GROSS AND NET EMPLOYMENT EFFECTS: MAIN DIFFERENCES AND INTERPRETATION

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„ Innovation and employment: cornerstones of energy transition“
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Example: RET and Employment

Observation: Many impact studies, diverging results, different methodological approaches, system boundaries and assumptions → review of impact studies (IEA-RETD Employ Project):

- lot of impact assessment studies have been conducted
- each defines gross or net impact individually → definition of gross and net impacts is necessary:
  - Gross impact studies are less complex and less expensive. These studies show only a part of the picture, but they are useful to show regional effects, required qualification (area), technology specific effects, …
  - Net impact studies include positive and negative effects that occur beyond the RE industry and its upstream industry → they show a net benefit
- clearly formulated data requirements, but data availability is a problem

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RET: overview of identified effects

Positive effects (+): → job increases	Negative effects (-): → job losses	effects
increase in investment in RET	displaced investment in conventional generation technology	direct → indirect
increase in O&M in RE generation	displaced O&M in conventional power generation	direct → indirect
increase in fuel demand (biomass)	decrease in fossil fuel demand	direct → indirect
increase in trade of RE technology and fuel (biomass)	decrease in trade of conventional technology and fossil fuels	direct → indirect
higher household income from employment in RE industry	lower household income from employment in CE industry	induced type 1
decreased electricity price for households and industry due to merit-order effect, CO_2 pricing, etc.	increased electricity price for households (budget effect) and industry (cost effect) due to additional generation cost of RE-based power generation	induced type 2

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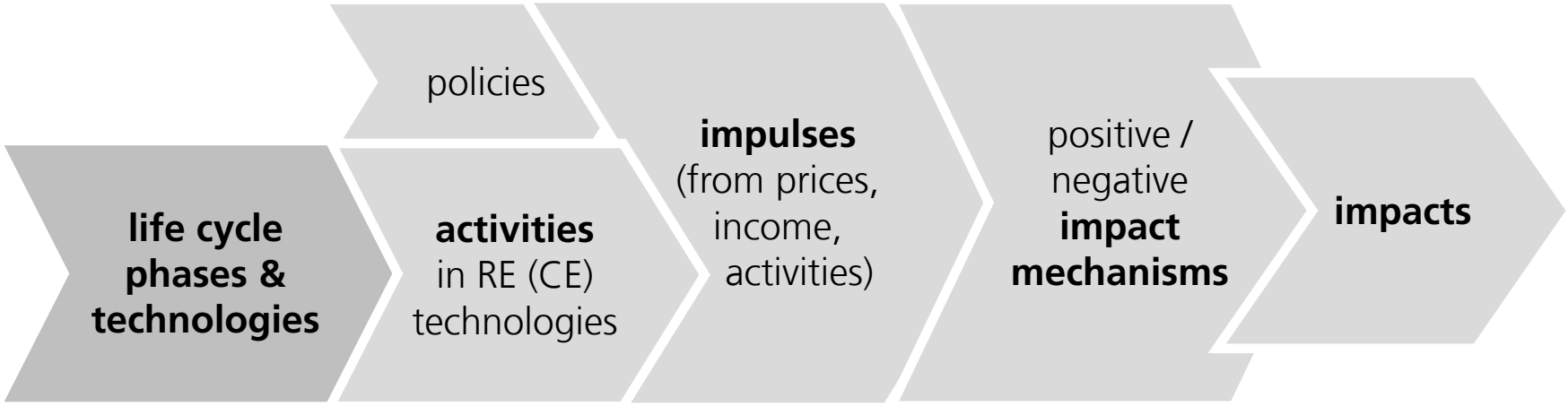
RET: causal chain- from activities to impacts



Examples				
	R&D, planning & development, MCI, O&M, fuel supply, ex/imports, ...	**expenditures** for investment, O&M, fuel …. **income** from RE, **prices** for power, …	direct, indirect and induced **effects**	employment, GDP

CE: conventional energy;
MCI: manufacturing, construction, investment;
O&M: operation and maintenance;

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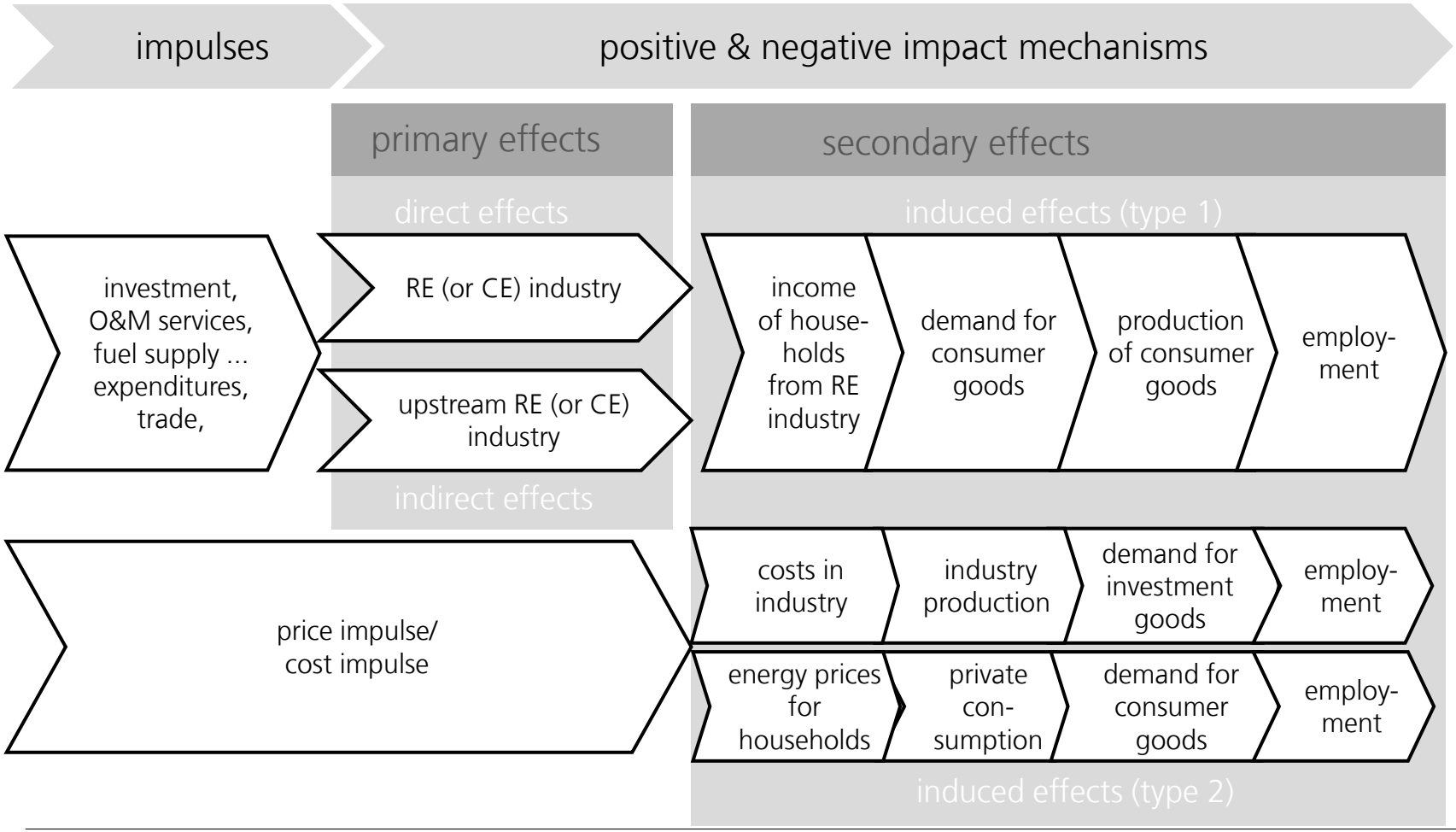
RET: causal chain - from impulses to effects



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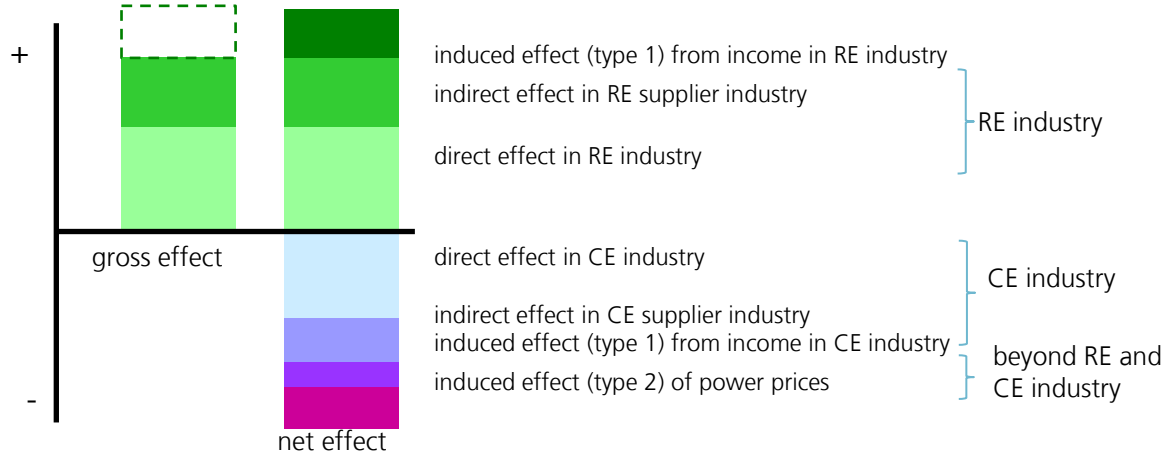
RET: Causal Chain- from effects to impacts

Effects can be positive or negative:

- **direct** (within the RE or CE industry)
- **indirect** (in the upstream industry of the RE or CE industry)
- **induced** via prices and income generated in RE or CE industries affecting sectors (via consumption) beyond the RE or CE industry and its upstream industries

Effects add up to an impact:



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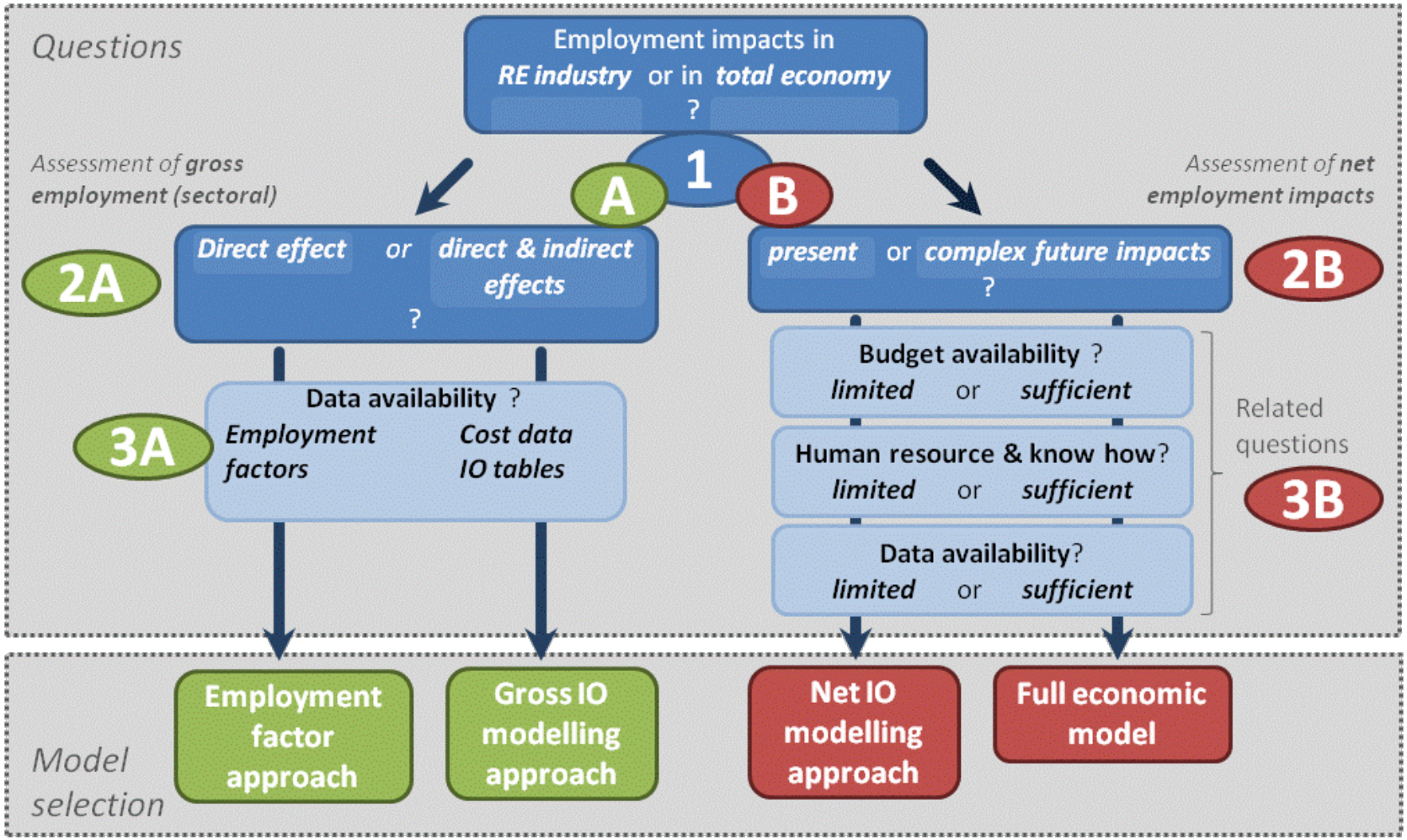
RET: Deciding on modelling approaches



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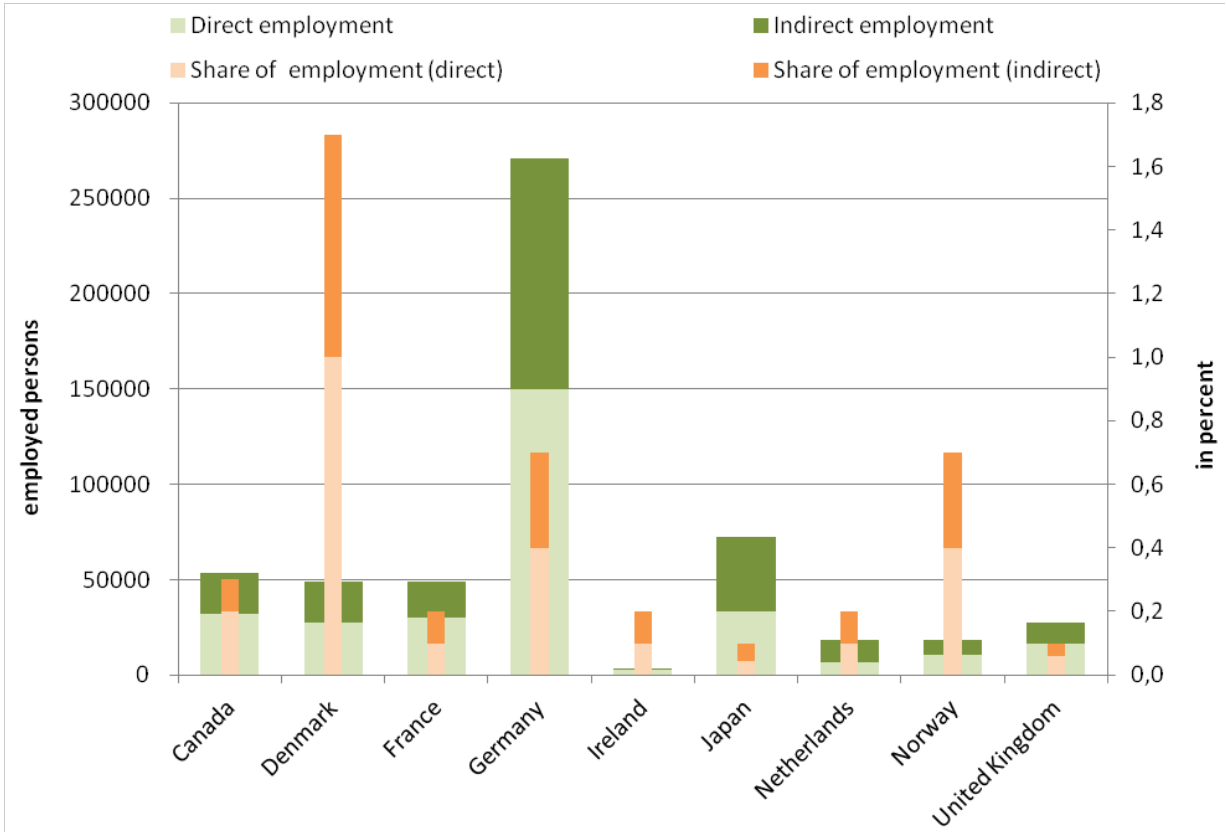
RET: Sectoral employment of selected countries



Assessment based on the gross IO-approach for RETD-countries (RET power generation, 2009)

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Innovation and Employment?

Do we really capture all relevant impacts of innovation ?

- expenditures for R&D? → activity
- lower technology costs? → investment and O&M expenditures
- new products or processes → …. ?

Which effects occur through innovation?

- the same as with RET deployment ? → check by an illustrative example e.g. ice harvesting industry

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Example: Cooling industry and employment

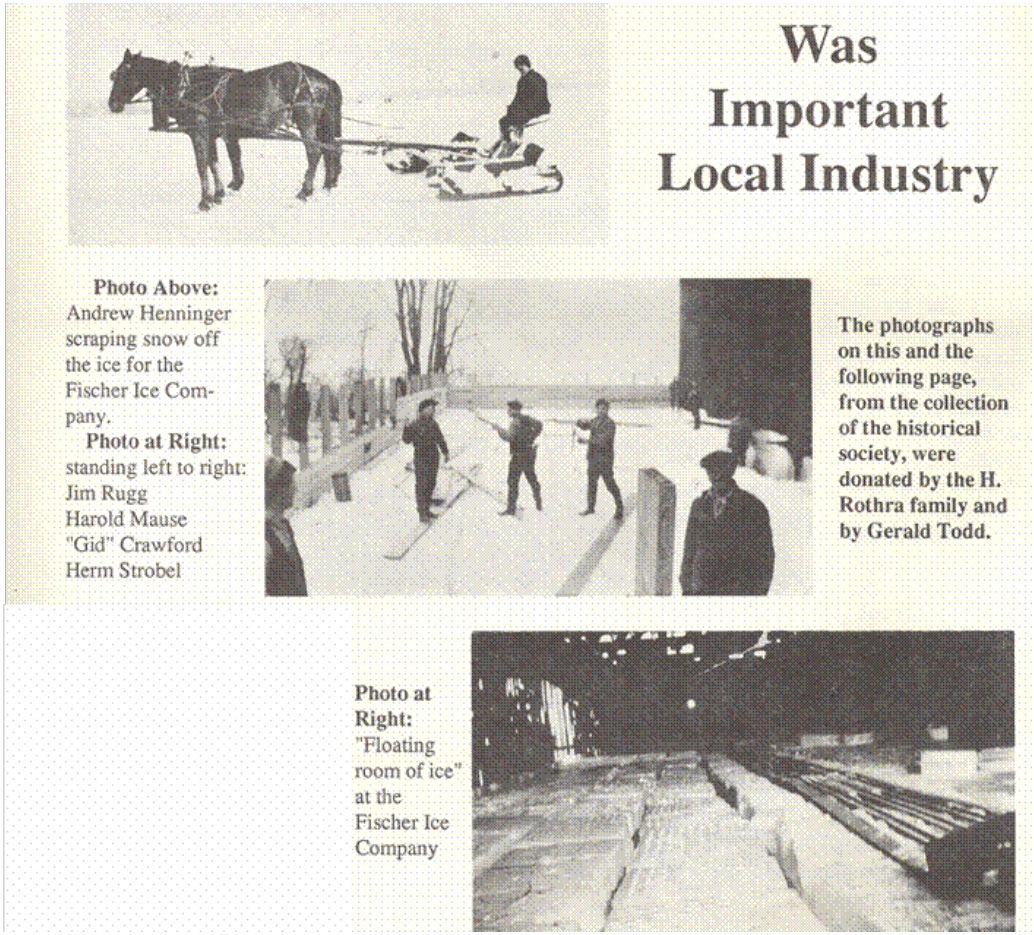
Example „Ice harvesting industry“ (II):

1811 - 1940

- harvesting: development of plough harvesting machines, → price decreases
- storing: standards for ice cubes → price decreases
- transporting: improvment in isolation and transportation → price decreases

radical innovation:

- freezer (1868), refrigerators (FT)
- 1940 no ice harvesting industry



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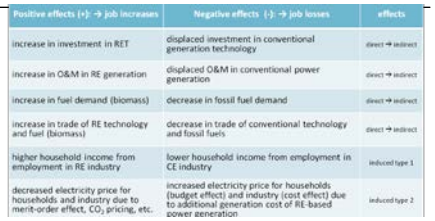
Cooling industry: overview of effects



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Use the same effects as before,

only replace RE and CE by FT and II, **but** …..

Positive effects → job increases	**Negative effects → job losses**	**Type of effect**	
increase in investment in **FT** industry and upstream industry	displaced investment in **II** industry and upstream industry	Investment effect	In/direct
increase in O&M services in **FT** industry/ services and upstream industry	displaced O&M services in **II** industry and upstream industry)	O&M effect (services)	In/direct
increase in trade of **FT** technology	decrease in trade of **II** technology (harvesting, ... technology)	Trade effect	In/direct
higher household income from employment in **FT** industry	lower household income from dismissals in **II** industry	Income effect	Induced effect type I
decreased **cooling** price for households and industry	-	Price effect	Induced effect type II
New production possibilities and higher comfort through FT	-	Production opportunity effect	**Induced effect type II**

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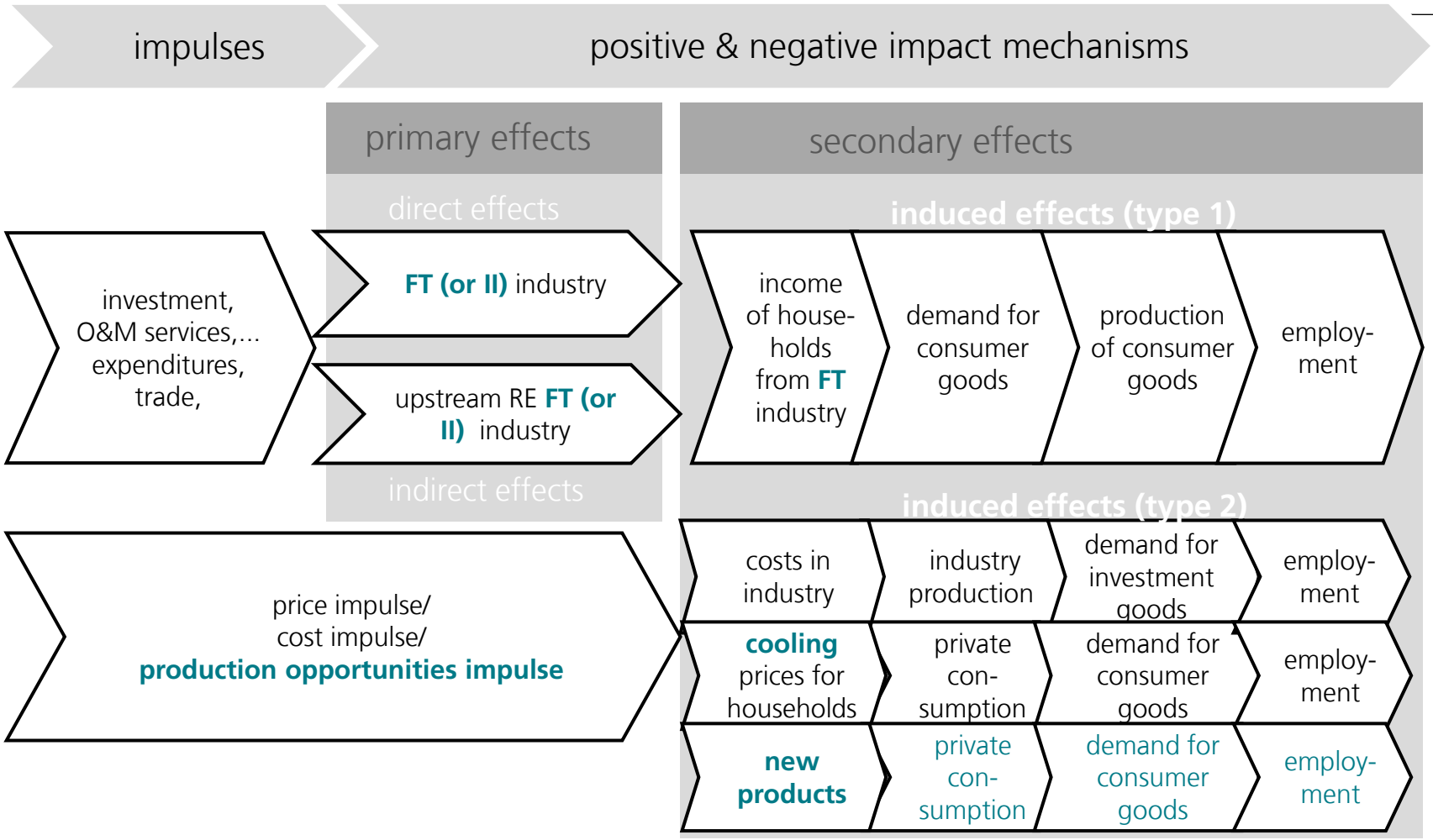
FT: causal chain - from impulses to effects



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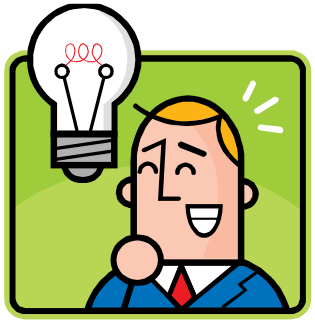
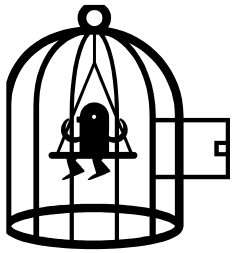
Lesson learnt:



- „new“ impulse production opportunity: access to power in remote areas could also create new production opportunities and hence increase overall production and employment

- two principal employment effects of RET use:
  - gross (sectoral effects) employment
  - net (total economy) employment



- impact of innovation on employment can be captured by the same „approaches“

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Thank you for your attention

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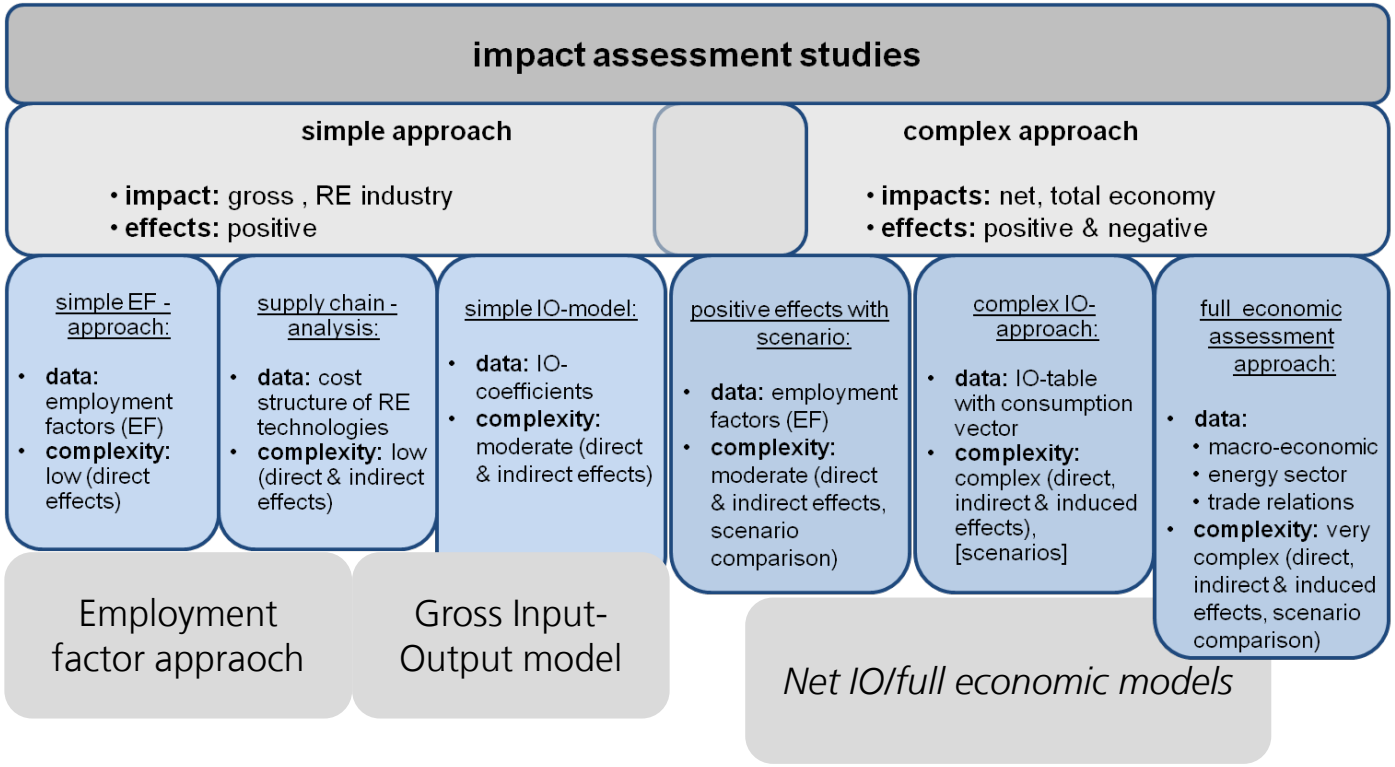
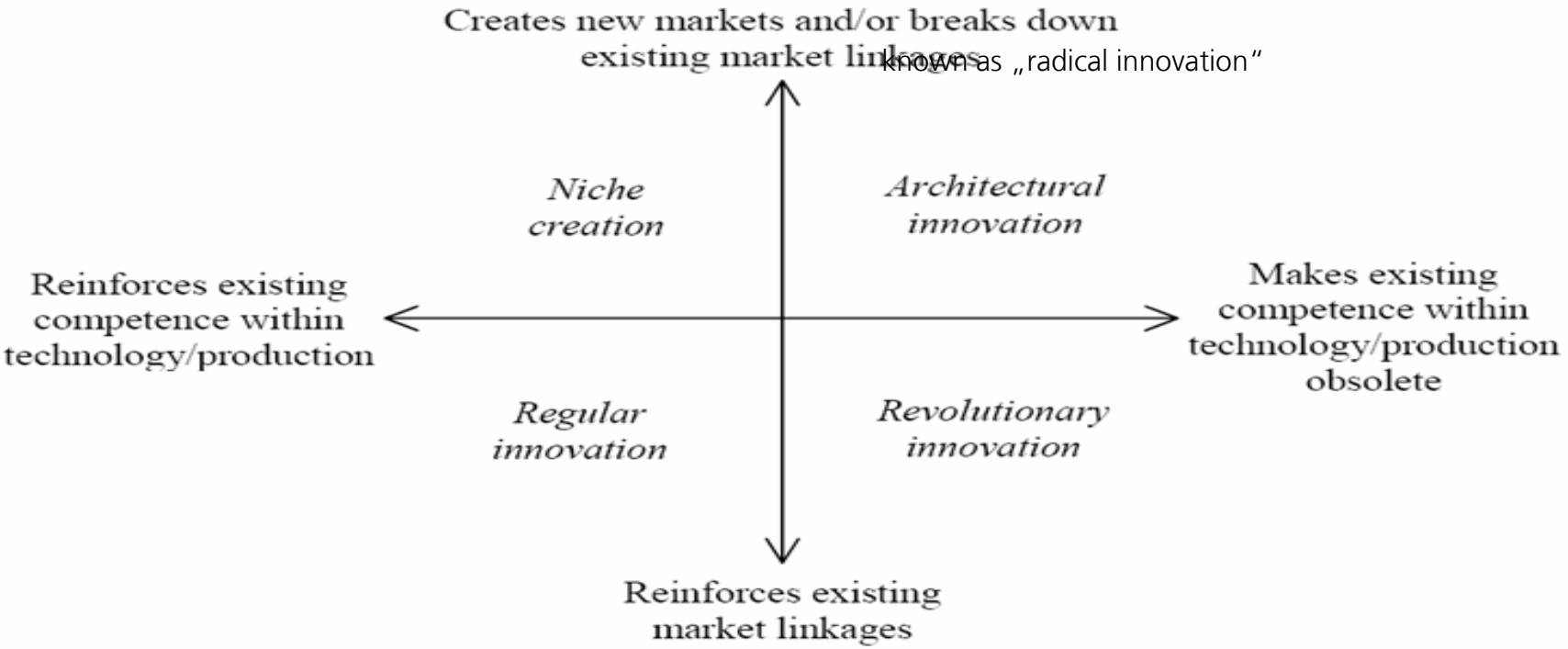
Outcome of review process



→ definition of impact based on effects taken into account

Impacts of Innovation on employment?

Transilience map (tansient & resilience): market and technology dimension



Quelle: Abernathy & Clark, überarbeitet: Utterback, Radical product innovations