アジア低炭素社会に向けて:Towards Low-Carbon Society in Asia
Asia LCS scenarios and actions How to achieve sustainable low-carbon society
Feb. 22, 2011, International Conference Hall, JICA Research Institute, Tokyo

S-6-4

経済発展に伴う資源消費増大に起因する温室効果ガス排出の抑制に関する研究

Study on Reduction of GHG Emission Associated with Increasing Resource Consumption by Economic Development

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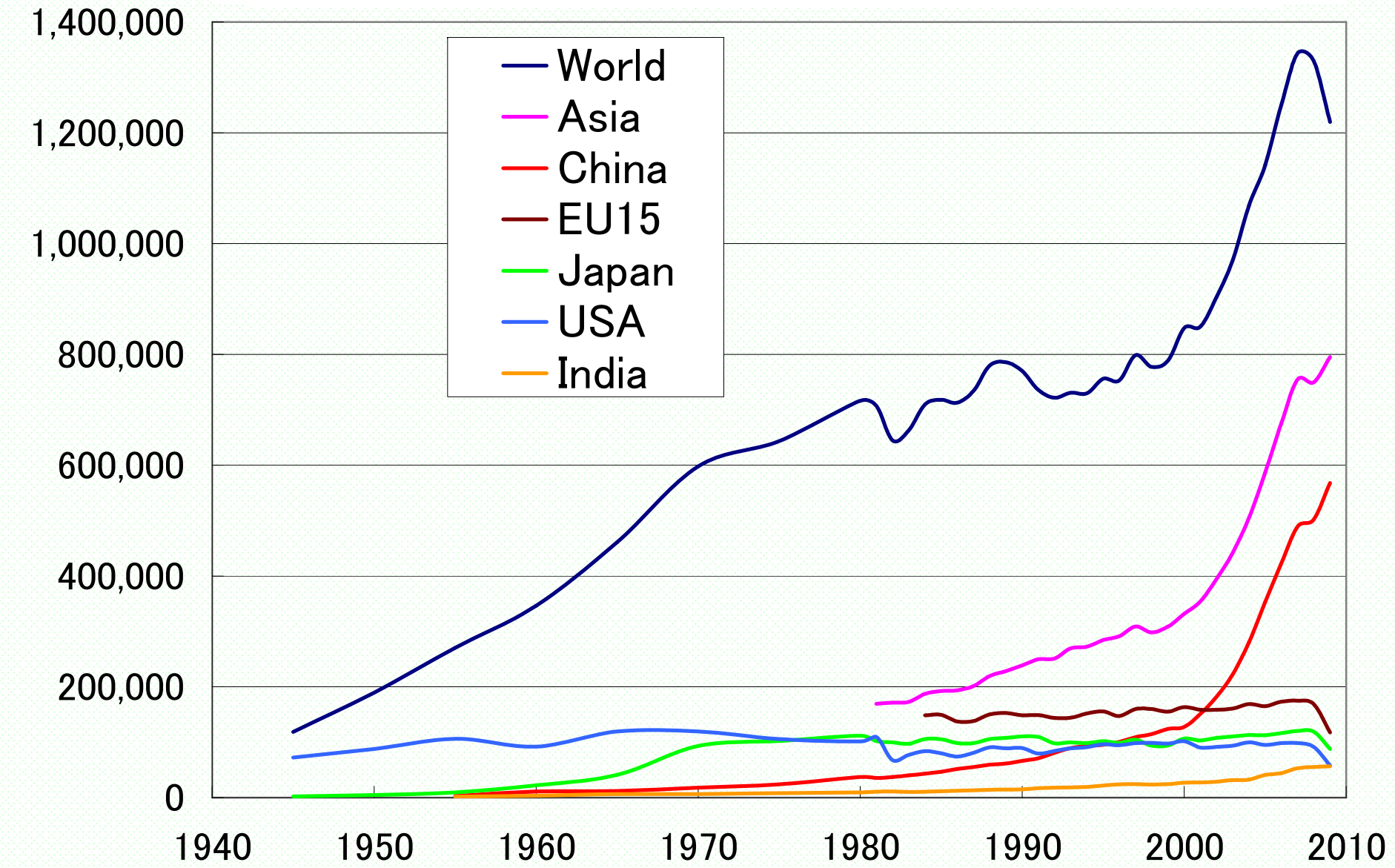
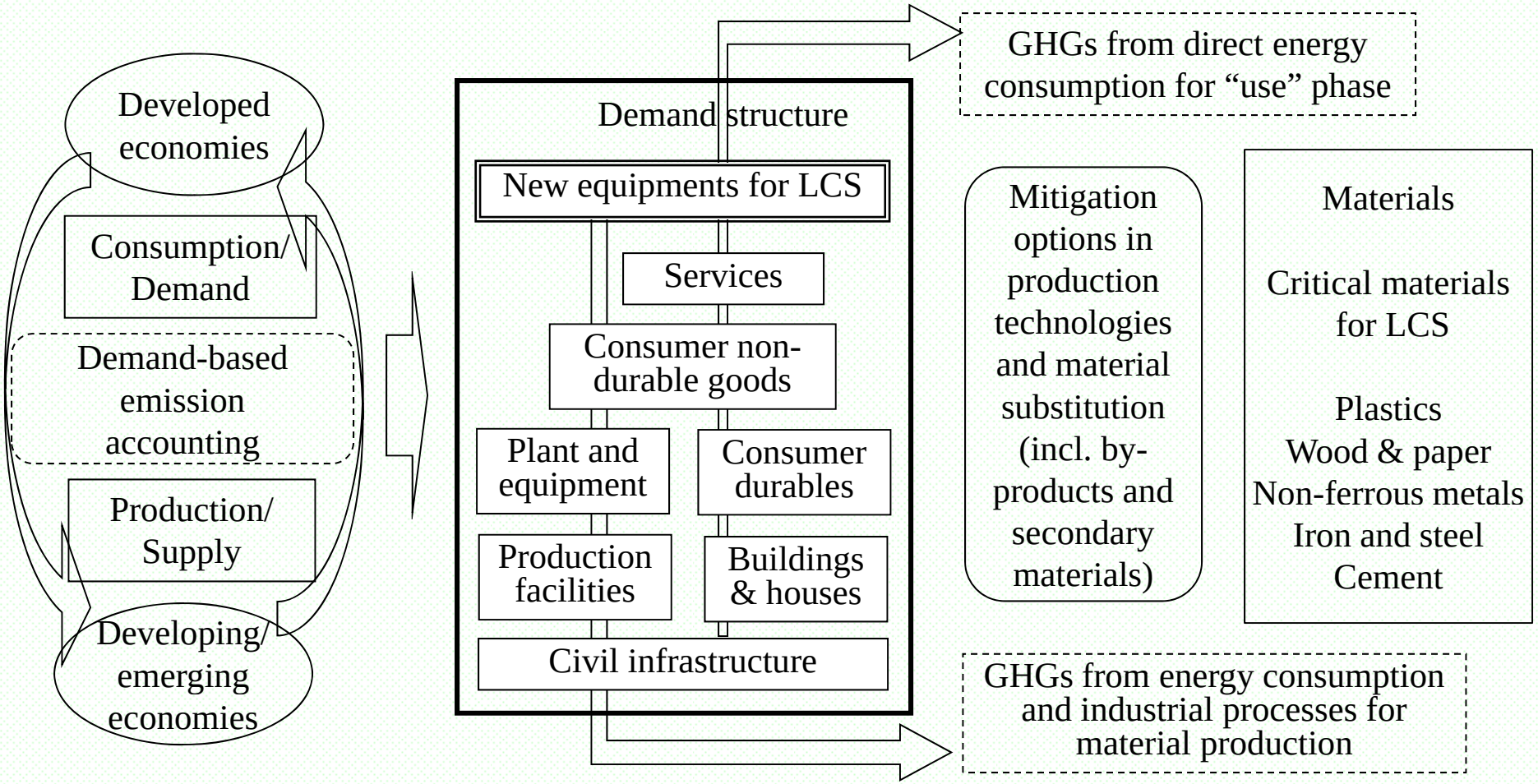
世界各地域の粗鋼生産量の推移
Trend of Crude Steel Production by Region



Source: World Steel Association (former IISI)

GHG emissions by various material requirements with economic development



Relationship between various demands and economic development	Material requirements by demand categories	GHG emissions for material production
Trend analysis & scenario analysis	Material flow & stock model	Inventory of technologies

物質資源と低炭素社会に関する主要課題
Key Issues for Material Resources vs. LCS

- 炭素集約度の高い原材料（鉄鋼、アルミ等）生産における国際分業
- 資源集約度の高い財の国際貿易に内包された温室効果ガスおよびその削減ポテンシャルの消費国・輸入国ベースでの勘定スキームの適用可能性

  →OECD Green Growth StrategyのHeadline Indicatorの候補に
- 低炭素技術に必要な稀少金属（白金族、リチウム、希土類等）の供給制約
- 炭素排出の抑制のための二次資源・副産物の賢明な利用
  - 低炭素電力を用いた電炉での鉄スクラップ利用
  - 廃木材や廃プラのカスケード利用（再生材料として利用した後にエネルギー利用）
  - セメント生産におけるスラグや石炭灰利用による石灰石代替

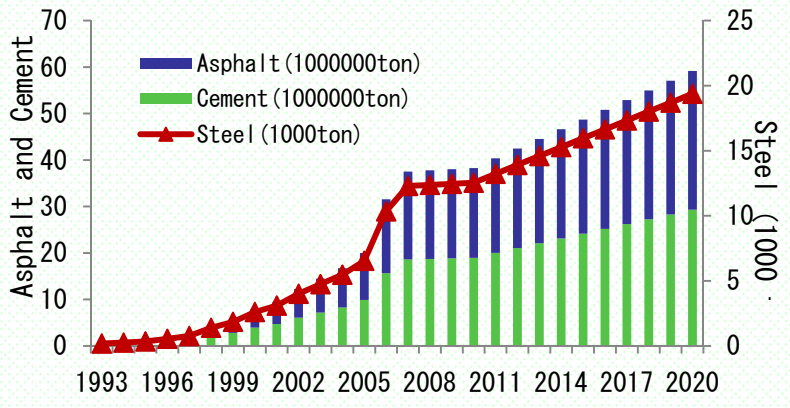
- International role sharing in carbon-intensive material production industries (e.g. Steel & Aluminum smelters)
- Possibility of consumer/importer-based accounting scheme to consider GHGs and their reduction potential embodied in international trade of resource-intensive commodities → A candidate headline indicator for OECD's Green Growth Strategy
- Availability of critical metals for Low-Carbon Technologies (e.g. PGMs, Lithium, Rare-earths, etc.)
- Wise use of secondary resources as potential to reduce carbon emissions, e.g.,
  - Scrap iron to EAF with low-carbon electricity
  - Efficient cascading use of waste plastics
  - Use of slag as substitute of limestone in cement production

Estimate of Demand for Construction Materials

- Estimate based on China's plan for construction of transportation network
- Current construction speed is faster than the plan
- Infrastructure per capita or per area in China is not still enough

Railway

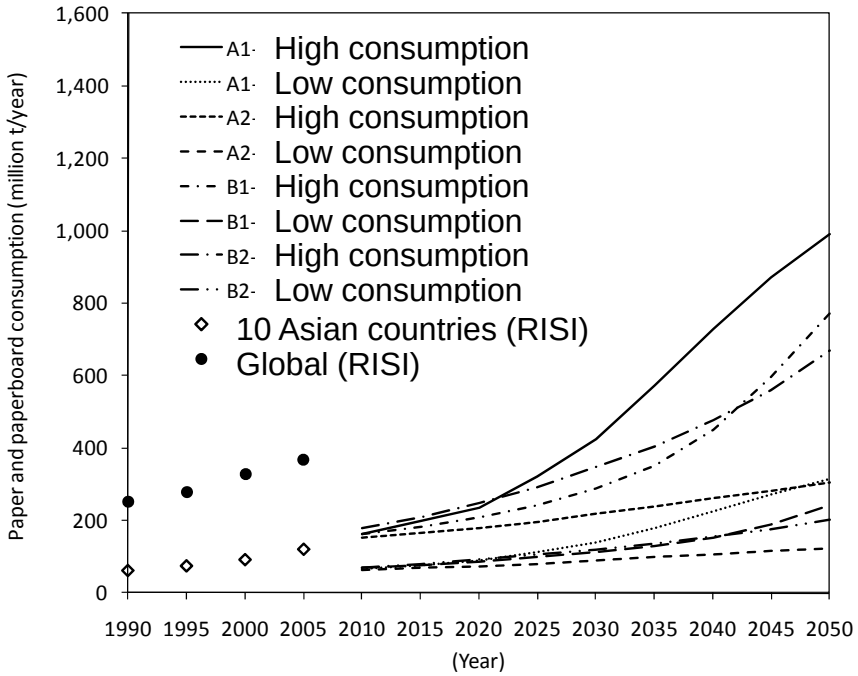
Highway

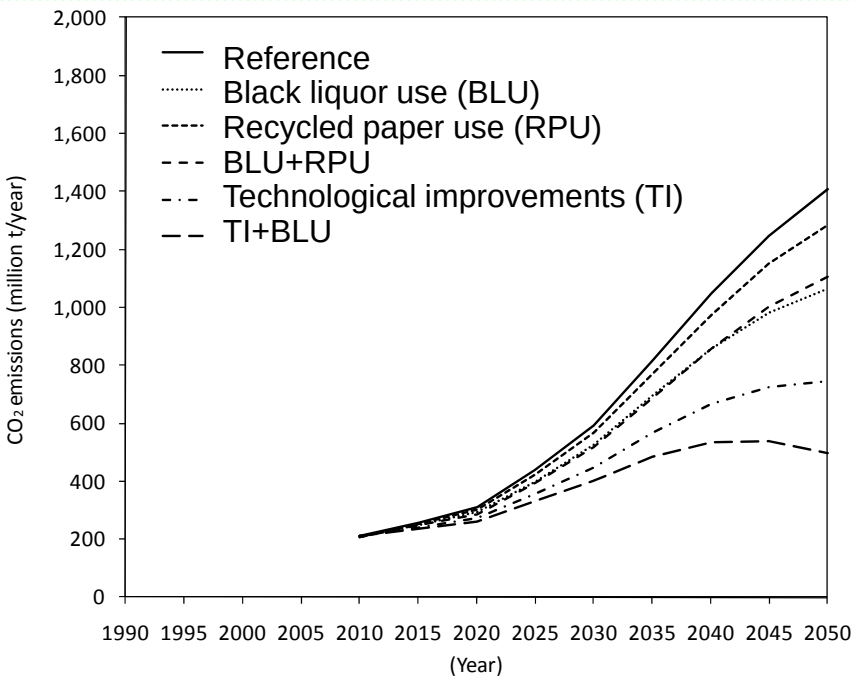


	Unit	USA	China	India	German	France	Brazil	Japan	Italy	UK
Railway length	10000 km	22.67	7.8	6.33	3.39	2.95	2.95	2.01	1.67	1.62
Railway density	Km/km^2	0.025	0.008	0.019	0.095	0.054	0.003	0.053	0.055	0.066
	Km/10000 persons	7.54	0.59	0.58	4.11	4.84	1.56	1.57	2.87	2.67
Road length	10000 km	646.58	193.05	331.65	64.45	95.15	175.19	119.70	48.77	39.83
Road density	Km/km^2	0.724	0.201	1.009	1.805	1.739	0.206	3.168	1.619	1.627
	Km/10000 persons	215.02	14.60	30.28	78.17	156.29	93.14	93.79	83.90	65.74

Estimate of Demand for Paper and Paperboard and Evaluation of CO_2 Reduction Potential

- Demand in major 10 Asian countries in 2050 (China about 50%; India about 20%) will be 30%–270% of current global consumption of paper and paperboard (tentative).
- CO2 reduction potentials in 2050 were estimated to be 20% for black liquor use, 10% for recycled paper use, and 50% for technological improvements compared with reference scenario (A1 high consumption) (tentative).



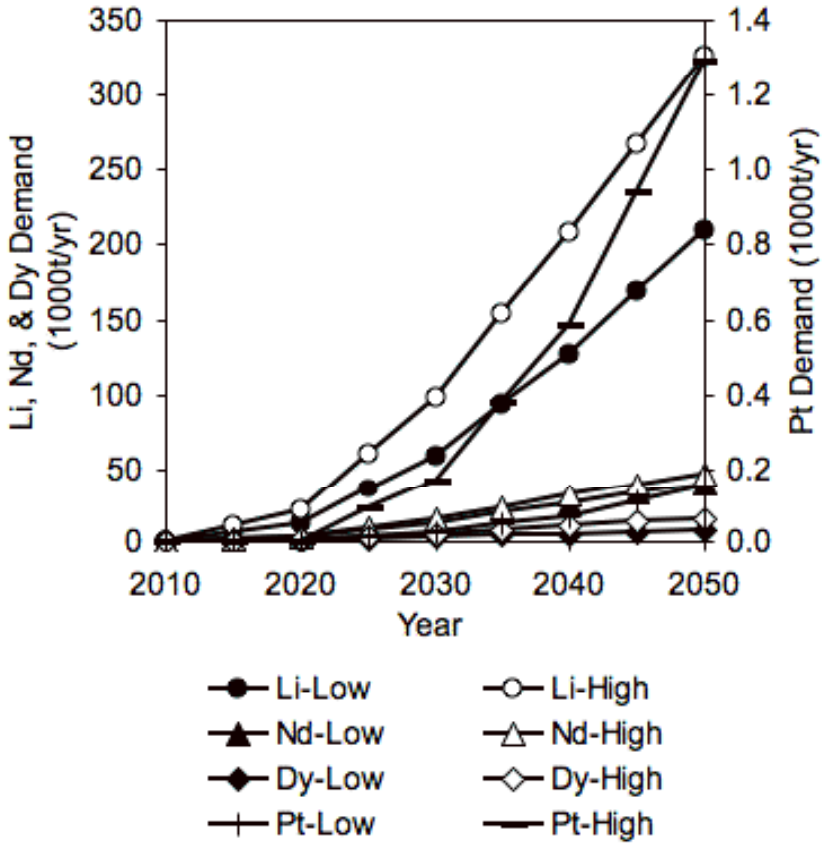


(Srouce: RISI ”Global Industry Statistics Database” for consumption during 1990-2005)

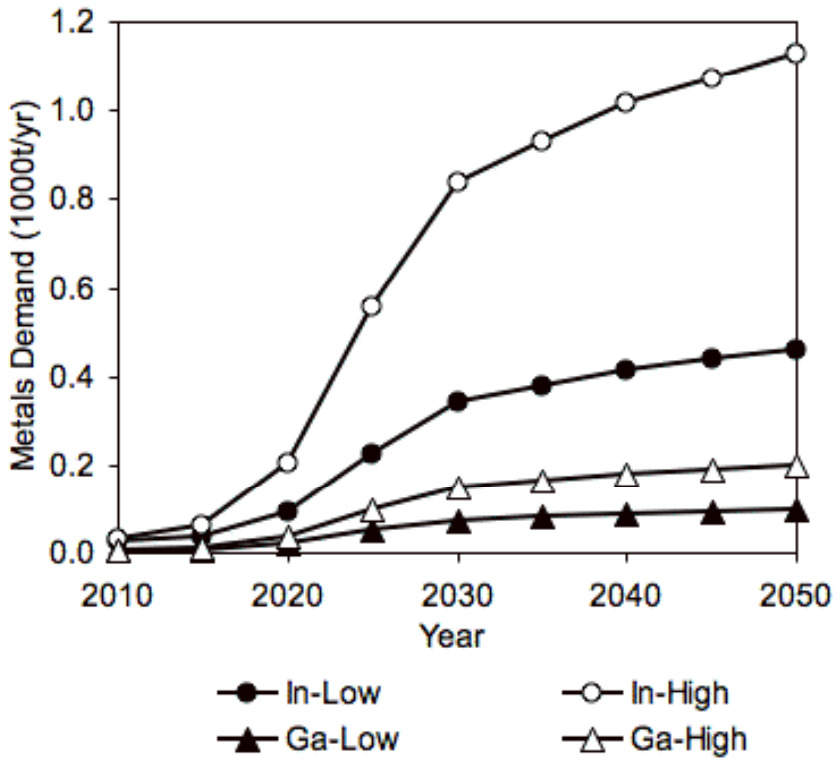
Estimate of Demand for Metals Used for Mitigation Technologies

- Demand for metals used for new generation vehicles (electric, plug-in hybrid, and fuel cell vehicles), solar battery, and wind power will greatly increase

New Generation Vehicles



Photovoltaic



Alternative development path in terms of resource consumption ?
（Possibility of Circular Economy/Society）

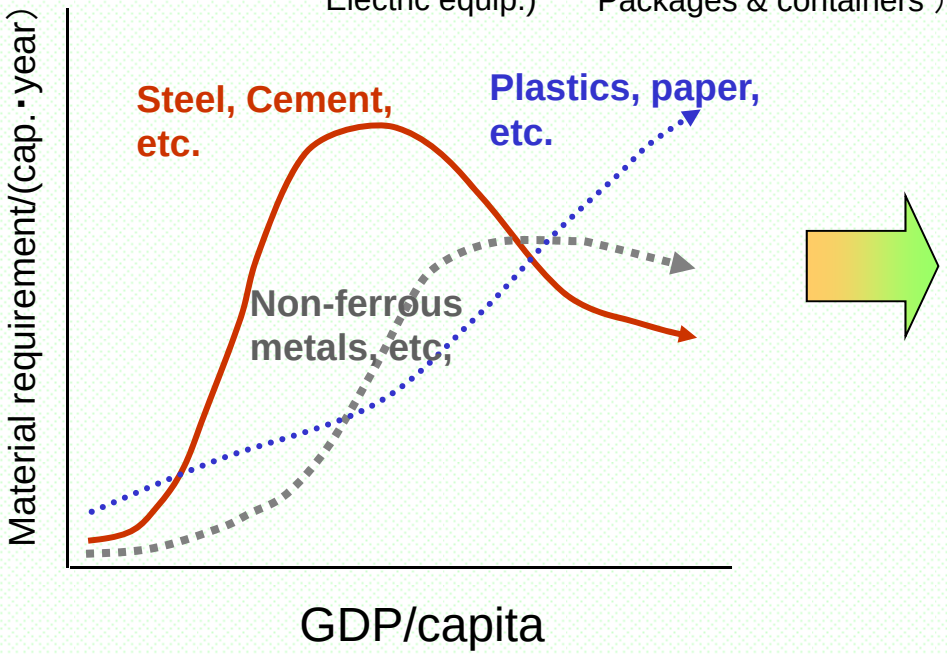
$$\frac{CO_2\ \text{Emission}}{GDP} = \frac{\text{Material Req.}}{GDP} \times \frac{\text{Energy Consump.}}{\text{Material Req.}} \times \frac{CO_2\ \text{Emission}}{\text{Energey Consump.}}$$

Traditional growth pattern with mass consumption of materials

Infrastructure
（Buildings, Roadways, etc. ）

Consumer durables
（Automobiles, Electric equip.)

Mass consump. of disposables
（Daily necessaries, Packages & containers ）



Alternative development pattern with low material, low carbon

Infrastructure
（Compact city）

Consumer durables
（Reuse, Rental, Lease)

Proper consump. of commodities
（Reduce, Recycle）

Do developed countries have sufficient supply of primary/secondary resources to satisfy demand from developing countries ?