Global Energy Scenarios

Transformation Toward Efficiency & Decarbonization

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Energy Management for Large-Scale Research Infrastructures

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2012 INTERNATIONAL YEAR OF
SUSTAINABLE ENERGY
FOR ALL

2030 Energy Goals

- Universal Access to Modern Energy
- Double Energy Efficiency Improvement
- Double Renewable Share in Final Energy

Aspirational & Ambitious but Achievable

Global Energy Transformations

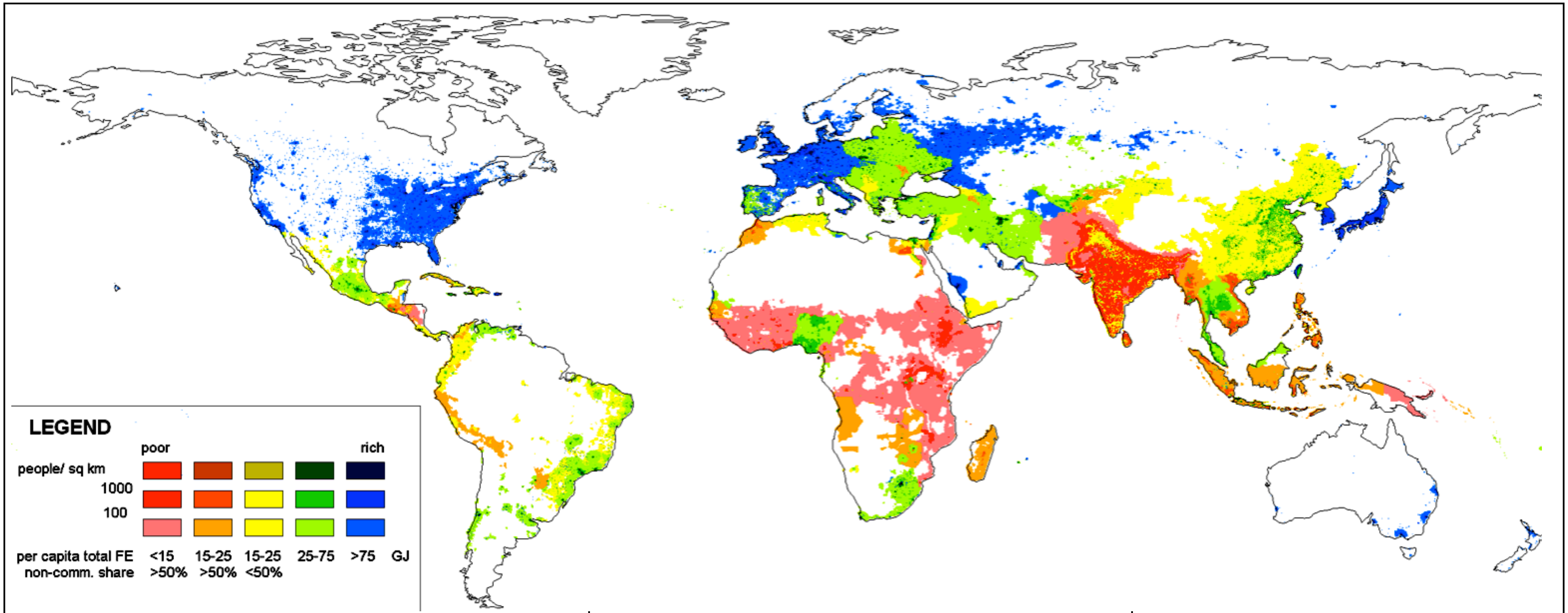
- Access to energy and ecosystem services (a prerequisite for MDGs & wellbeing)
- Vigorous decarbonization for mitigating climate change brings multiple co-benefits
- Energy transformations require R&D and rapid technology diffusion & deployment
- Sustained energy investments are needed and would result in multiple co-benefits

Food for a Week, Darfur Refugees, Chad

Food for a Week, Germany

Mapping Energy Access

Final energy access (non-commercial share) in relation to population density

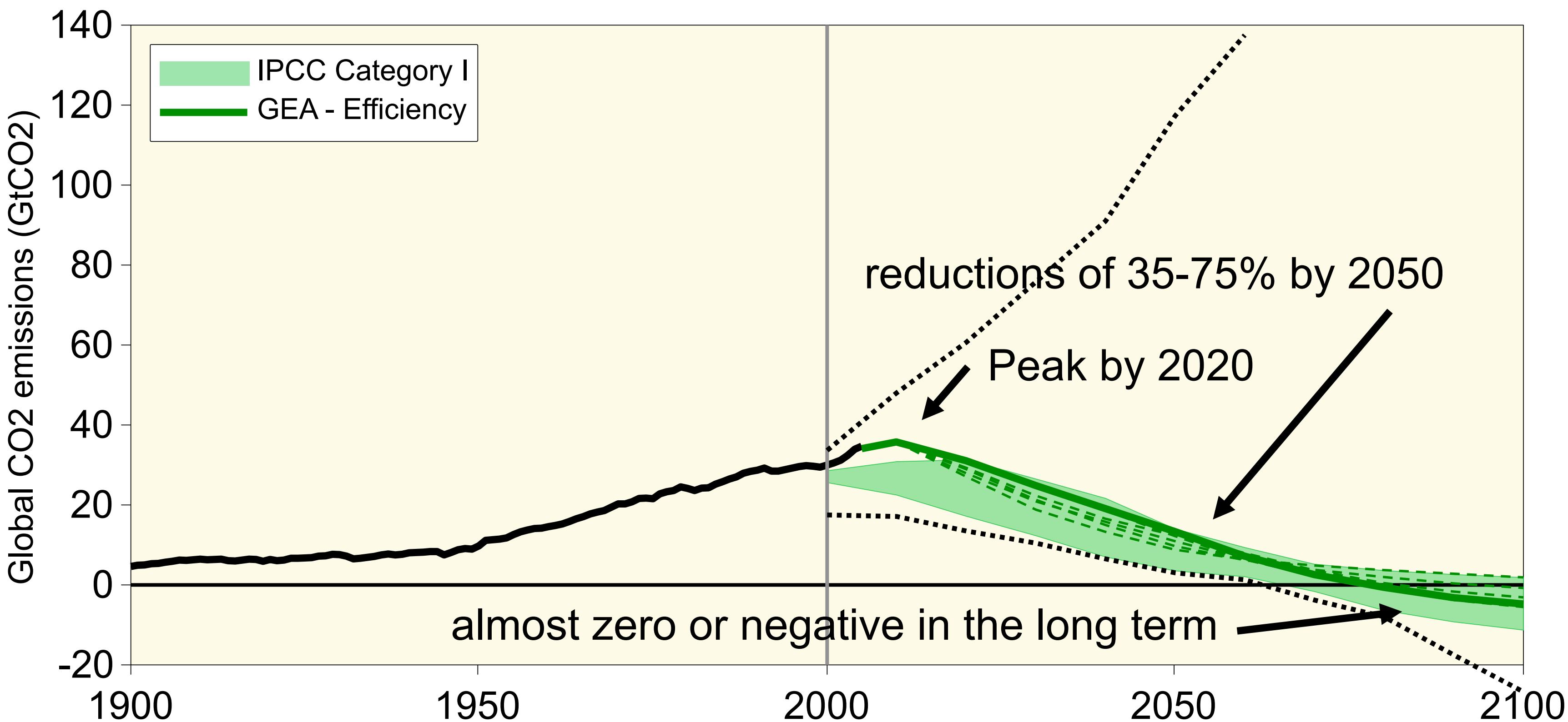


Billions of people:

Abject poverty: 1.3
Poor: 0.6
Less poor: 1.4
3.3
Middle class: 1.6
Rich: 1.2
2.8

Source: Gruebler et al, 2009

Global Carbon Emissions



Source: Riahi et al, 2011

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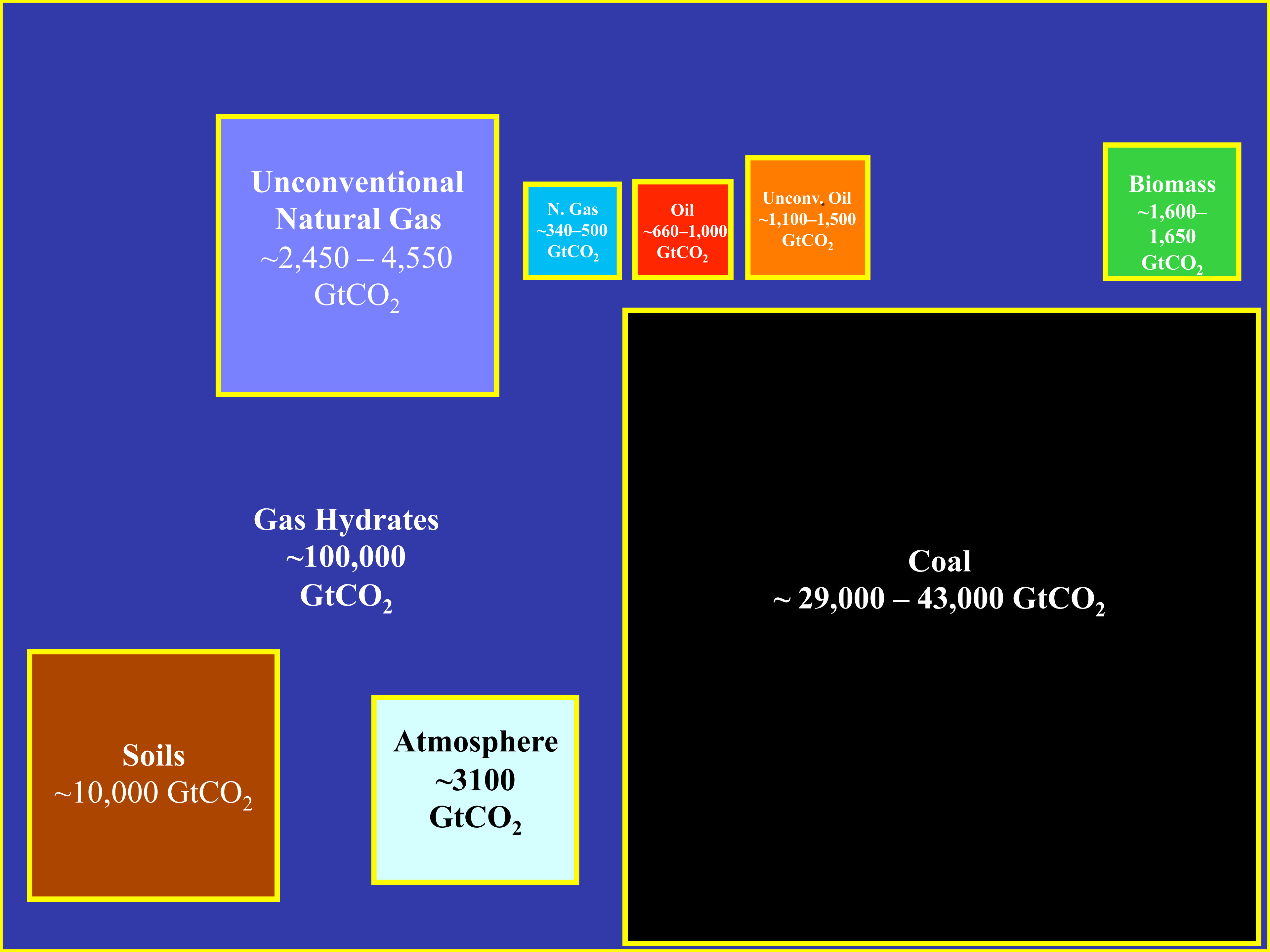
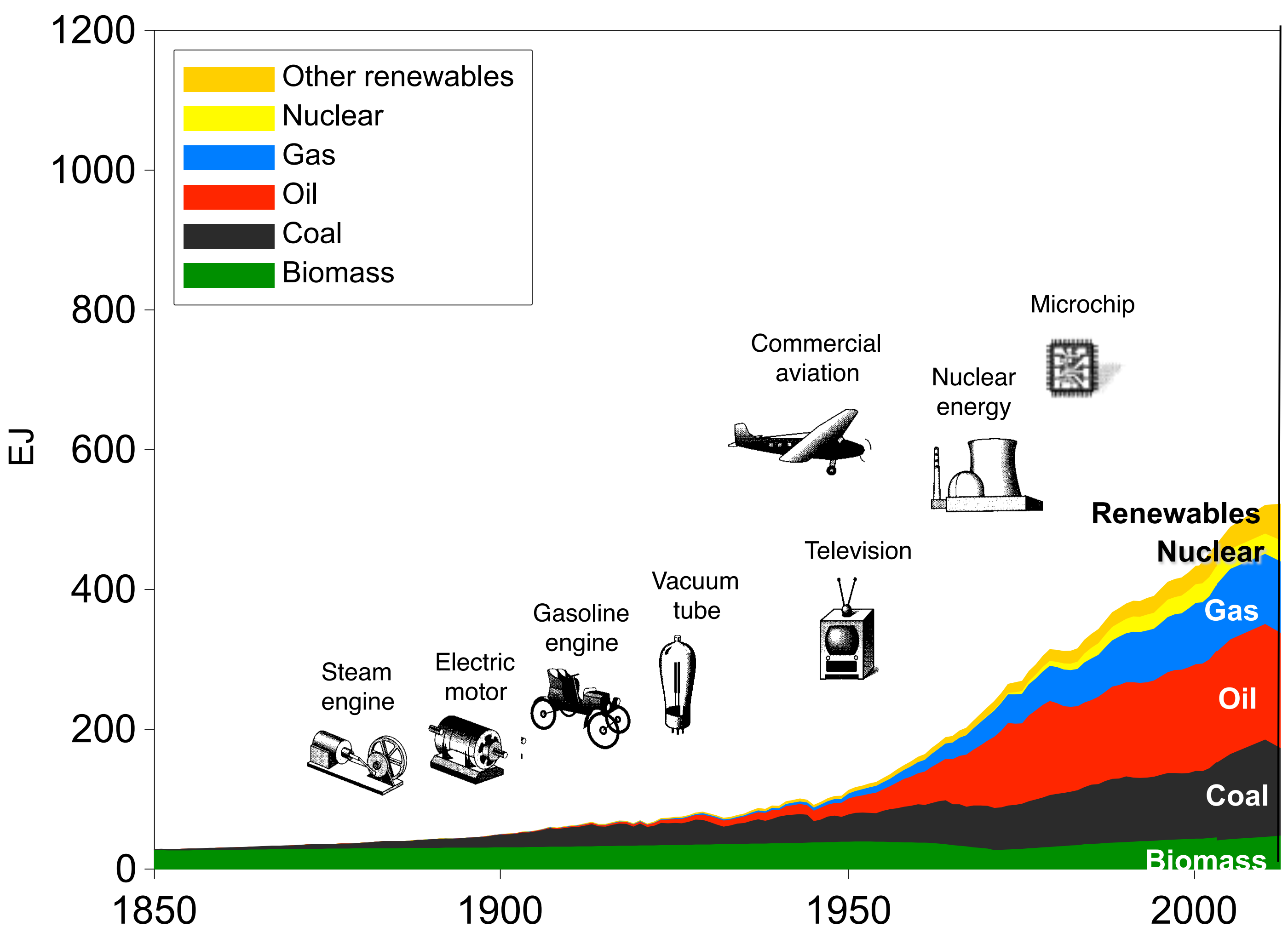

Unconventional Natural Gas ~2,450 – 4,550 $GtCO_2$
N. Gas ~340–500 $GtCO_2$
Oil ~660–1,000 $GtCO_2$
Unconv. Oil ~1,100–1,500 $GtCO_2$
Biomass ~1,600–1,650 $GtCO_2$
Gas Hydrates ~100,000 $GtCO_2$
Coal ~ 29,000 – 43,000 $GtCO_2$
Soils ~10,000 $GtCO_2$
Atmosphere ~3100 $GtCO_2$

Energy and Water from Deserts

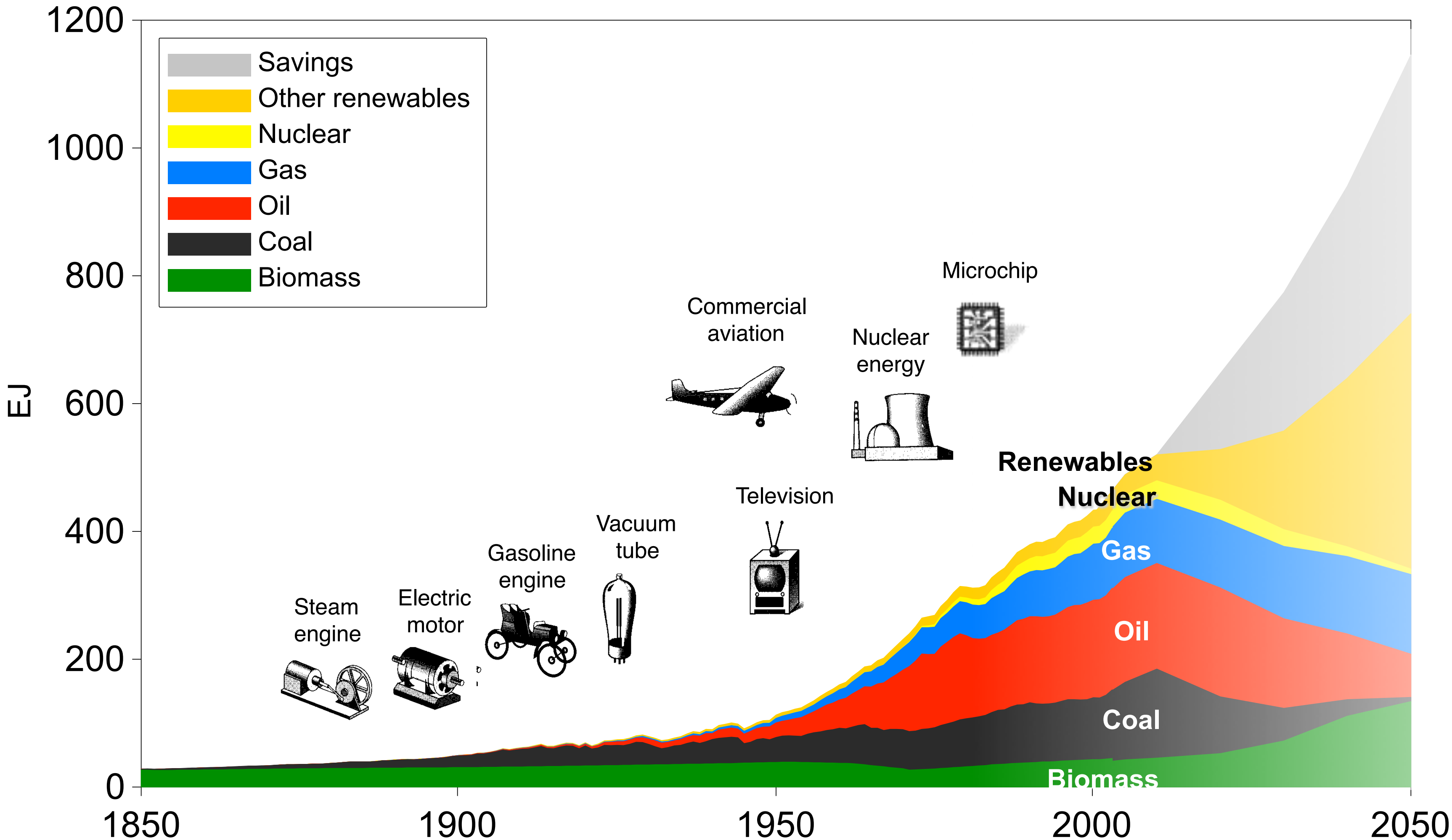
Source: Hasni, 2011

Global Primary Energy



Global Primary Energy

no CCS, no Nuclear



Source: Riahi et al, 2011

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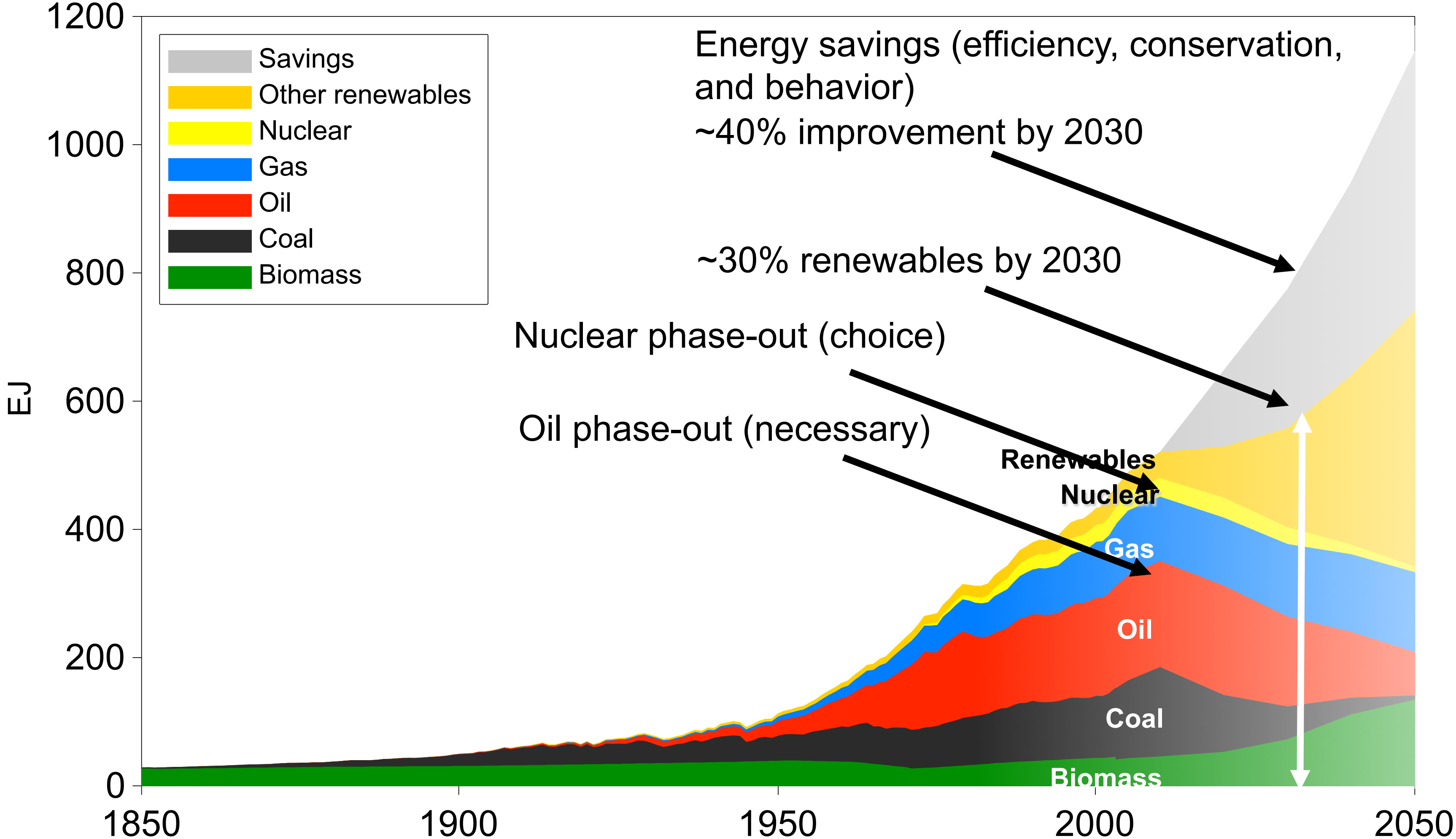
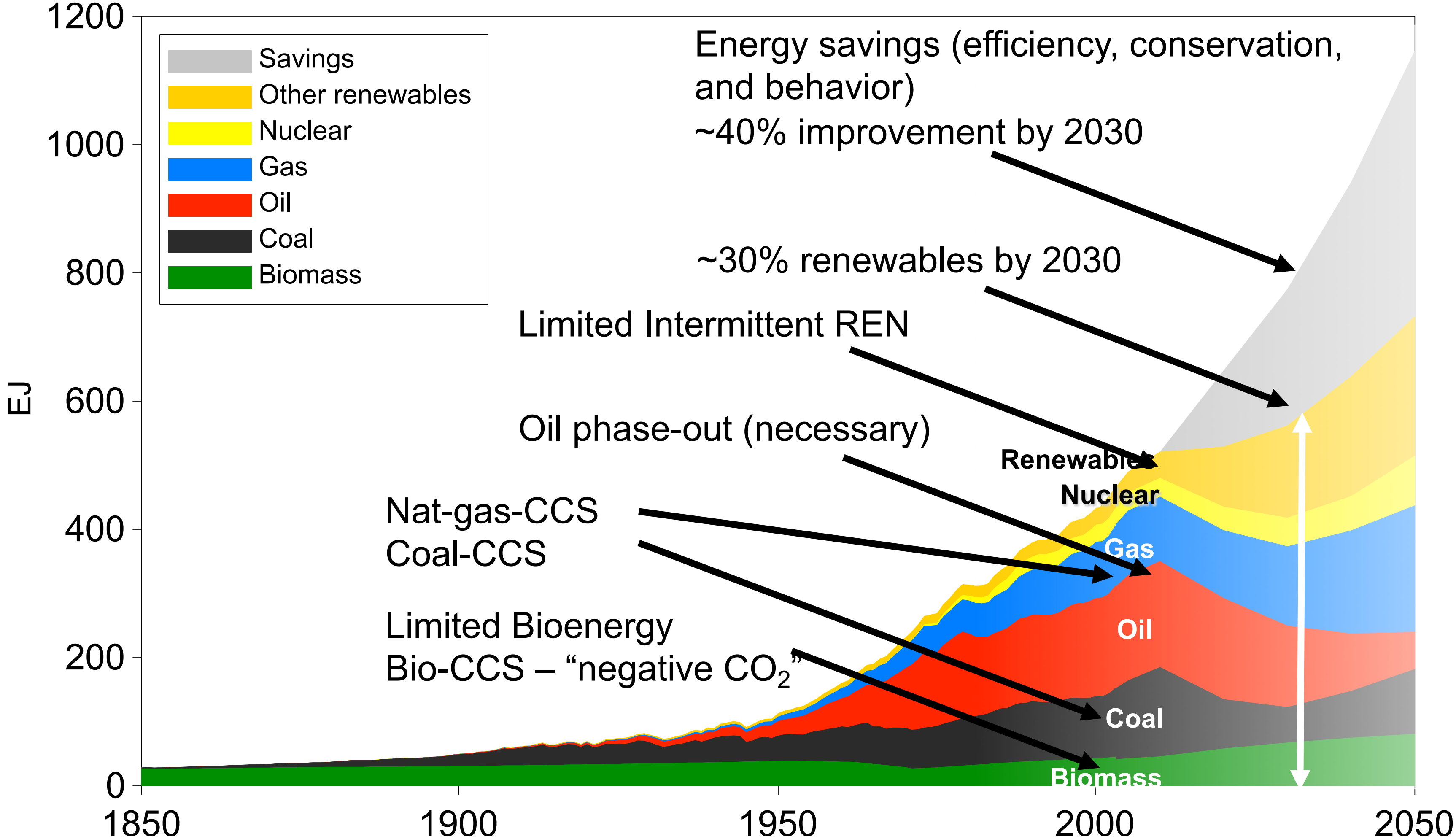


Source: Riahi et al, 2011

Global Primary Energy

lim. Bioenergy, lim. Intermittent REN



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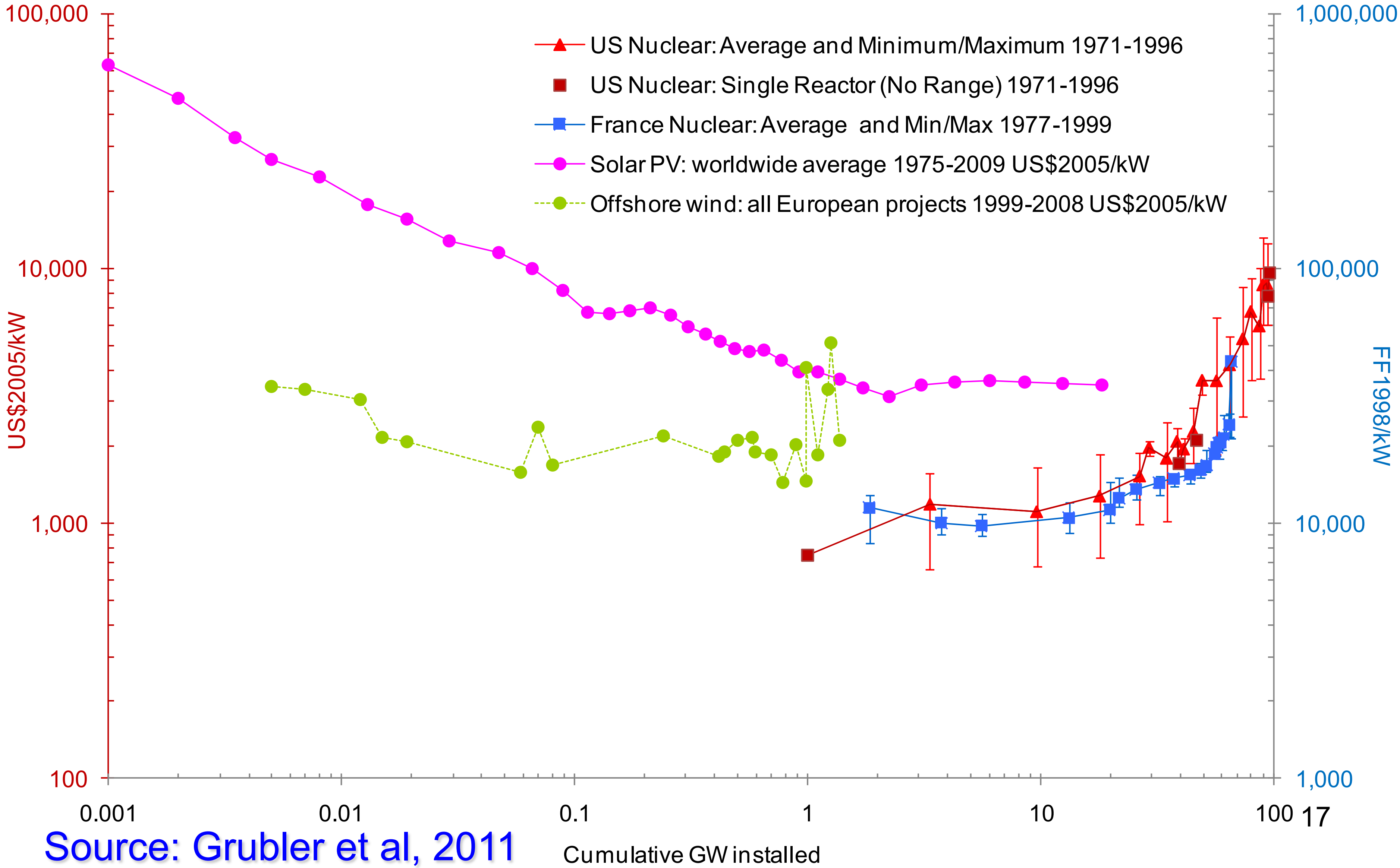
Global Energy Investments

Annual Energy Investments	Innovation RD&D [billion US$2005]	Markets Formation [billion US$2005]	Present Investments [billion US$2005]	Investment for SE4All [billion US$2005]
	2010	2010	2010	2010 - 2030
Efficiency	>> 8	~ 5	300	258 - 365[2]
Renewables	> 12	~ 20	200	259 - 406
Access	< 1	< 1	~ 9	36 - 41
Total	> 50	< 150	1250	1260 - 1680

Source: Grubler et al, & Riahi et al, 2011

Investment Costs

Photovoltaics, Offshore Wind and Nuclear



Source: Grubler et al, 2011

Example of savings by reconstruction

Before reconstruction

Reconstruction according to the passive house principle

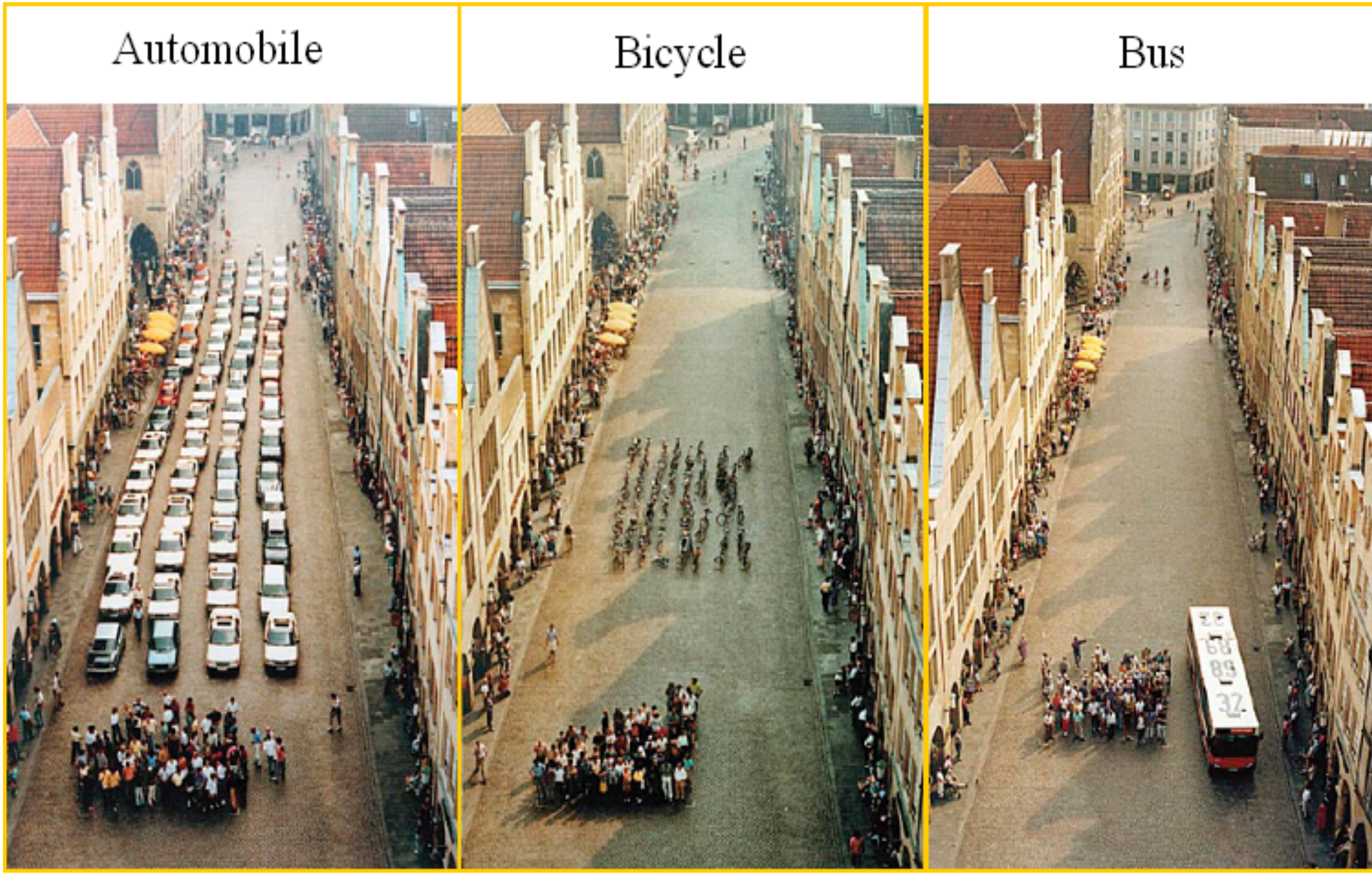
over 150 kWh/(m²a)

-90%

15 kWh/(m²a)

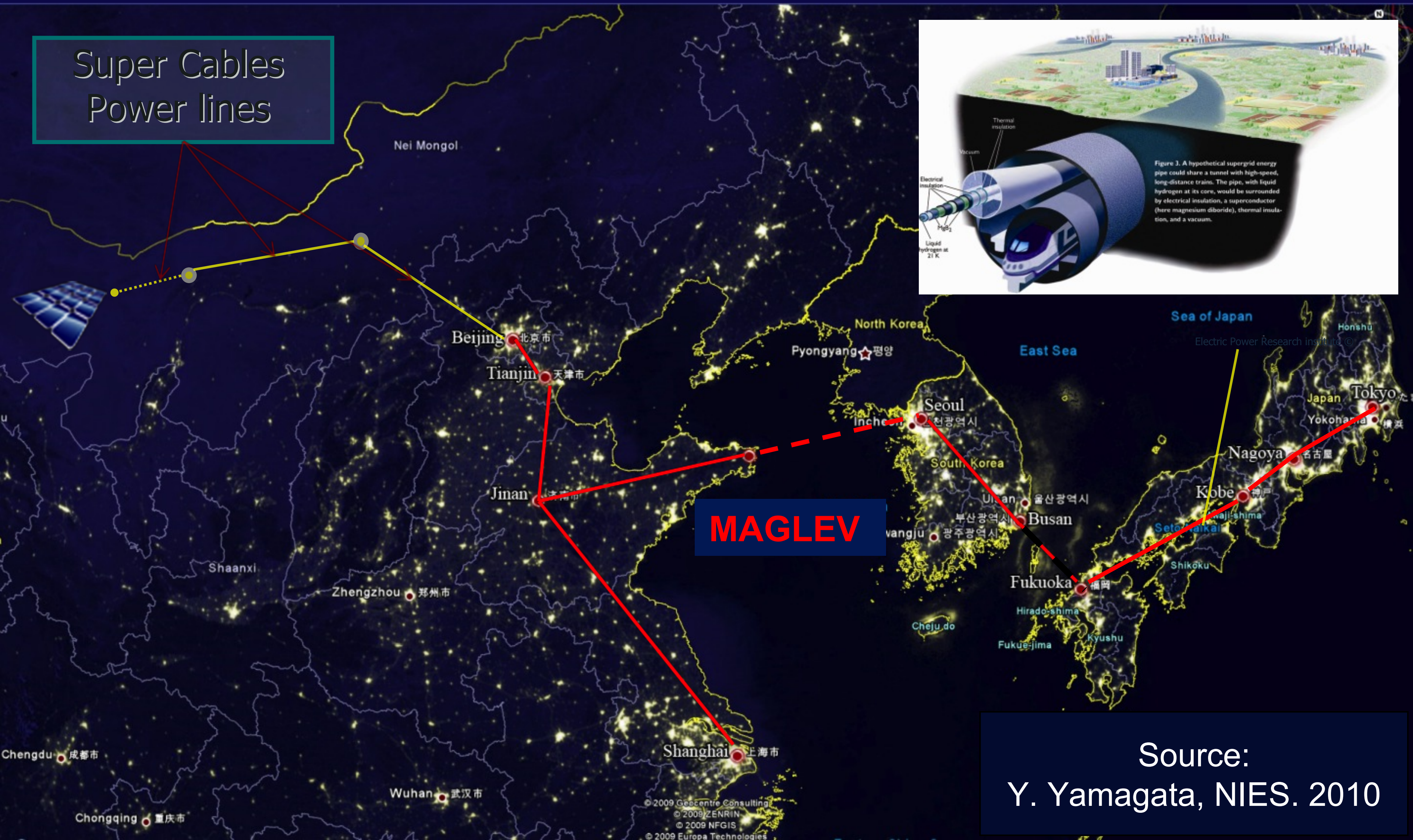
Source: Jan Barta, Center for Passive Buildings, www.pasivnidomy.cz, EEBW2006

Area Occupied by Various Transport Modes



Source: WBCSD, 2005

Potential Synergies between New Energy and Transport Infrastructures: Asian "Supergrid"



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Co-Benefits of Energy Investments

Based on IIASA-GEA: Riahi et al. 2010

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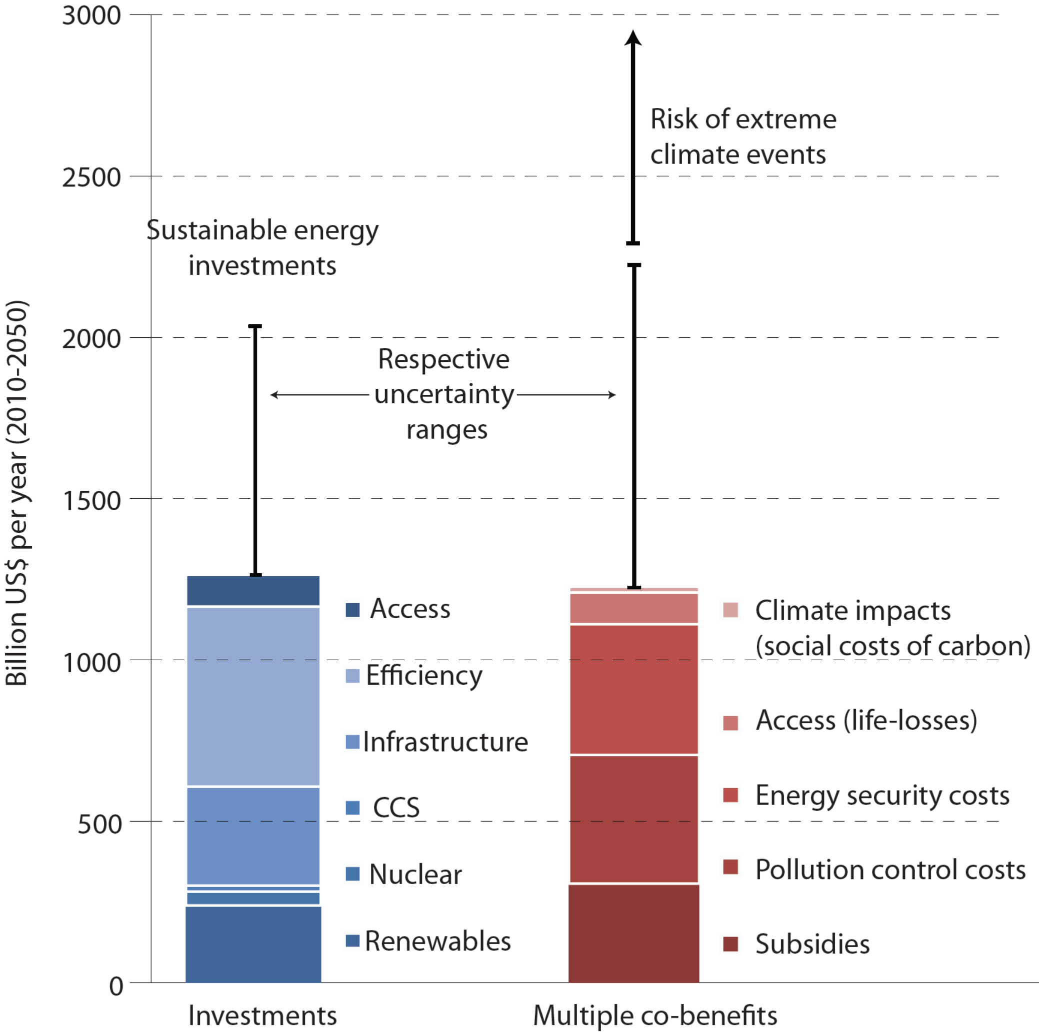

Multiple benefits include:

- Avoided climate change impacts (based on GEA pathways and estimated social cost of carbon from IPCC AR4, WGIII, chapter 3)
- Monetized health benefits due to universal en ergy access (based on GEA pathways and DALY estimates from WHO)
- Reduced need for energy security expenditures for limiting energy imports (due to higher reli ance on domestic renewables and efficiency): GEA estimate
- Avoided costs of pollution control due to application of zero-pollution technologies and efficiency enhancements (GEA)
- Avoided fossil fuel subsidies (GEA estimate)

Based on IIASA-GEA: Riahi et al. 2010