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Stream 1: Policy Planning: Environmental Policy

Global convergence of resource consumption level through resource use reduction policies in developed countries

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Structure of this presentation

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- ❑ Methodology
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Background: Need of convergence of resource use

- Over-consumption of the rich⇒overconsumption as a whole world
  - Environmental constraints：ecological footprint, planetary boundaries
  - Resource constraints：peak oil. Critical metals
- Under-consumption of the poor
  - Need economic development for poverty alleviation
  - Need drastic increase of material consumption
  - Issues of equity

Large gap in Metal stocks between developed and developing countries

Metal type	Stock per capita（Developed countries）	Stock per capita（Developing countries）
Aluminium（kg）	350–500	35
Copper（kg）	140–300	30–40
Iron/steel（kg）	7000–14000	2000
Lead（kg）	20–150	1–4
Stainless steel（kg）	80–180	15
Zn（kg）	80–200	20–40

Source: UNEP (2010) Metal stocks in society

Rationale of resource use reduction in developed countries

- Rich, capable countries must establish sustainable consumption and production model such that "decent quality of life for all" can be achieved within resource/environmental constraints.
- Reducing resource use level of developed country will lower the catching-up target for developing countries.
- Reduced resource use in developed countries will allow developing countries to use higher share of the limited resource for their development.

Objective of the study

- This study aims to illustrate the potential contribution of resource use reduction policy in developed country to promote strong decoupling between welfare and resource use.
- As a resource use reduction policy in developed countries, this study employs resource cap on iron ore use implemented through resource tax in developed countries.
- To see whether decoupling happens, impacts of such a policy on resource use, "quality of life (welfare level)" and environmental impact (e.g. CO_2 emission) were quantitatively assessed.
- In addition to direct resource use and CO_2 emission, material footprint and carbon footprint (i.e. life cycle impact indicators) are assessed to get implications for consumption based approach.

Methodology

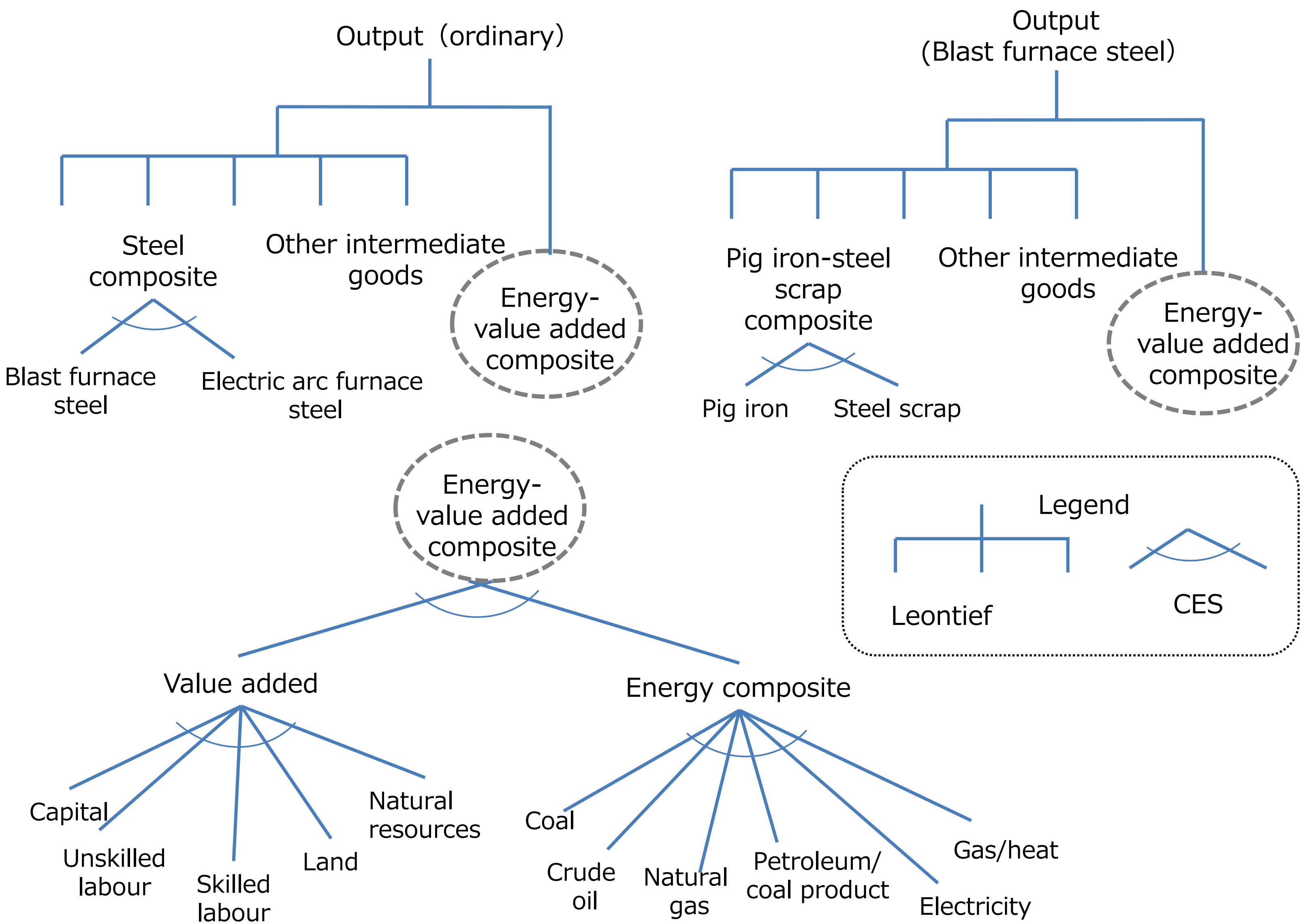
Policy impact assessment using CGE model

- Global recursive dynamic CGE model based on GTAP database ver.7 and macro-economic projections by CEPII (Foure et al. 2012) for 2004-2020.
- Aggregation scheme: 13-region, 52-sector
- Iron/steel/recycling related sectors are disaggregated.
- Sector-specific capital accumulation: Total investment is allocated to each sector based on sector specific rate of returns (with CET function).

Life cycle resource/environmental impact assessment

- Linking CGE-IO: update IO based on CGE results
- IO was updated for each time step (1-year)
- Iron ore use coefficient of each sector (how much ton of iron ore is used to produce 1 dollar of output) is estimated for each CGE simulation results (time-wise and scenario-wise). Same for carbon.
- Material footprint/carbon footprint is estimated for each CGE results.

Production functions with iron-steel disaggregation



Disaggregation of iron/steel/recycling sectors

GTAP sector	Disaggregated sector
Other mining (omn)	Iron ore
	Copper ore
	Minerals nec
Iron and steel (i_s)	Pig iron
	Blast furnace steel
	Electric arc furnace steel
Non-ferrous metal (nfm)	Copper metal
	Metals nec
Manufactures nec (omf)	Manufactures nec
	Steel scrap recycle
	Copper scrap recycle
	Other scrap recycle

- Sectoral share data are from Japan IO (2005), US-IO (2002), and EORA.
- Trade share data are from UN Comtrade, World Trade Atlas (IDE-JETRO).
- For countries/regions without sufficient data, similar country/region's shares are used.

Policy scenario: resource cap with resource tax

Resource cap for developed countries

- Developed countries (Japan, Korea, US, EU, Australia, Chile) agree to reduce their aggregate iron ore use by 5% for 2015-2020 compared to BAU.
- These countries introduce uniform rate of resource tax on intermediate use of iron ore for 2015-2020 such that resource cap is achieved (i.e. Baumol-Oates tax).

Scrap recycling subsidy

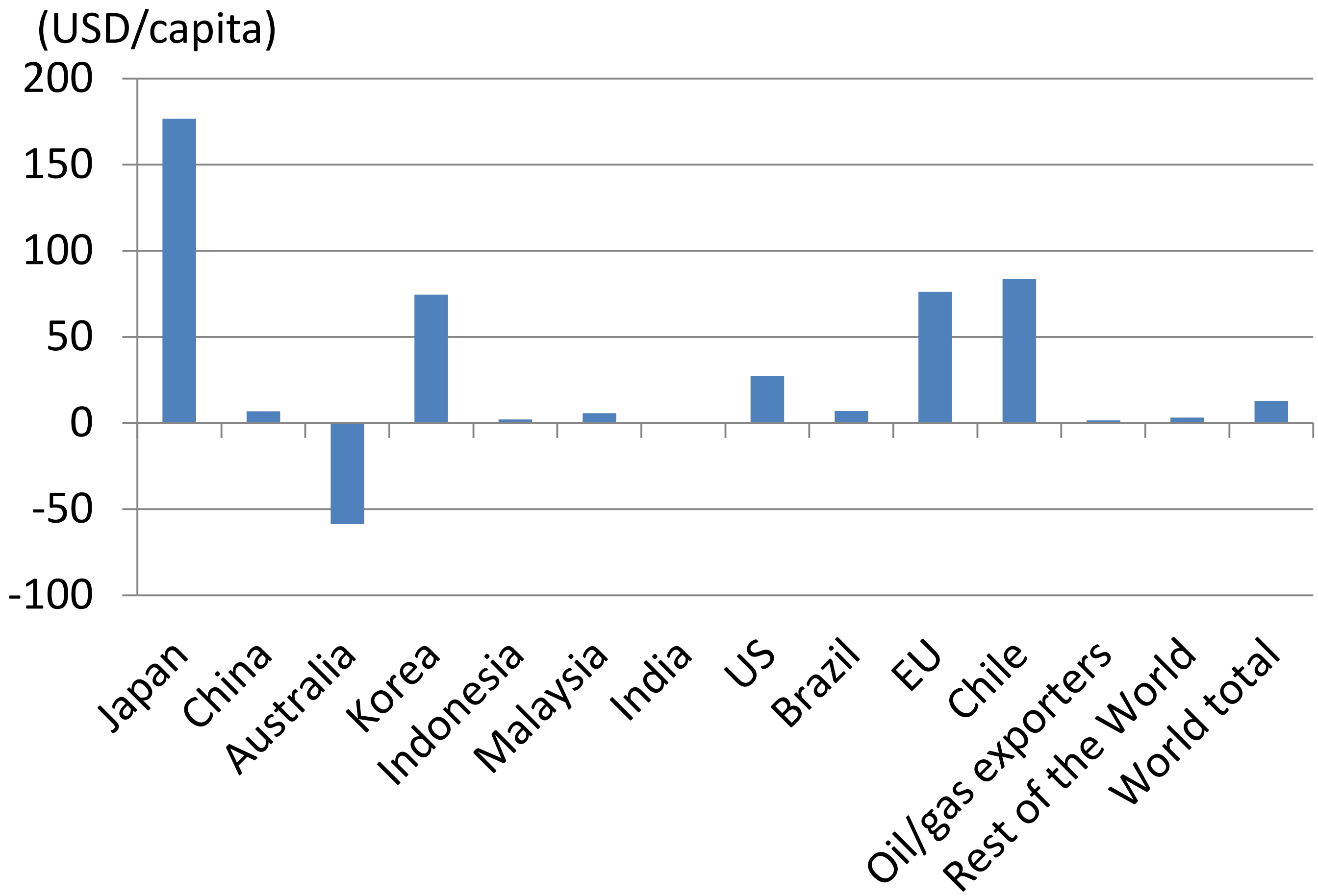
- A part of resource tax revenue is used for ad-valorem subsidy (20%) to steel scrap recycling sector. The remaining tax revenue is transferred to household.

Simulation results

Note:

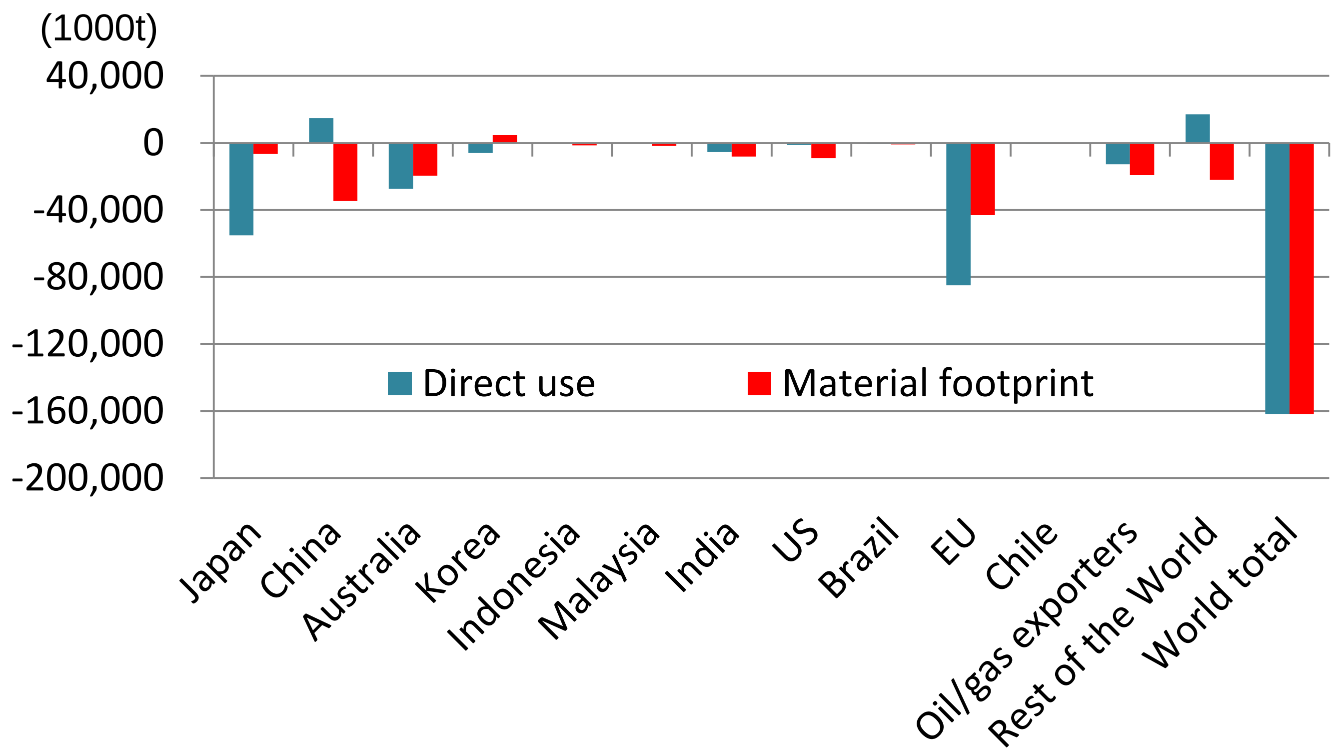
- Policy impacts in terms of changes (level or percentage) from BAU
- Results present cumulative impacts for the evaluation period (2015-2020).

Welfare impacts (EV: equivalent variations)



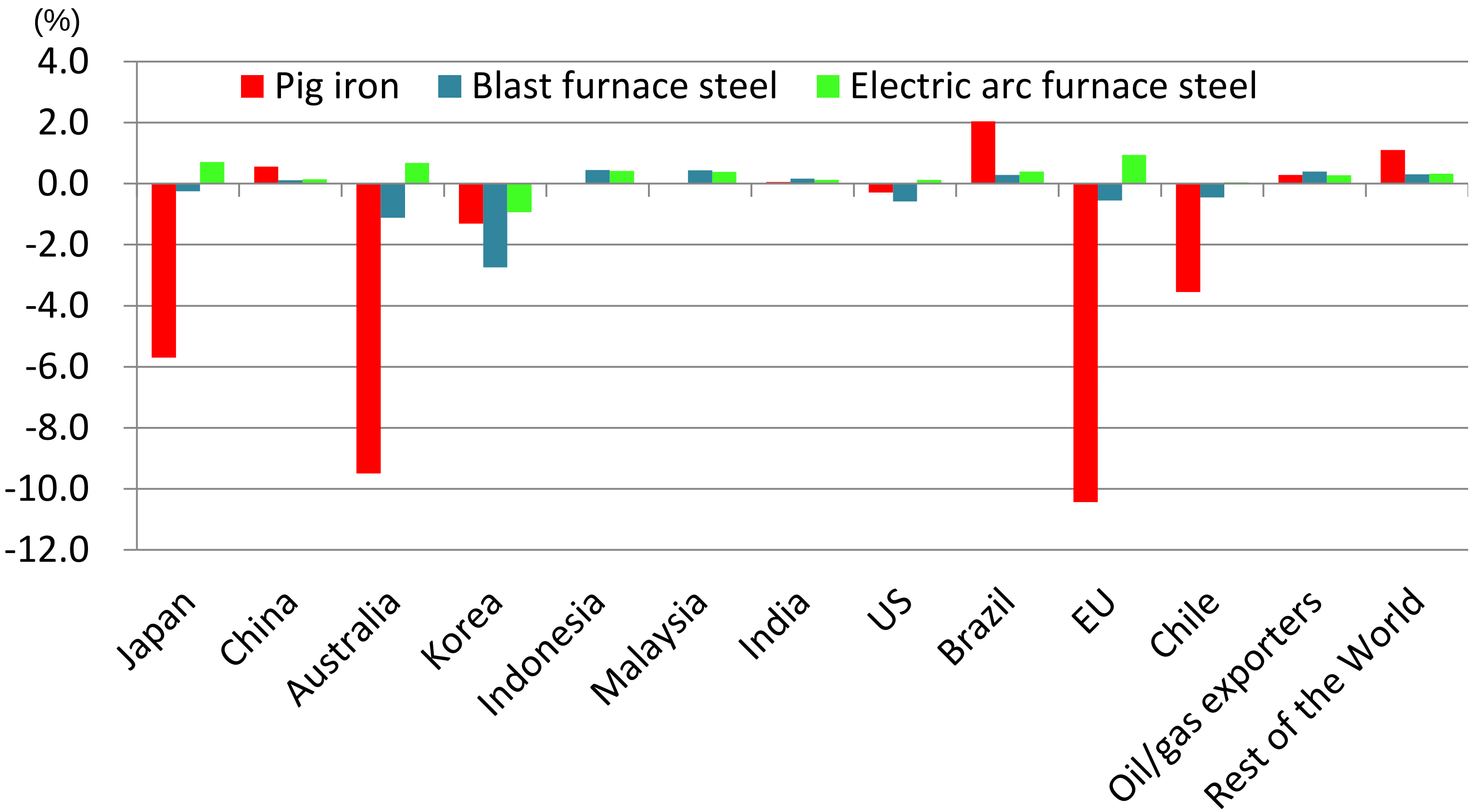
- All countries/regions except for Australia improve welfare level.
- World total is also positive.

Impacts on iron ore use



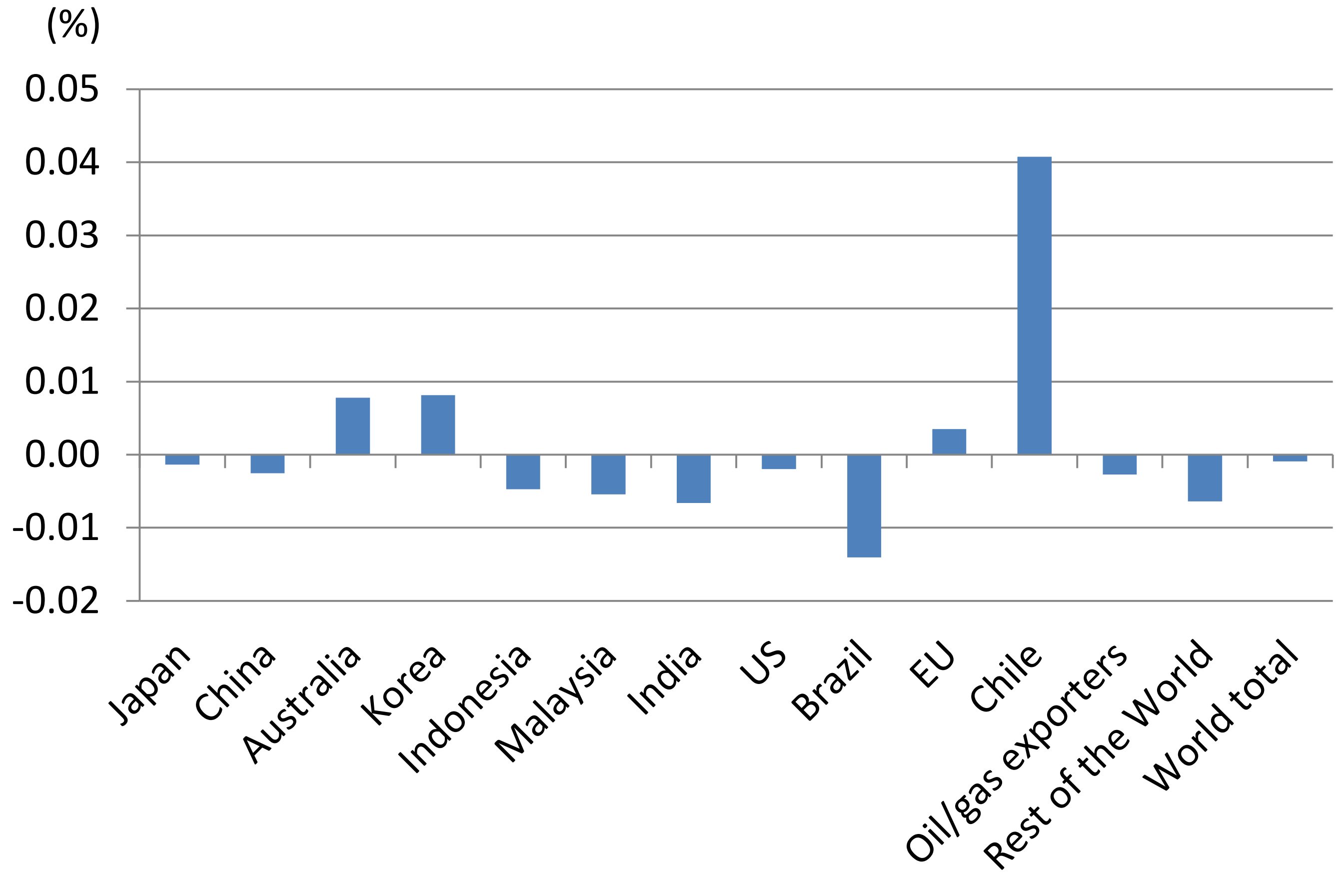
- In terms of material footprint, resource use in policy-implementing countries is not significantly reduced.
- Resource use reduction in developed countries (175 million ton) allows others to use more iron ore (13 million ton). ⇒ Global convergence in resource use is expected by this policy.
- Strong decoupling between welfare and resource use at the global level.

Impacts on iron/steel production



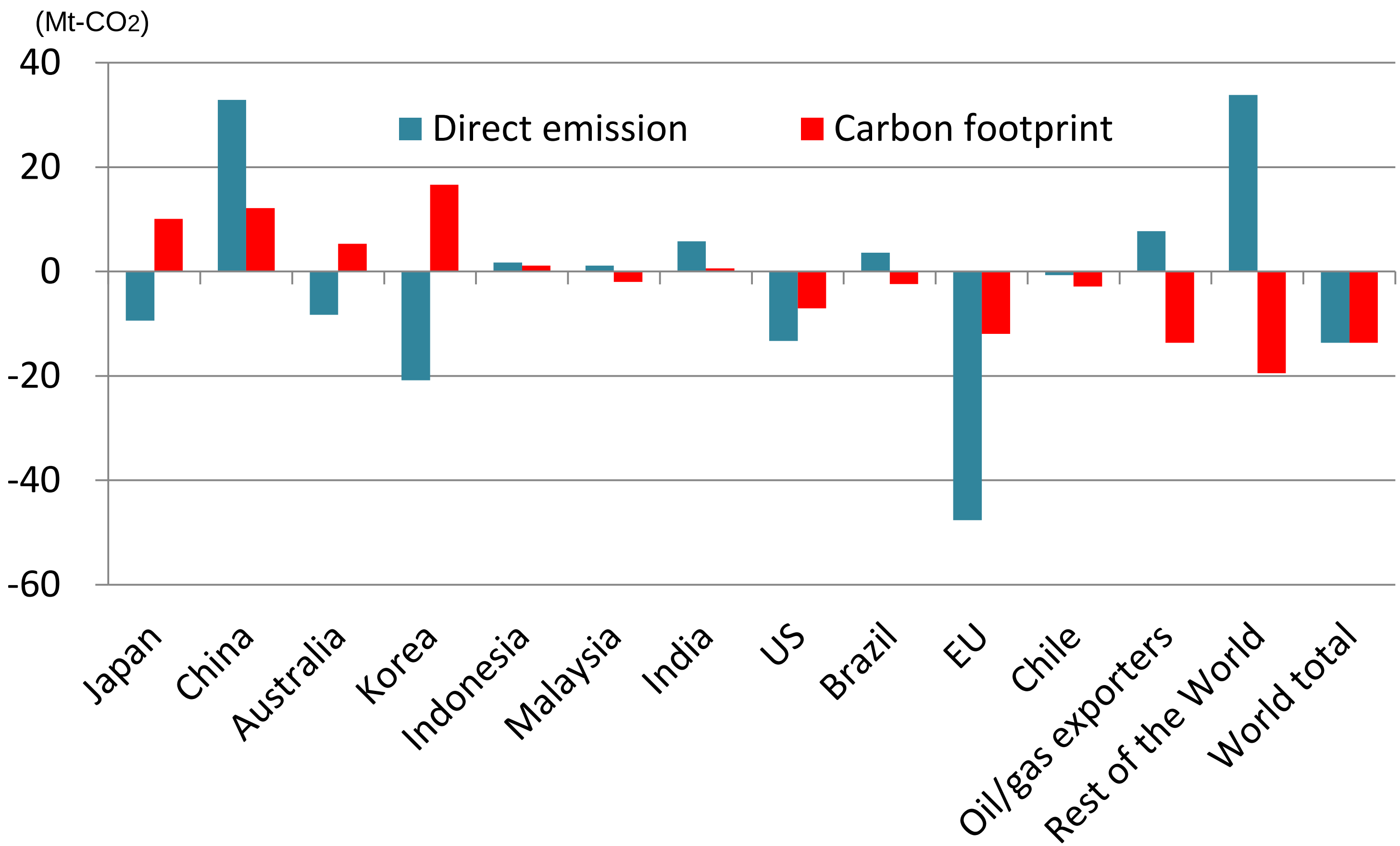
- In policy implementing countries/region, pig iron production drops significantly but decrease of blast furnace steel production is small, as a result of substitution by steel scrap.

Impacts on real GDP



- Impacts on real GDP are small at the order of 0.01-0.04%.
- The expected development benefit of allocating more resource to developing countries is not materialised. Better design of policy package must be sought.

Impacts on CO_2 emission



- Environmental co-benefit in terms of CO_2 emission reduction is observed.
- In terms of carbon footprint, this environmental co-benefit for policy-implementing countries/region is smaller or become negative. Decoupling is much difficult in terms of life cycle emissions.

Conclusion

- This study contends that achieving sustainable consumption and production which does not exceed planetary boundaries would be crucial to address challenges both for developed and developing countries, and that resource use reduction in developed countries could facilitate convergence of resource consumption at the appropriate level.
- Policy impact assessment tool using CGE and IO models was developed and policy impacts of resource use reduction policy scenario were assessed.
- Simulation results show that the aggregate equivalent variations of policy implementing countries (developed countries) increase and consequently strong decoupling between welfare level and resource use at the aggregate level is achieved.
- In addition, this policy mitigates international resource competition and promotes convergence of iron ore consumption with allowing emerging/developing countries to increase resource use.