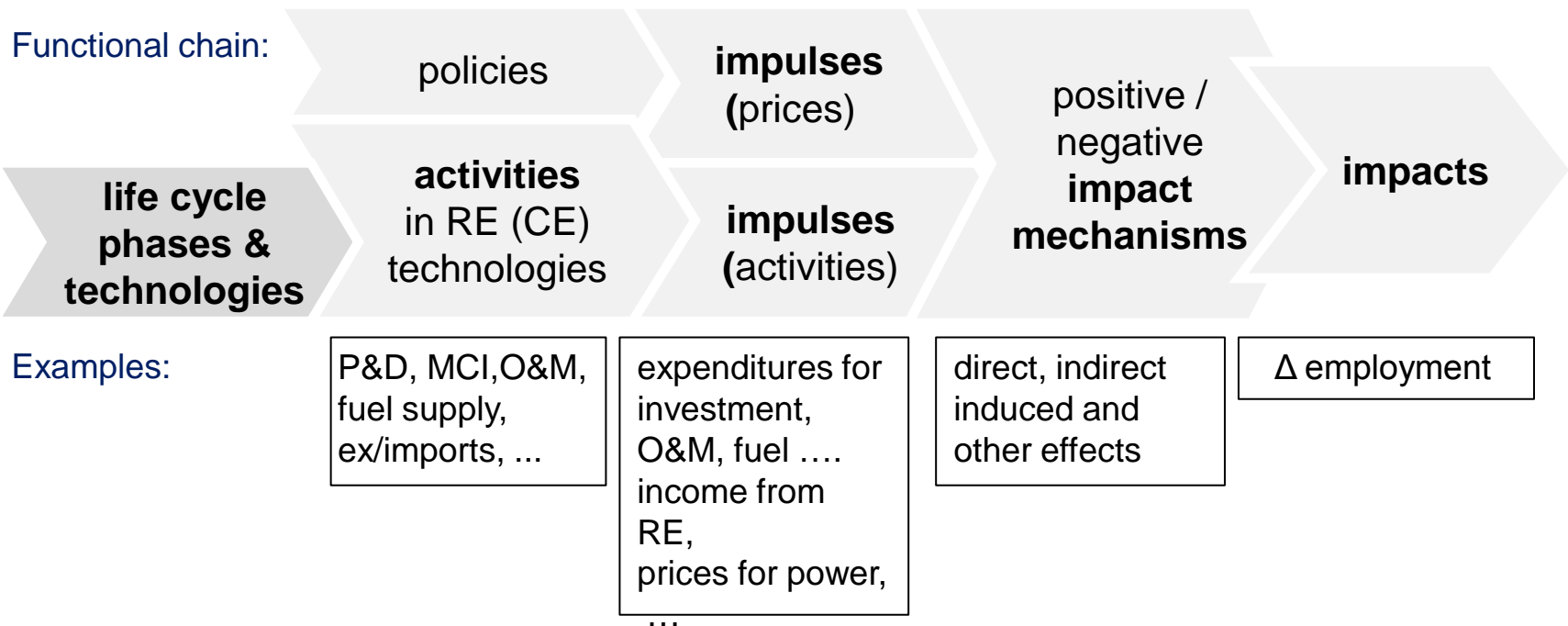
Examples:



Steps:



Type of impact assessment studies: net IO approach and full economic model



Steps:

determine system boundaries	determine activities and technologies	determine expenditures for RE use	assess domestic output by industry	calculate employment	take differences of scenarios	document calculations and results
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Type of impact study: net approaches

Characteristics	Net IO model	Full economic model
Approach	Closed quantity model, closed price model	Systems dynamic based, econometric, GE/CGE,... model
Induced effects (every sector of the economy)	RE income impulse Price impulse: limited to consumption	RE income and price impulses: Other effects: could take into account merit order effect, CO ₂ prices, crowding-out of investments.
Exports; imports	Ex/imports: as a share of sector output or sectoral input.	Ex/imports : as share of sector output or sectoral input, trade module
Time horizon	Present – future (simple assessment)	Future
Scenario development	limited baseline or counterfactual scenario	baseline
Dynamics	Limited	Feedback loops, multiplier and accelerator, (endogenous) technical change.
Price and quantity changes	Limited: Changes in prices or quantity are completely passed through to total output. A change in quantity does not translate into a price change (no “real” interaction).	Dynamic: Price or quantity changes could be modelled as a result of output <u>and</u> price changes. Changes due to merit-order effect or CO ₂ prices can be depicted in the model.
Economic relations	Relation between production, consumption and total output (averages): --> input-output relations between industry and final demand, payment sector (linear-limitational)	Relation between industries, private and public households (average and marginal): --> input-output relations, national accounting, trade, job market, fiscal, climate, energy sector, household consumption, ... policies.

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Conclusion and results for the guidelines (1)

- distinguish between the type of question to be answered:
 - employment in the RE industry
 - sectoral jobs
 - co-benefits (partial picture)
 - simple-moderate approach (not complex)
 - Economy-wide employment impact due to RE promotion
 - total jobs
 - net benefits (whole picture)
 - moderate-complex approach

- take into account your available budget and knowledge:
 - low budget/know-how → gross impact study or net input-output approach

Conclusion and results for the guidelines (2)

- decide on the methodological approaches
 - gross impact:
 - employment factor approach (direct)
 - appropriate employment factors needed, often not available for country
 - technology specific (potentially)
 - for quick estimates and updates
 - gross input-output approach (direct and indirect)
 - consistent framework allows other impacts to be assessed (e.g. value added)
 - integration of technology specific aspects
 - difficult to allocate RE industry impulses to IO-table industries

Conclusion and results for the guidelines (3)

- decide on the methodological approaches
 - net impact:
 - net input-output approach
 - see gross IO
 - limited linear relation between input-outputs, average coefficients not reflecting marginal changes
 - no interaction between prices and quantities
 - full economic model (also best suited to assess future impacts)
 - very complex, know-how intensive
 - requires energy sector, socio-economic and demographic data
 - assumptions for scenario development

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THANK YOU!

For additional information on EID-Employ

Online: <http://iea-retd.org/archives/ongoing/employ> or
http://www.isi.fraunhofer.de/isi-de/x/projekte/employ_314927_bf.php

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