Can future energy needs be met through more integrated infrastructures?

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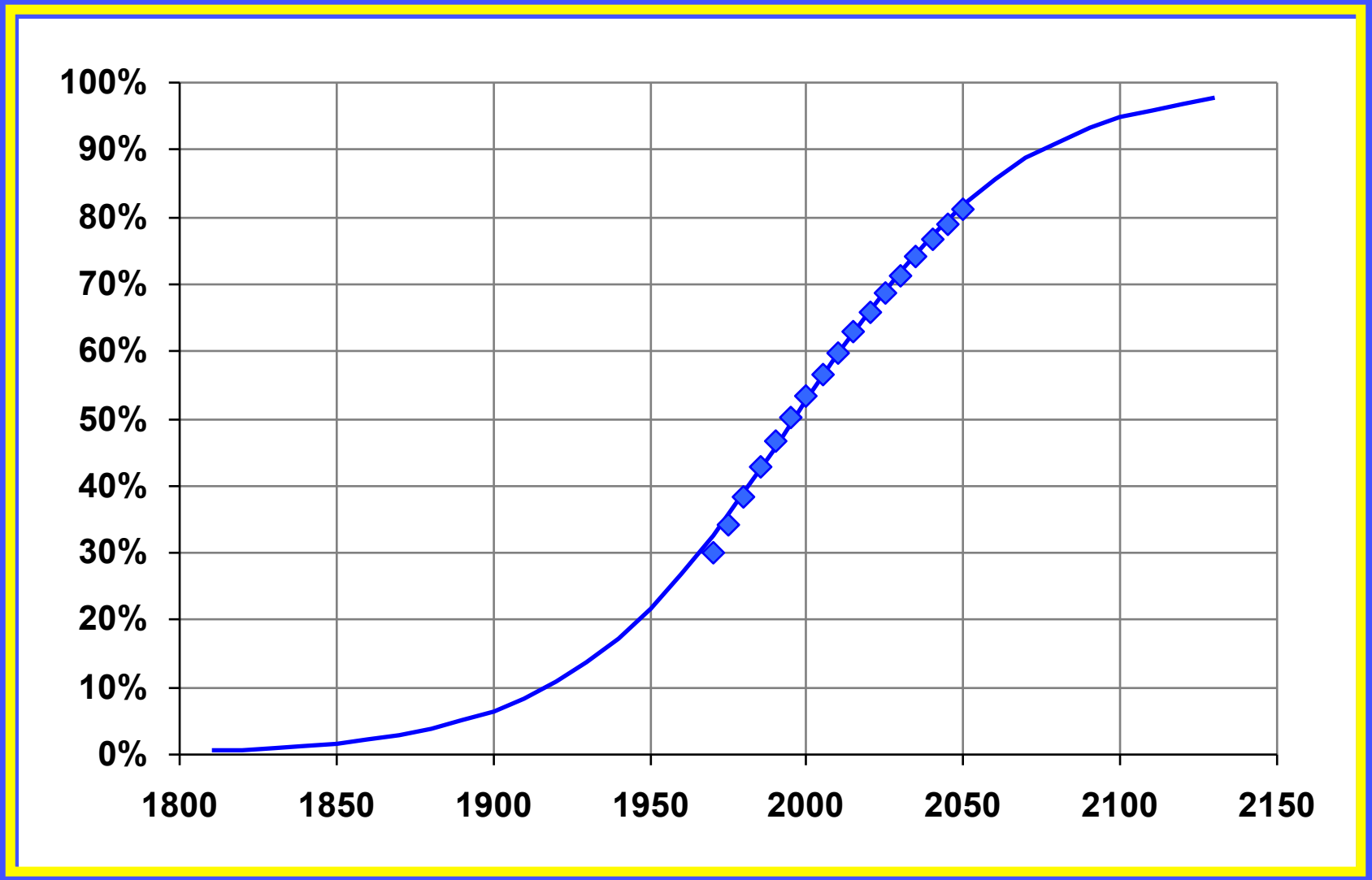
Brainstorming Workshop on Transporting Tens of Gigawatts of Green Power to the Market, Institute for Advanced Sustainability Studies
Kleist Villa, Potsdam – 12-13 May 2011

Education


100%
90%
80%
70%
60%
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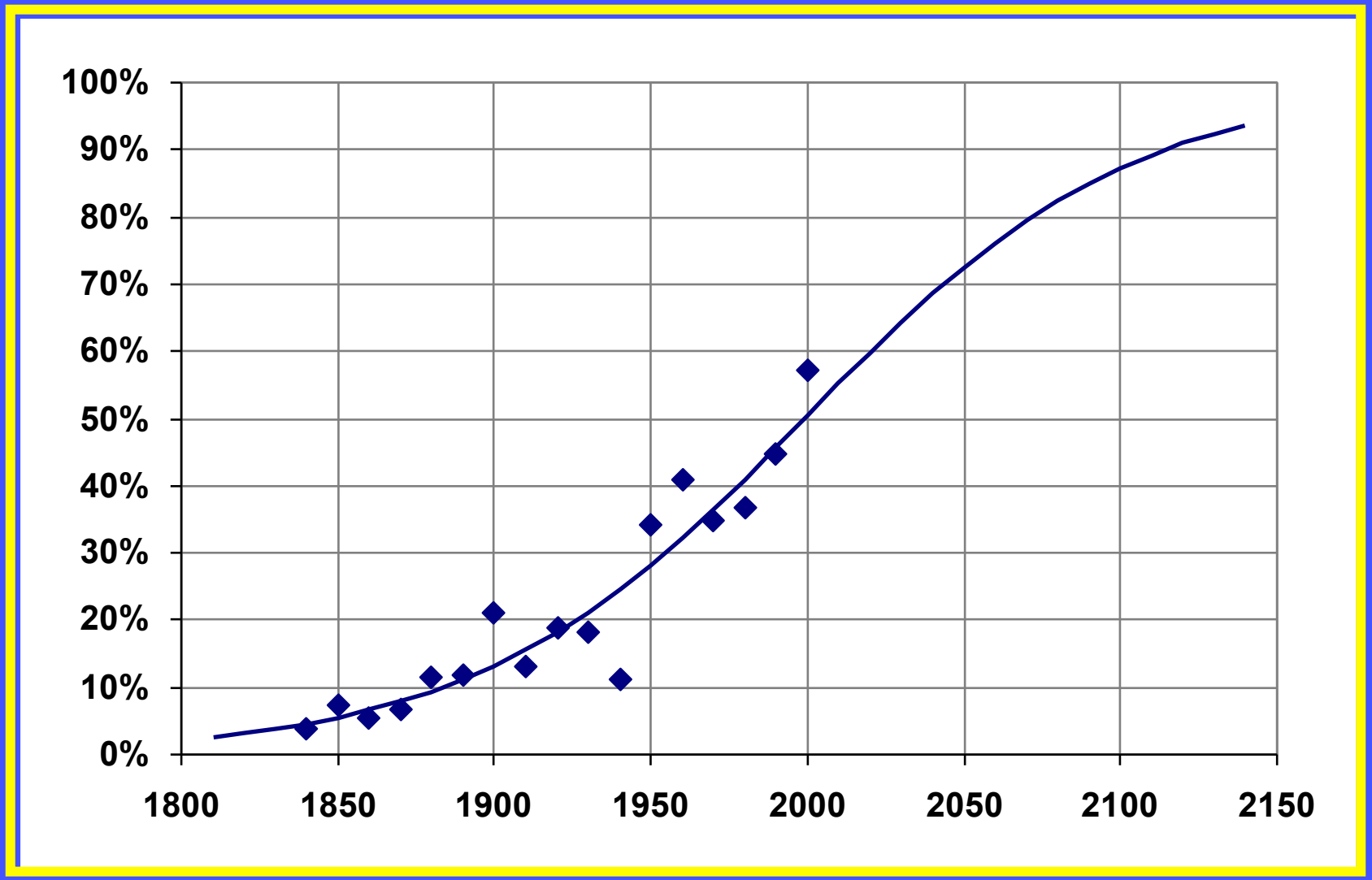
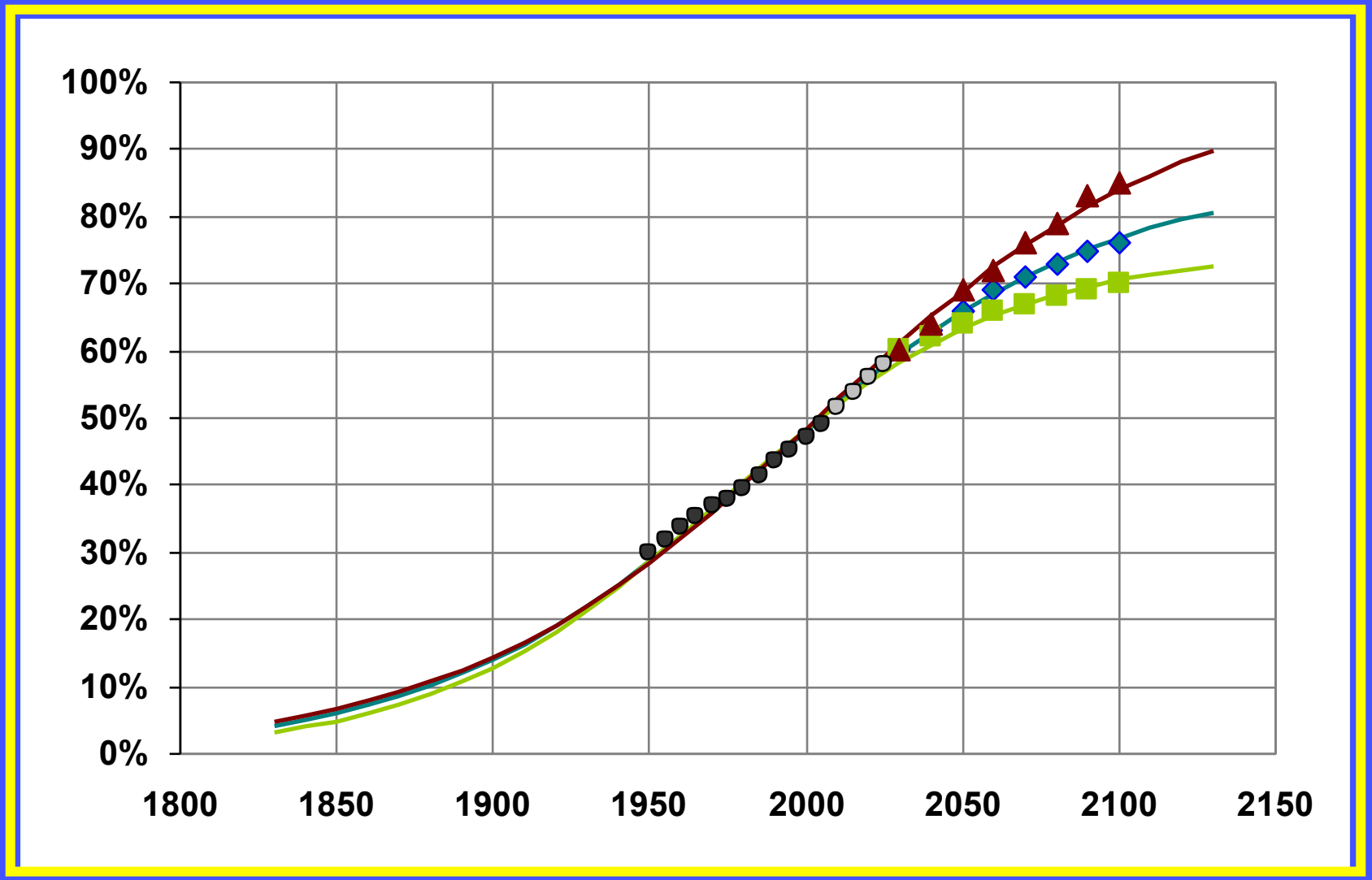
0%
1800
1850
1900
1950
2000
2050
2100
2150

Democratization

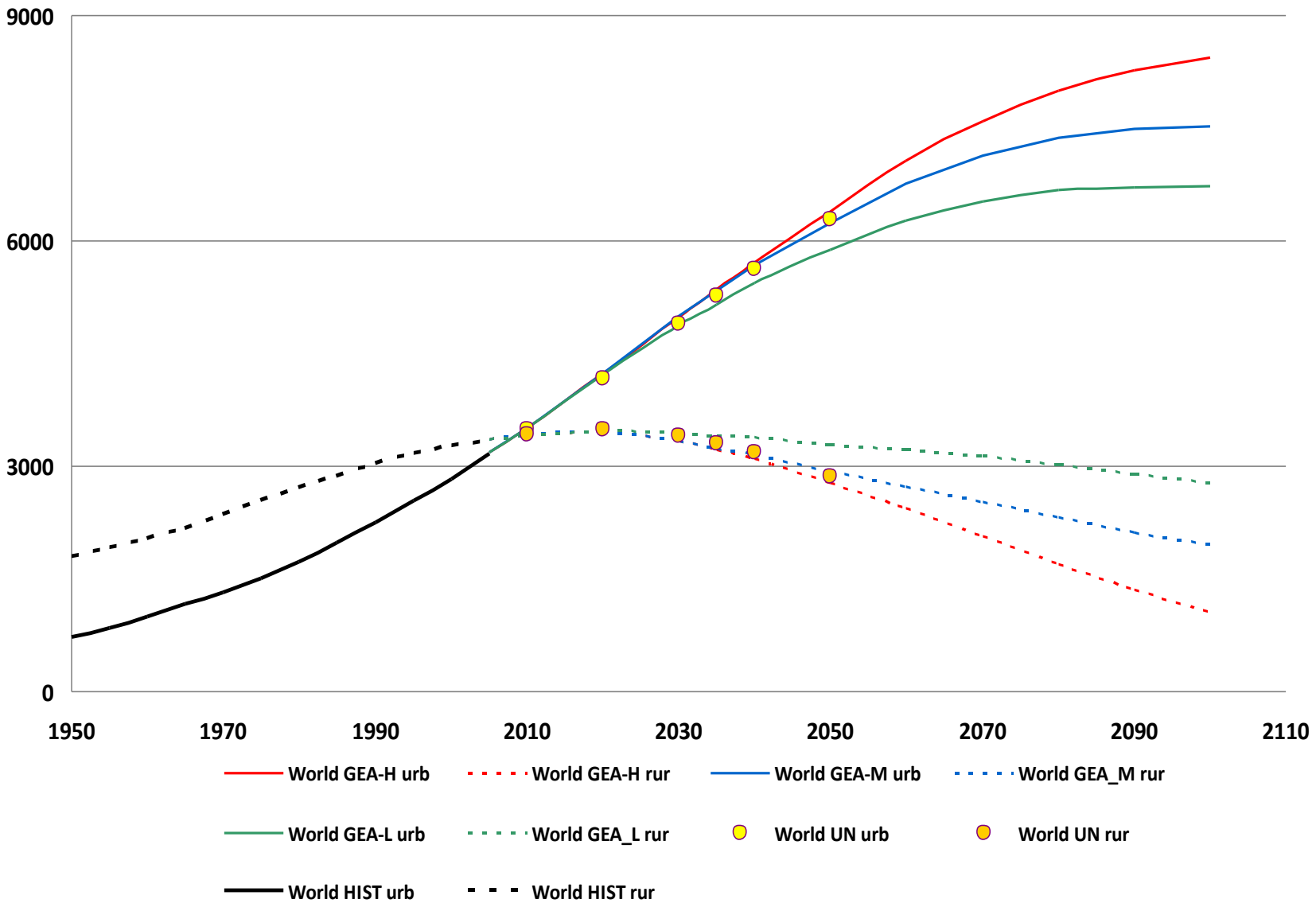


Urbanization

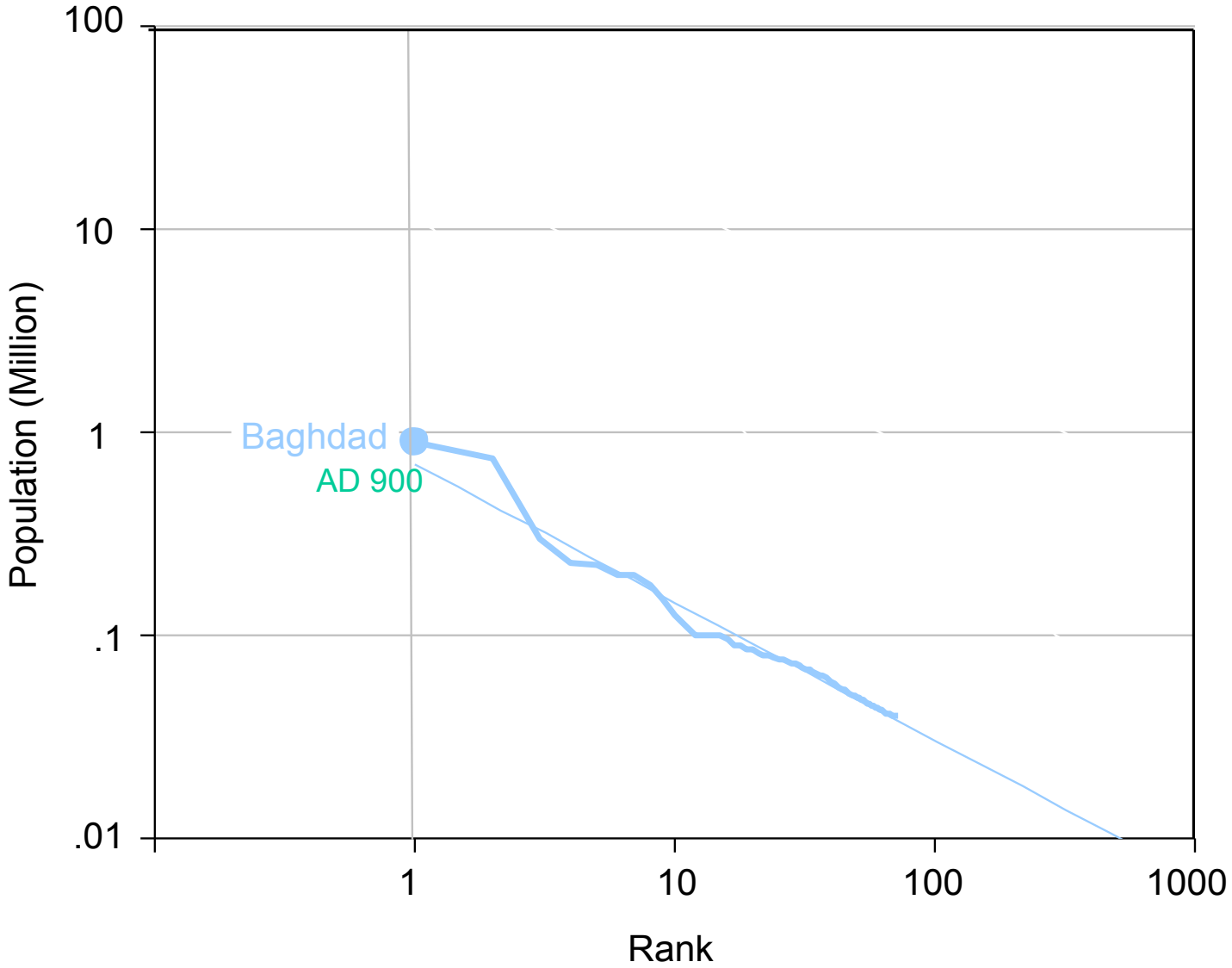


Urban and Rural Population Projections

(in Millions: GEA-H, GEA-M, GEA-L and UN WUP, 2010)



City Hierarchies (Rank Size)



Source: Gruebler et al, 2009

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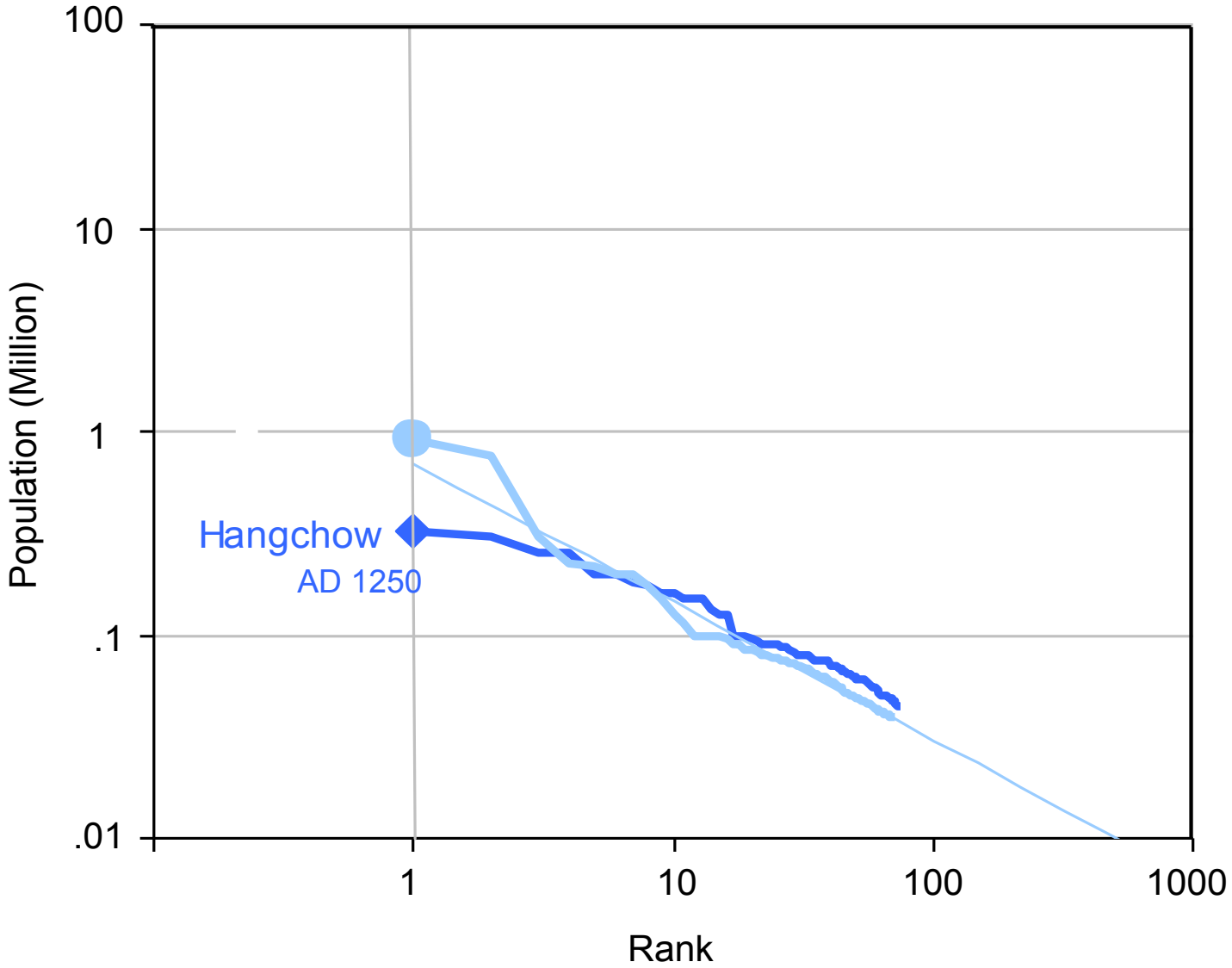

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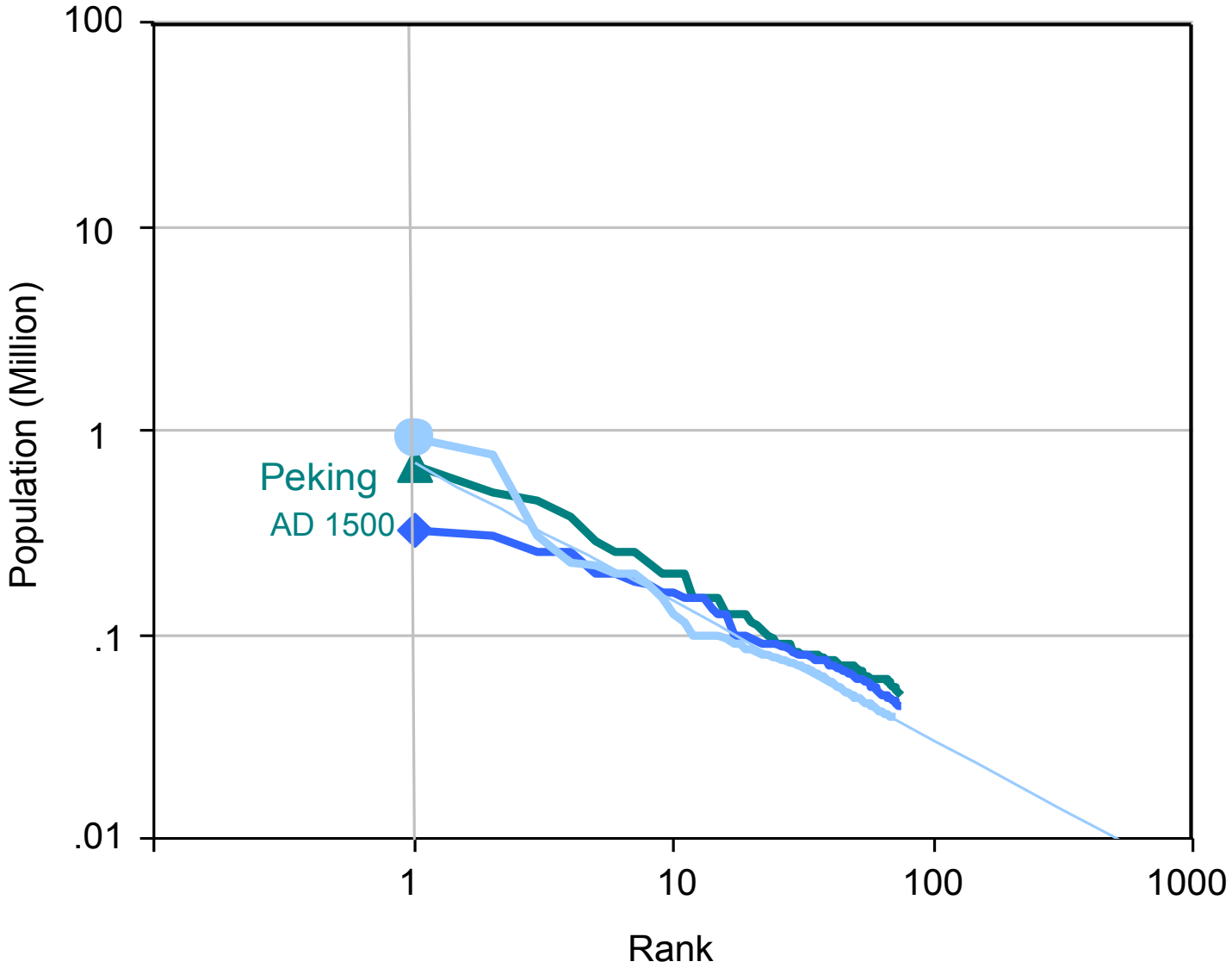

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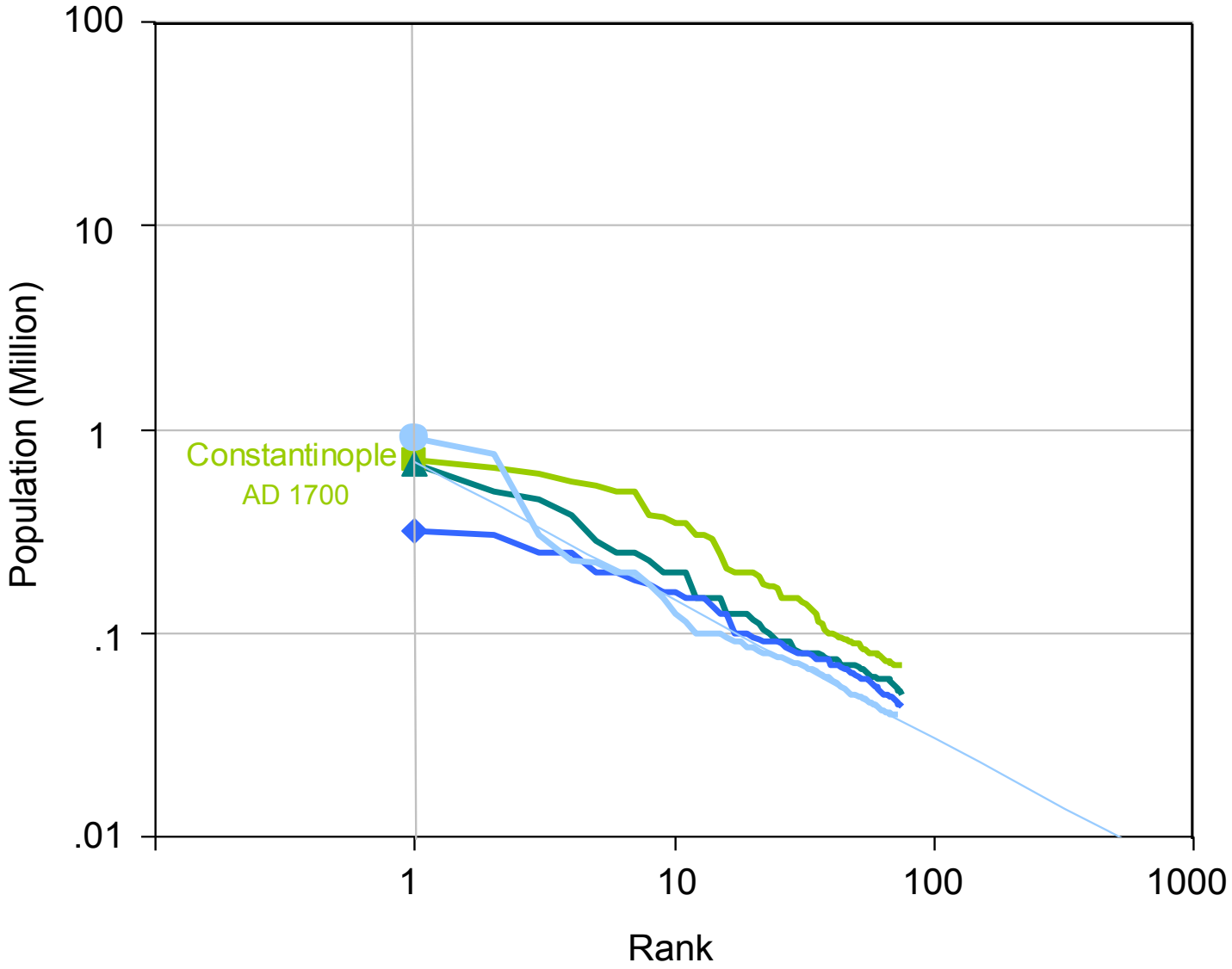

Source: Gruebler et al, 2009

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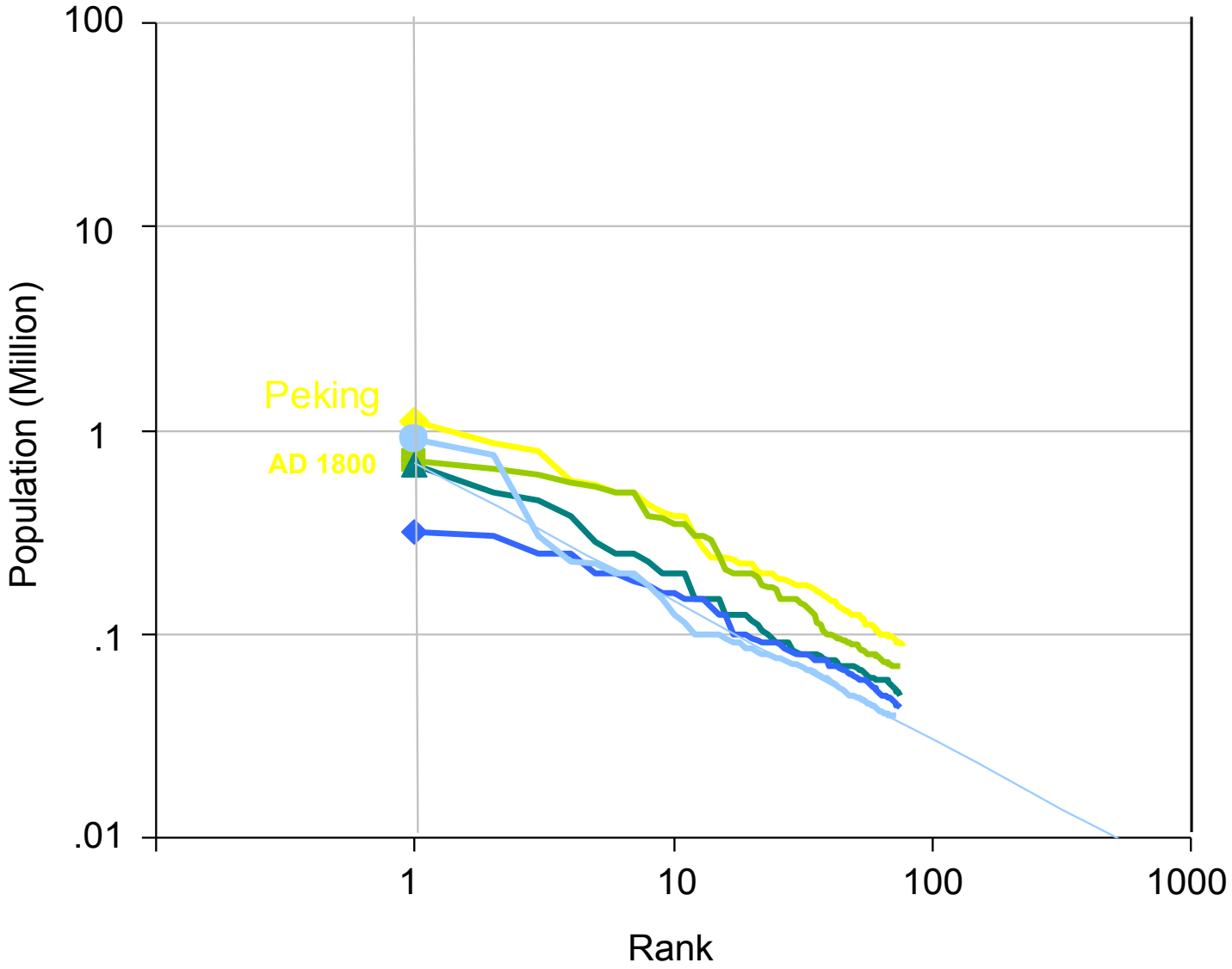

Source: Gruebler et al, 2009

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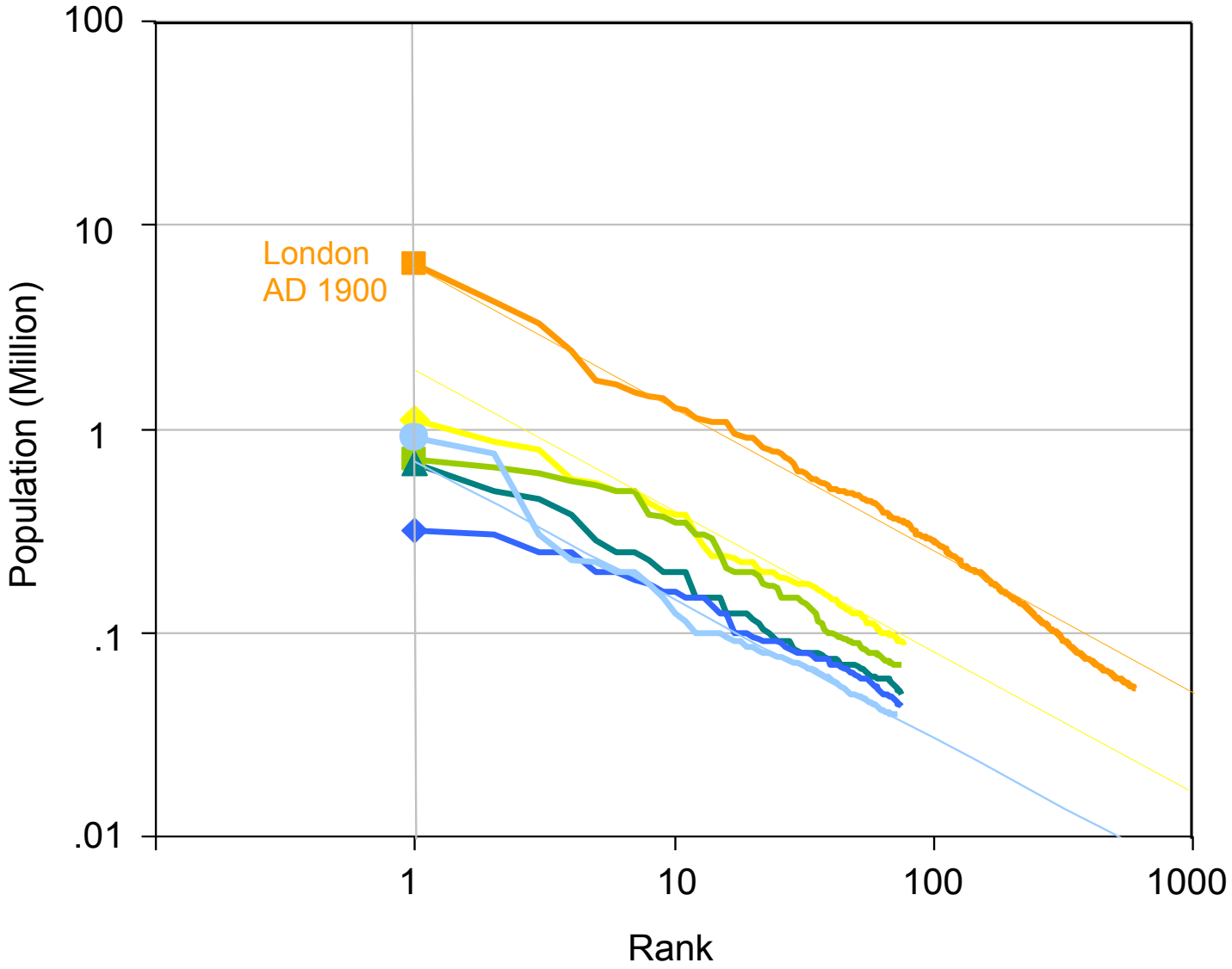
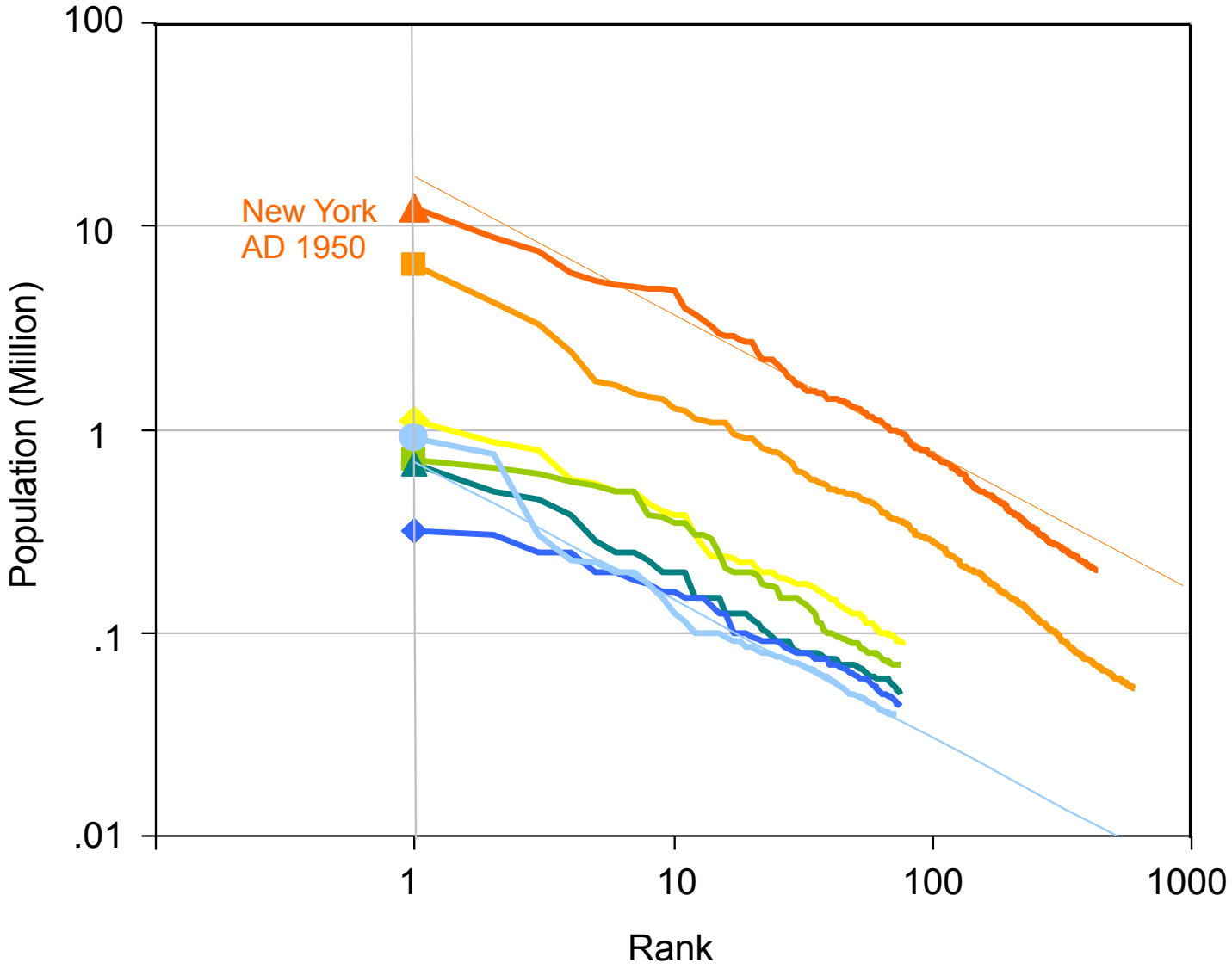


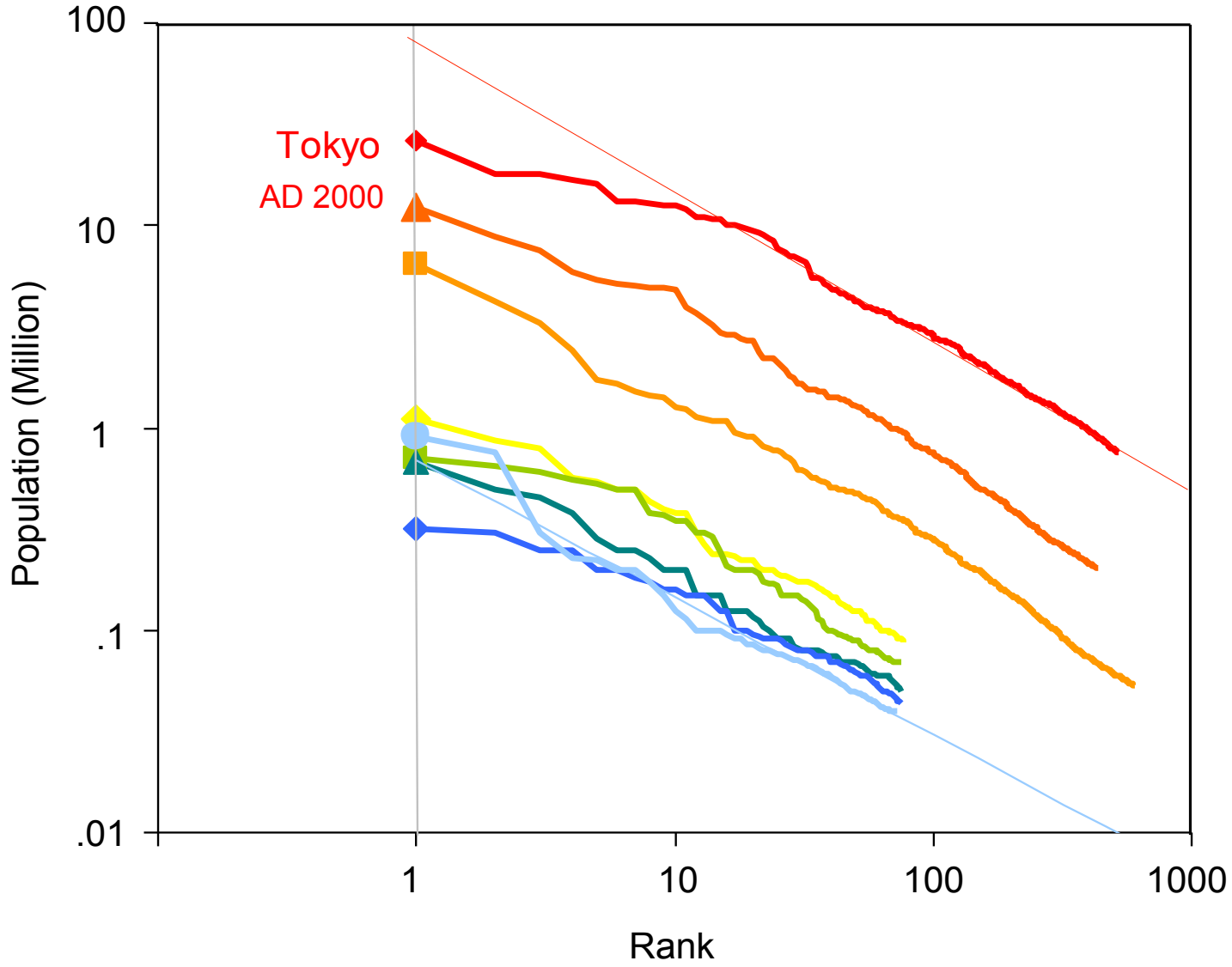
Source: Gruebler et al, 2009

City Hierarchies (Rank Size)



Source: Gruebler et al, 2009

City Hierarchies (Rank Size)



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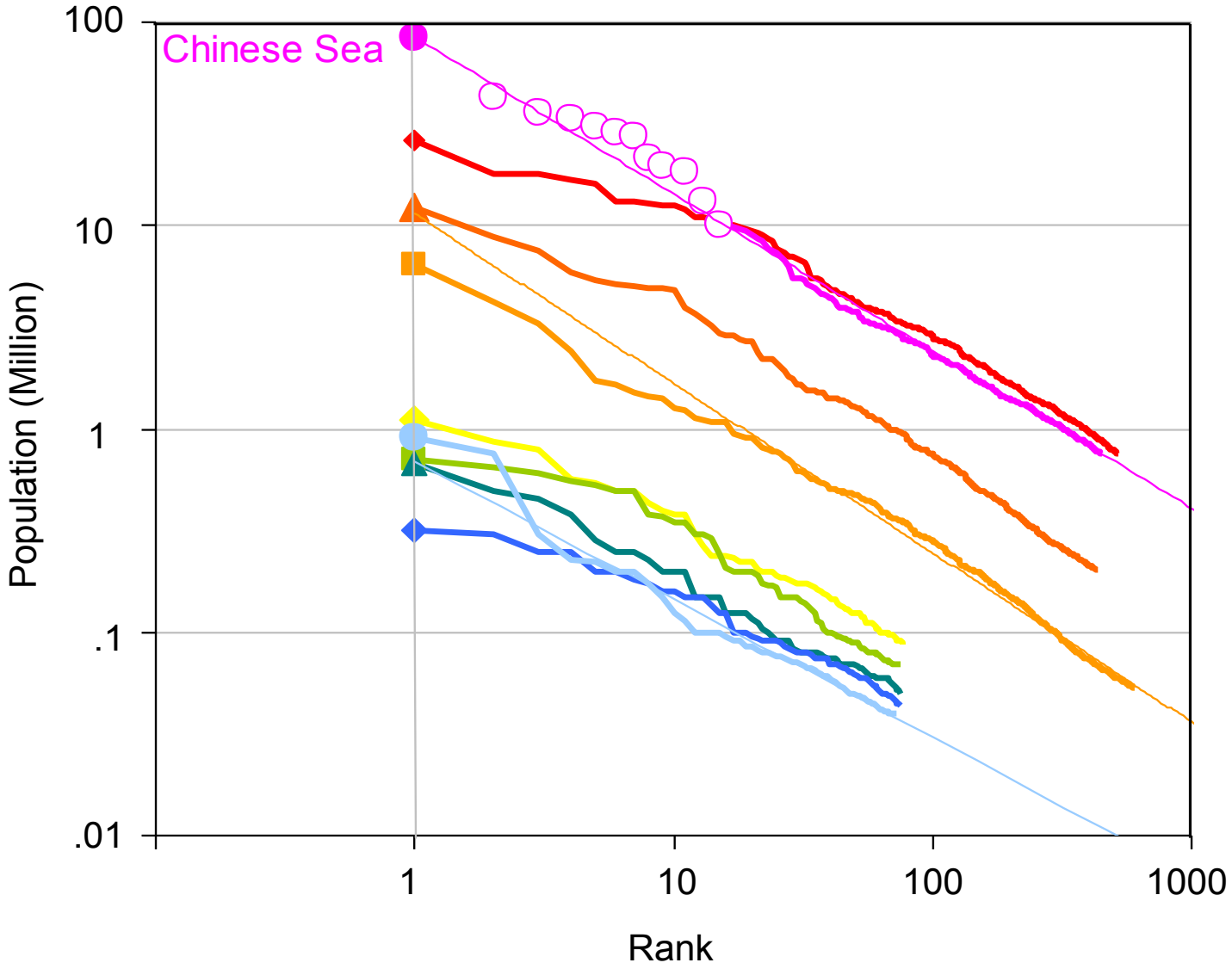
City Hierarchies (Rank Size)



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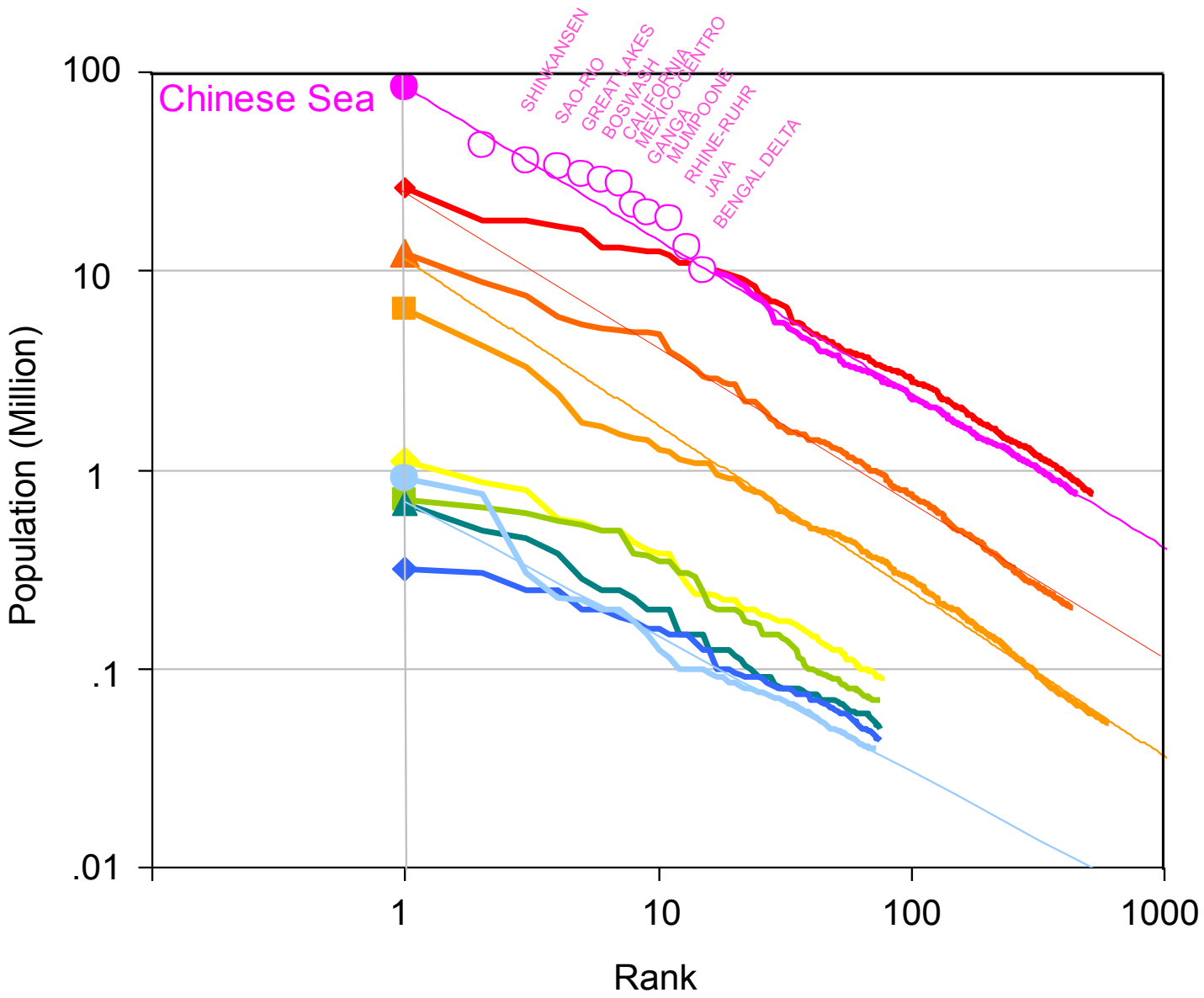


Source: Gruebler et al, 2009

Confronting the Challenges of Energy for Sustainable Development: The Role of Scientific and Technical Analysis

IIASA

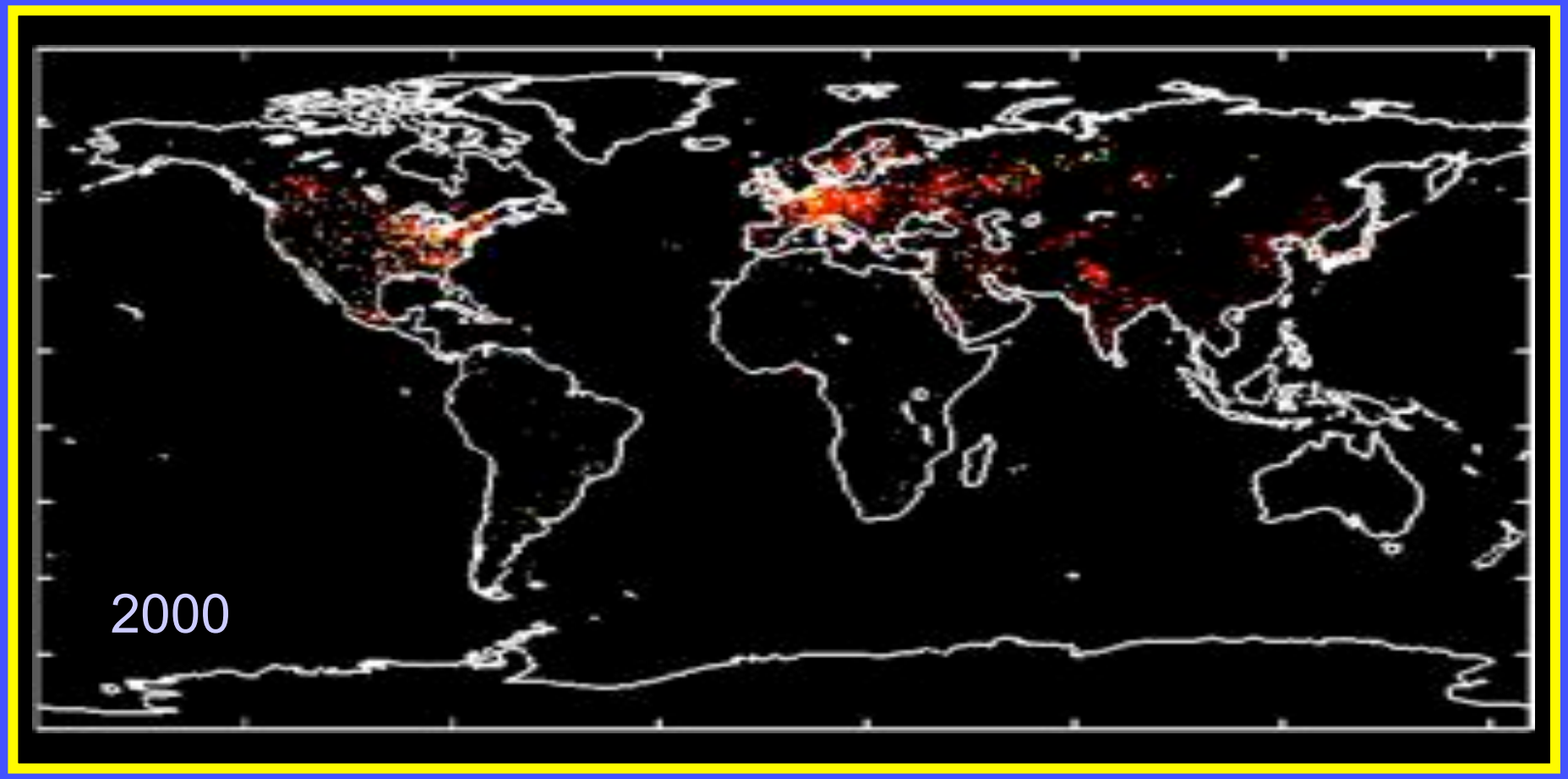
International Institute for Applied Systems Analysis
and its international partners present

www.GlobalEnergyAssessment.org

Towards a more Sustainable Future

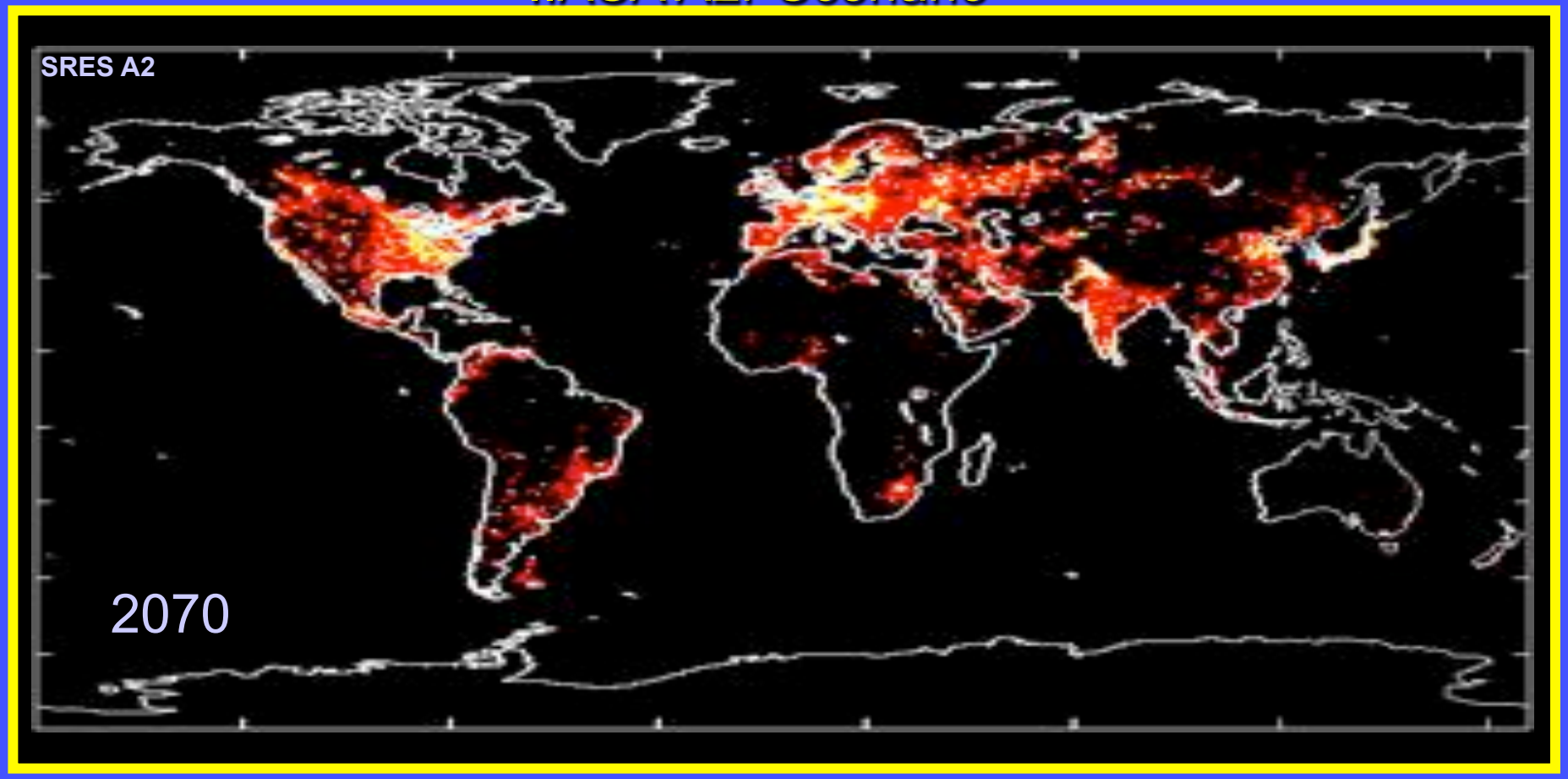
- Energy is a crucial development goal for responding to challenges in the 21st century
- Universal access is a pre-condition for overcoming poverty and feasible if all stake-holders work together.
- Energy transformation will bring multiple co-benefits for health, security, climate change
- Financing requirements are huge but achievable with right and sustained policies

Night Lights



Night Lights

IIASA A2r Scenario

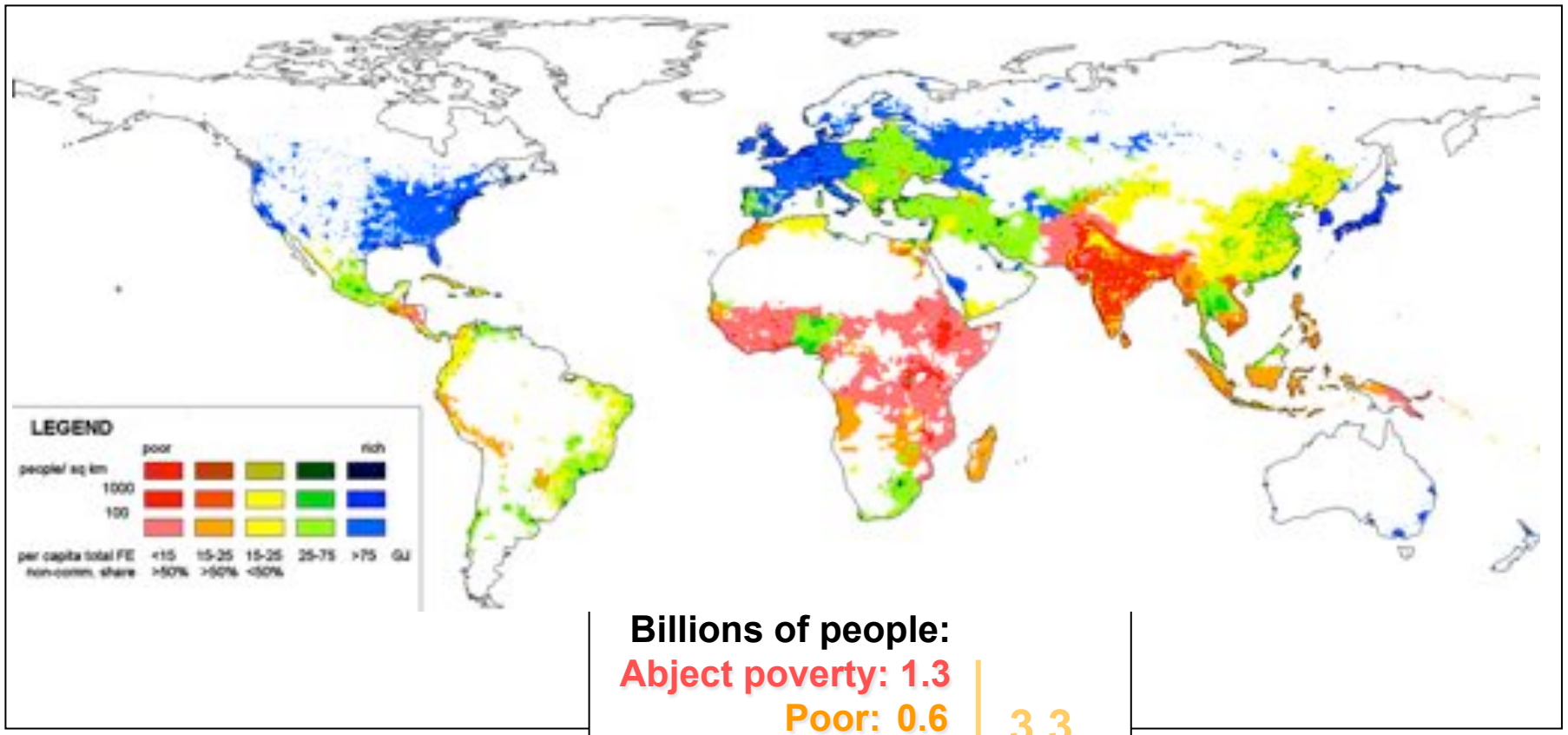


Global Energy Transformations

- 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

Mapping Energy Access

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

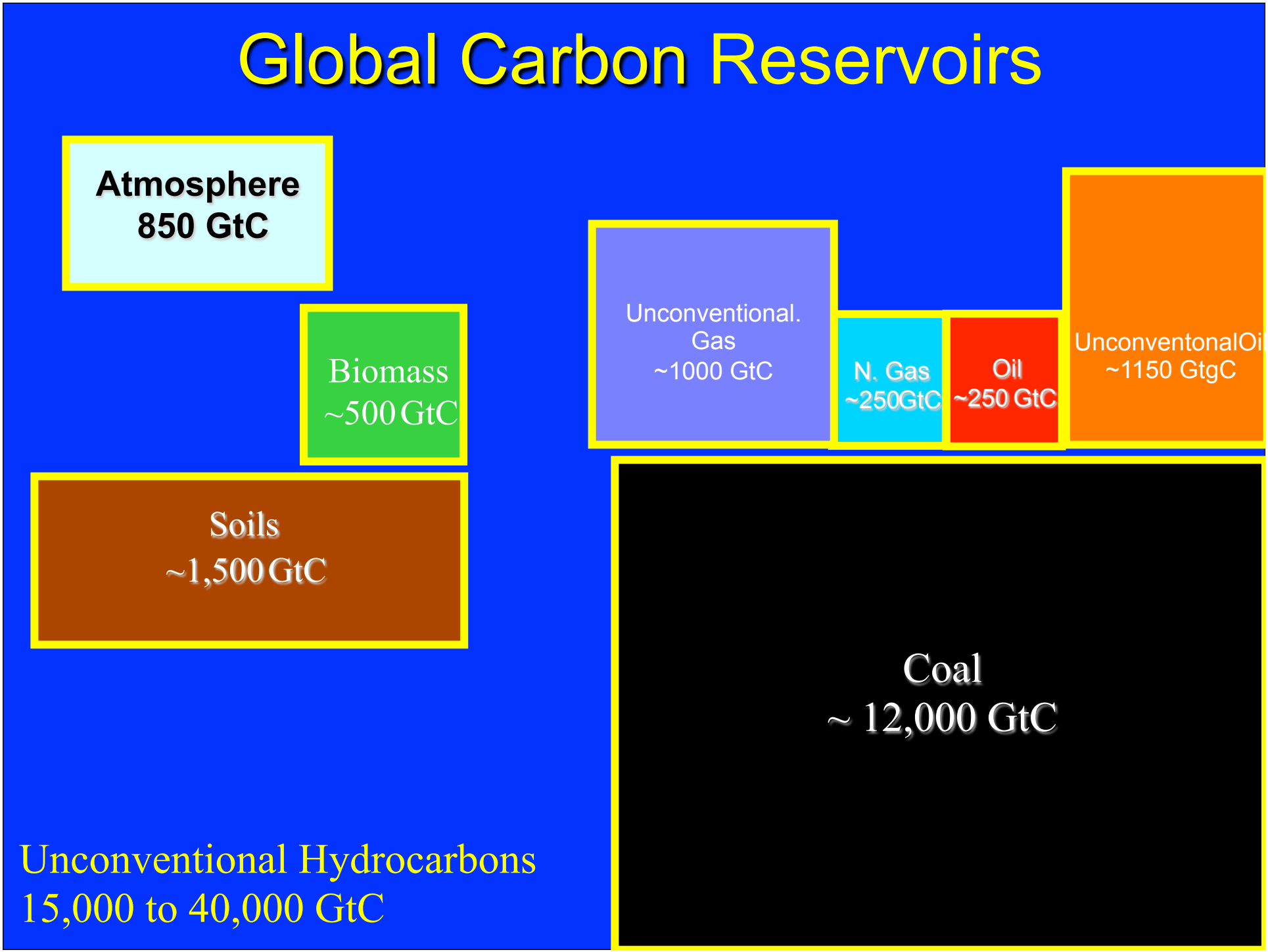


Billions of people:

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

Source: Gruebler et al, 2009

Global Carbon Reservoirs

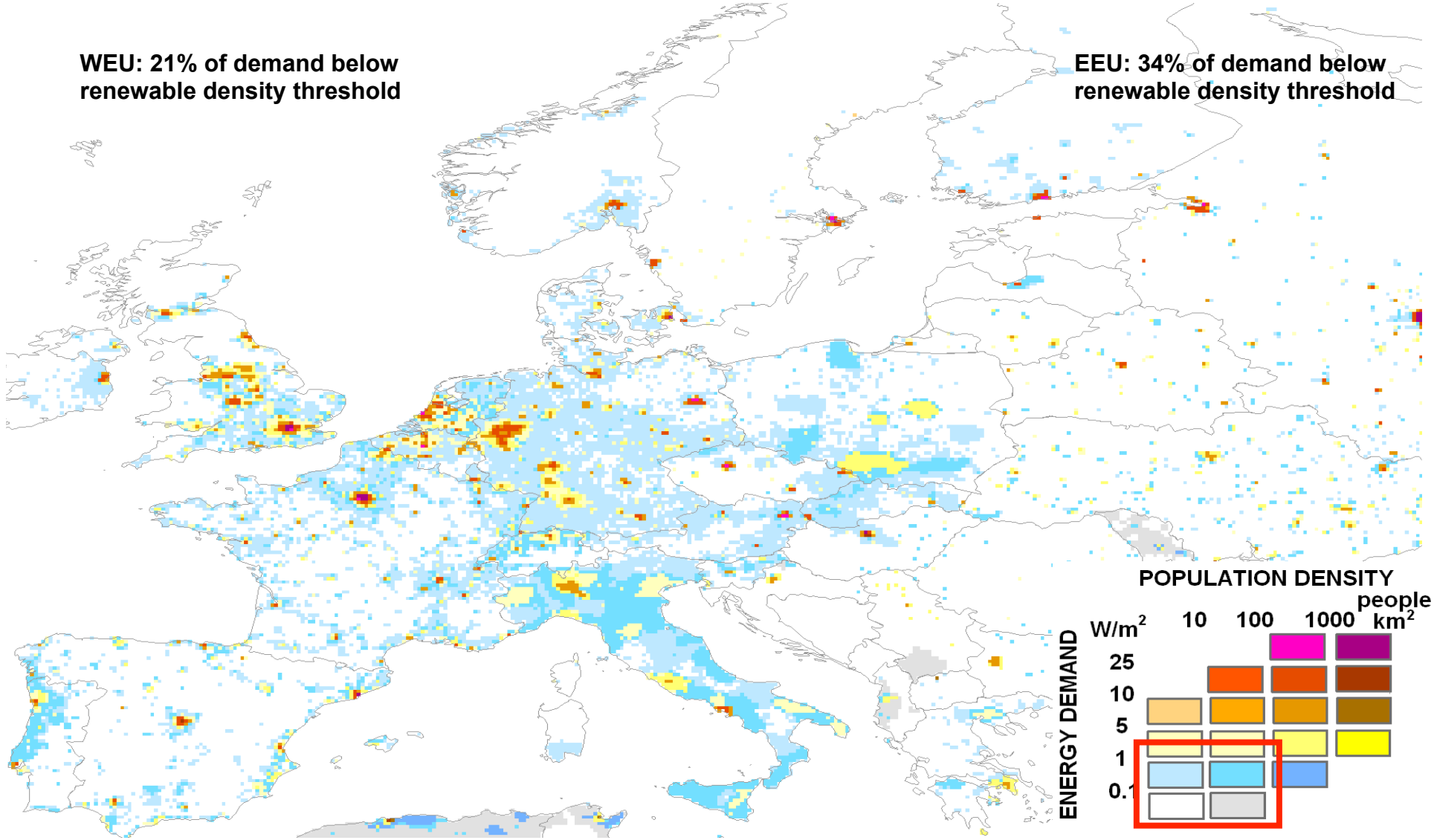


Unconventional Hydrocarbons
15,000 to 40,000 GtC

Europe Population vs. Energy Demand Density

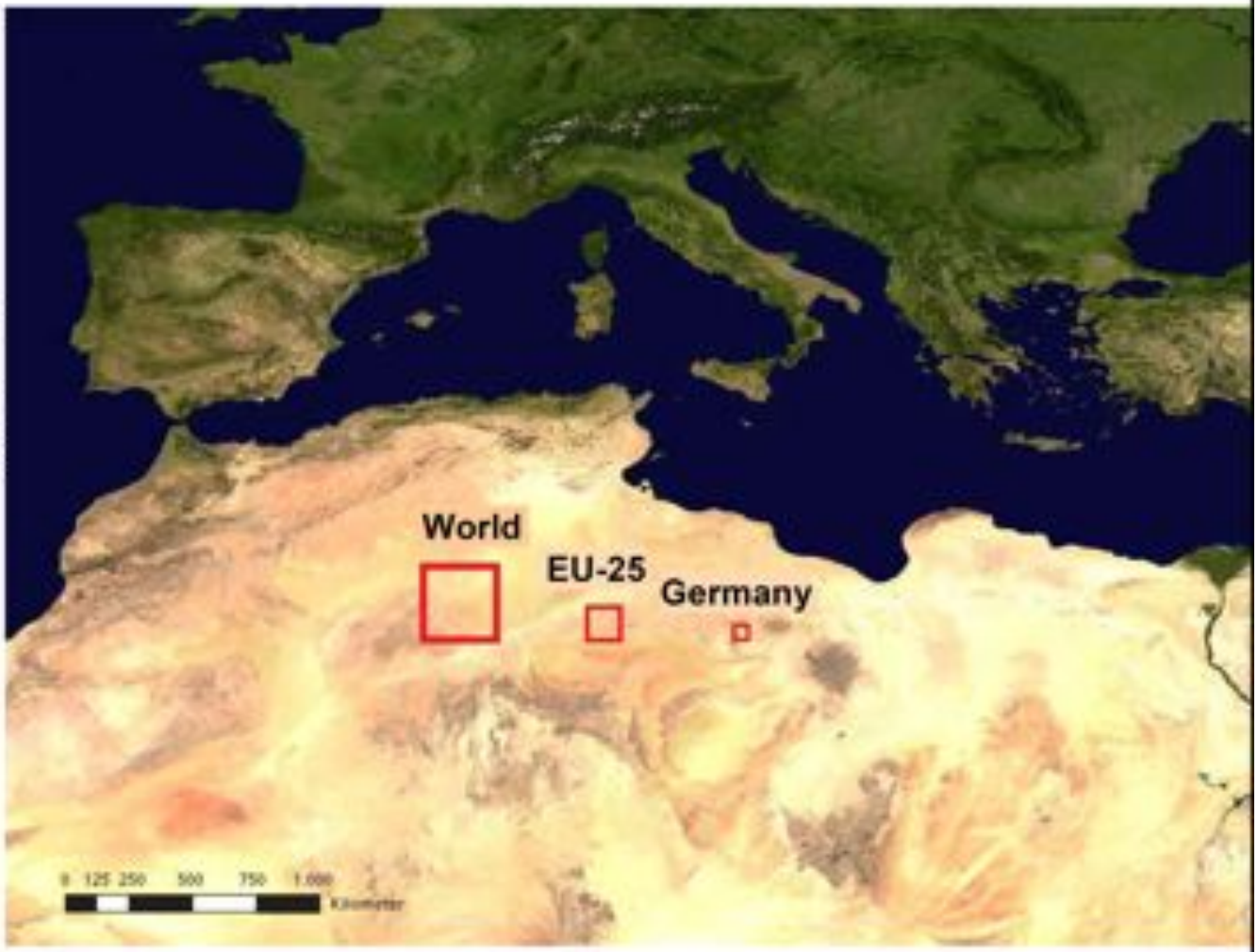
WEU: 21% of demand below renewable density threshold

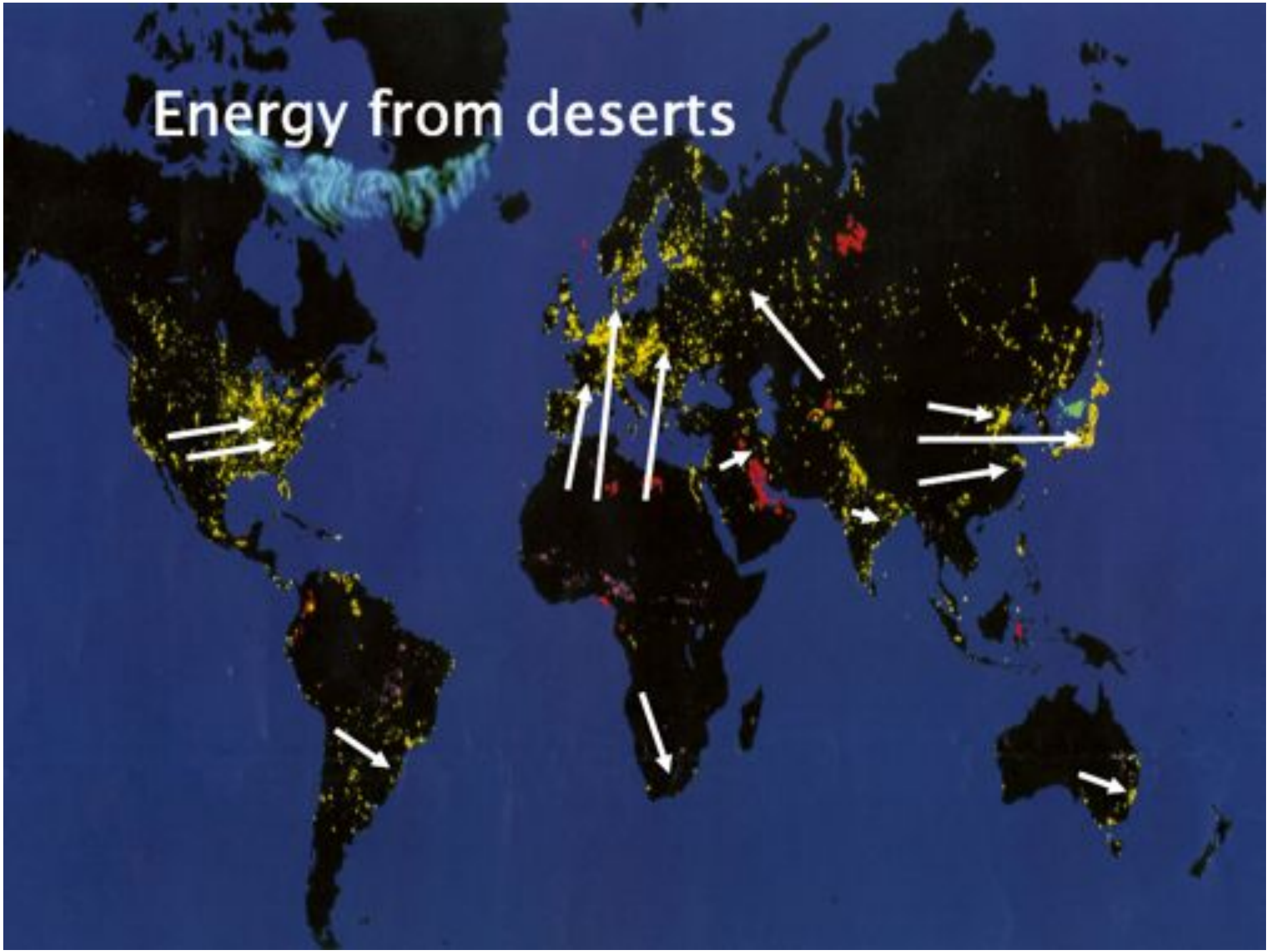
EEU: 34% of demand below renewable density threshold



Required desert area for the sustainable supply of electricity

World 300 x 300 km²
EU-25 150 x 150 km²
Germany 50 x 50 km²




Energy from deserts

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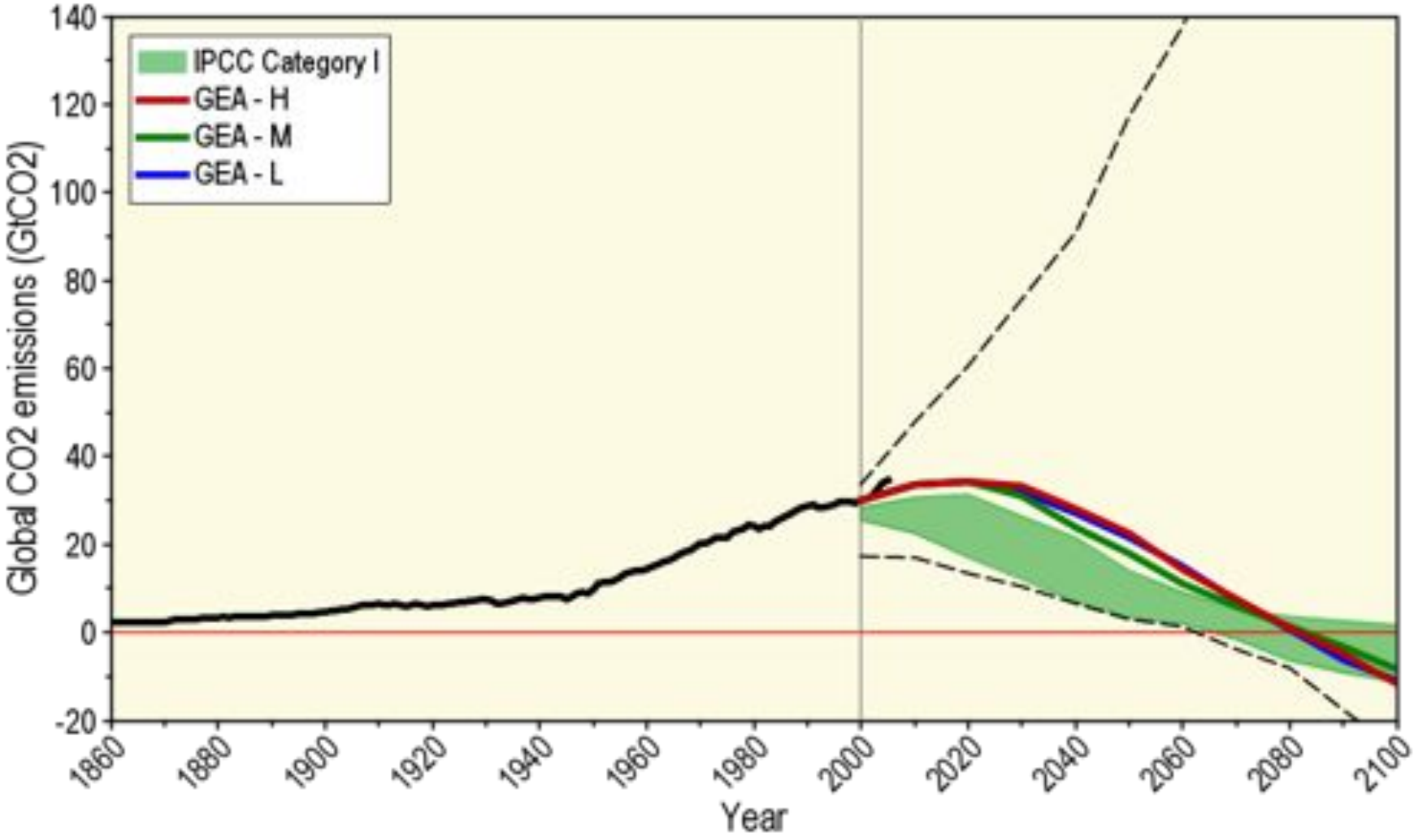
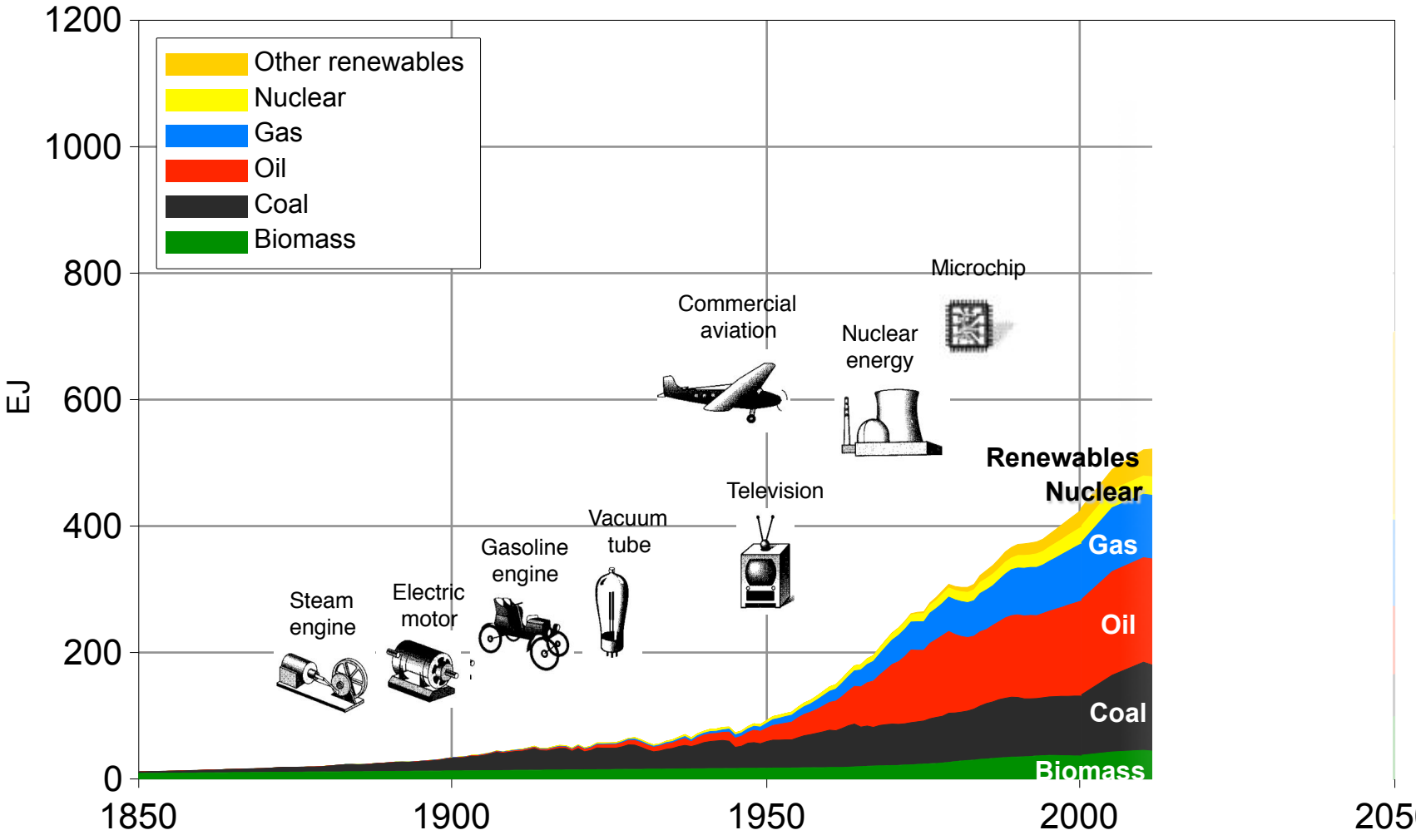
Global Carbon Emissions

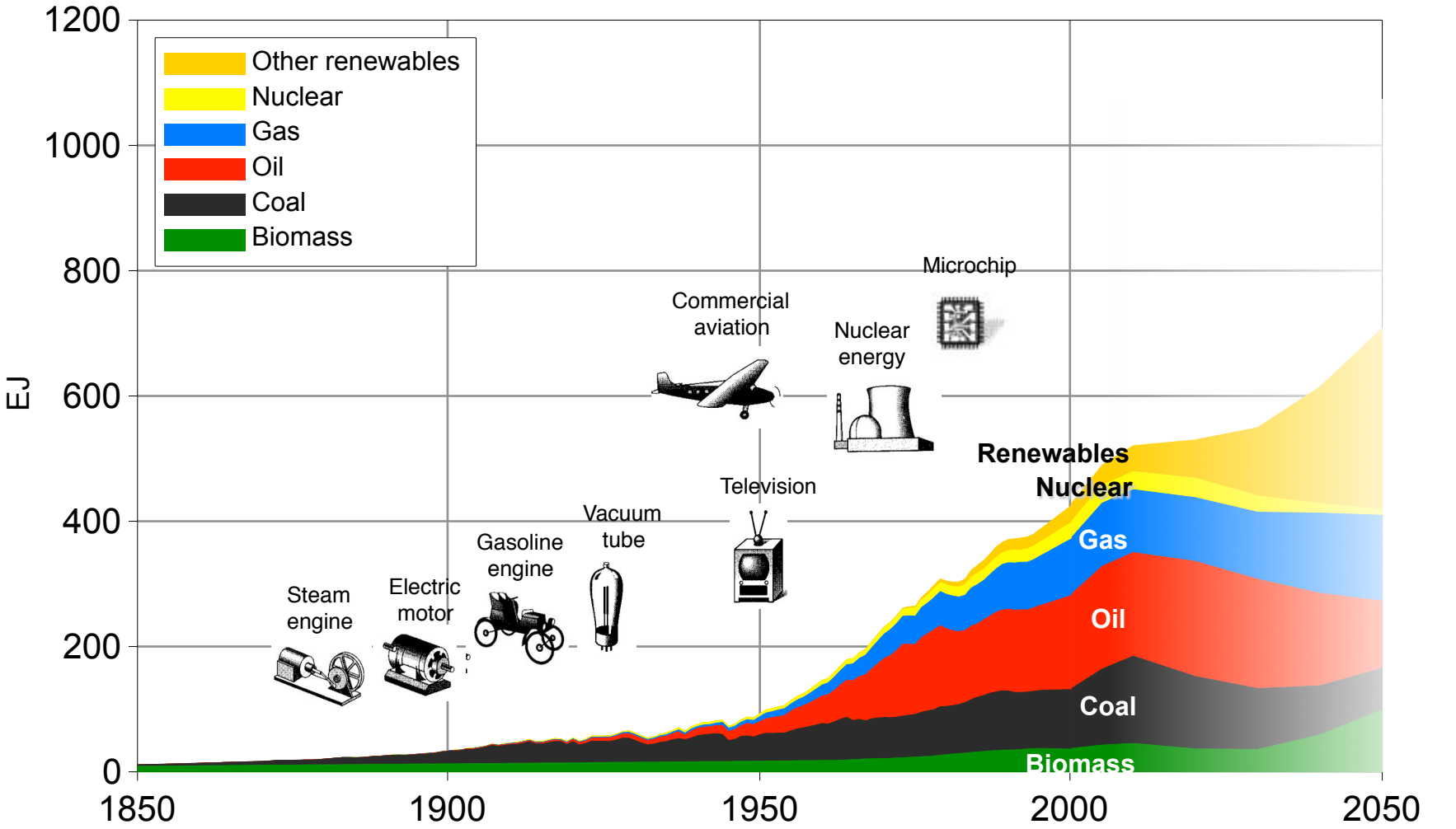


Global Primary Energy



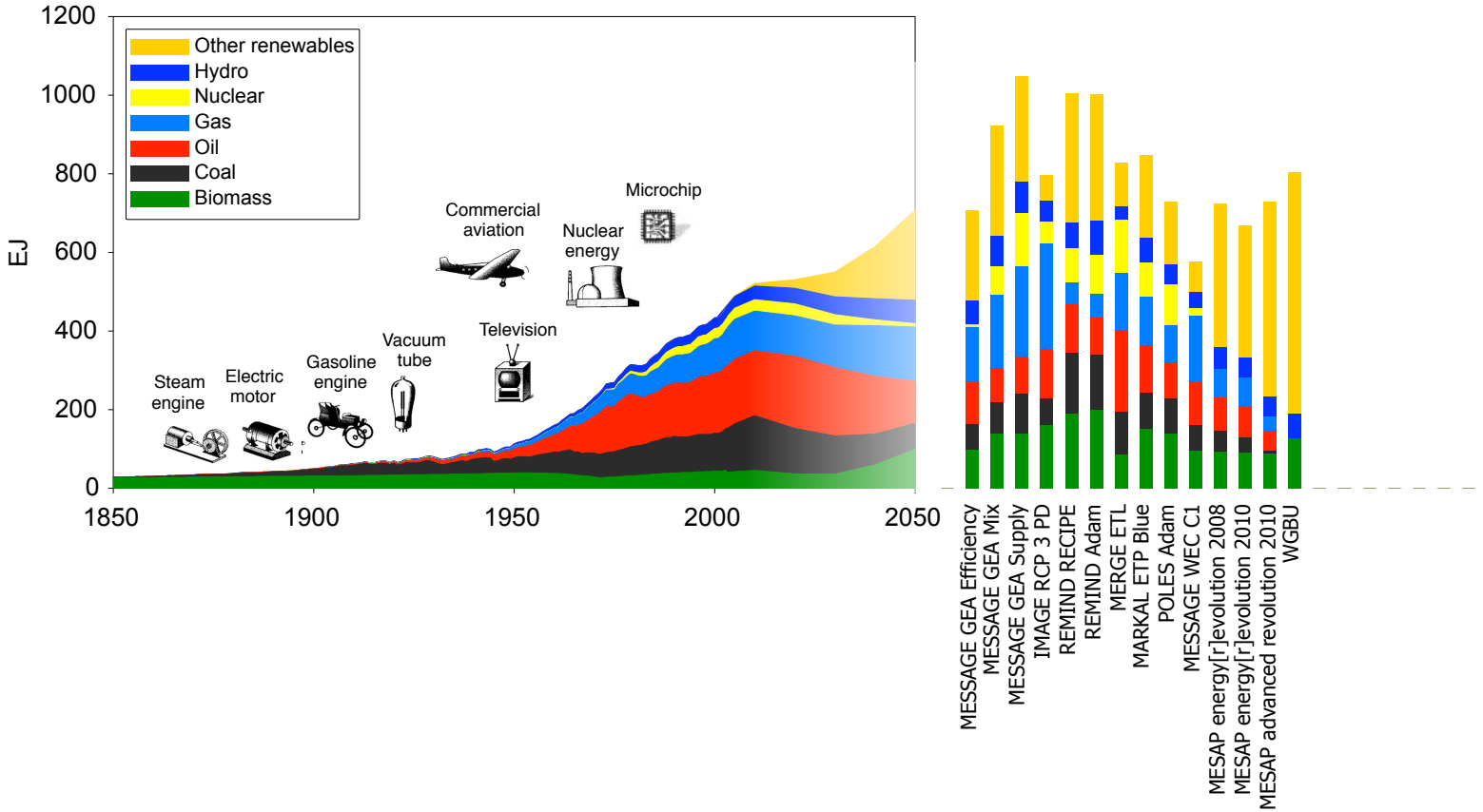
Global Primary Energy

Efficiency



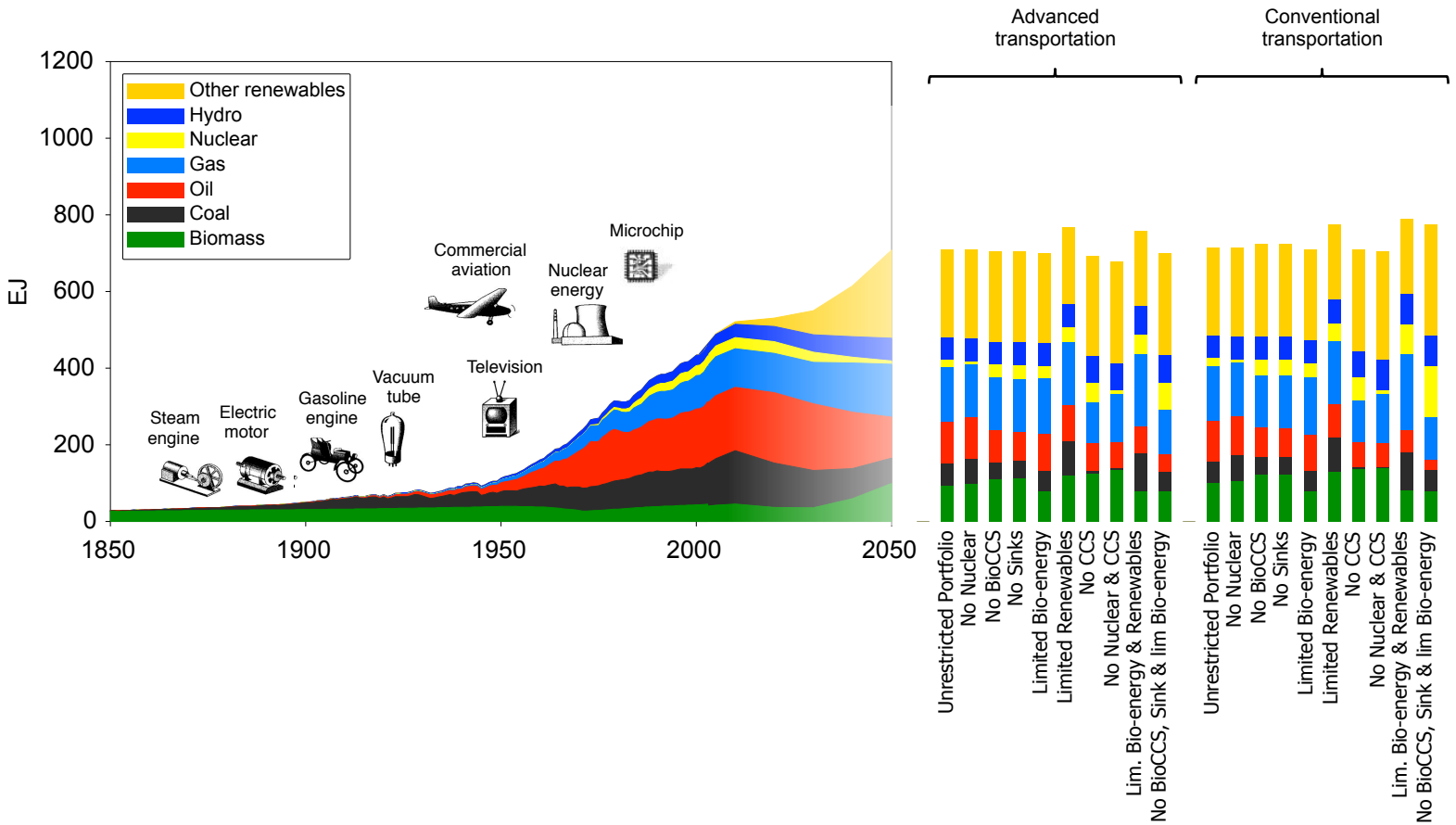
Global Primary Energy

Efficiency

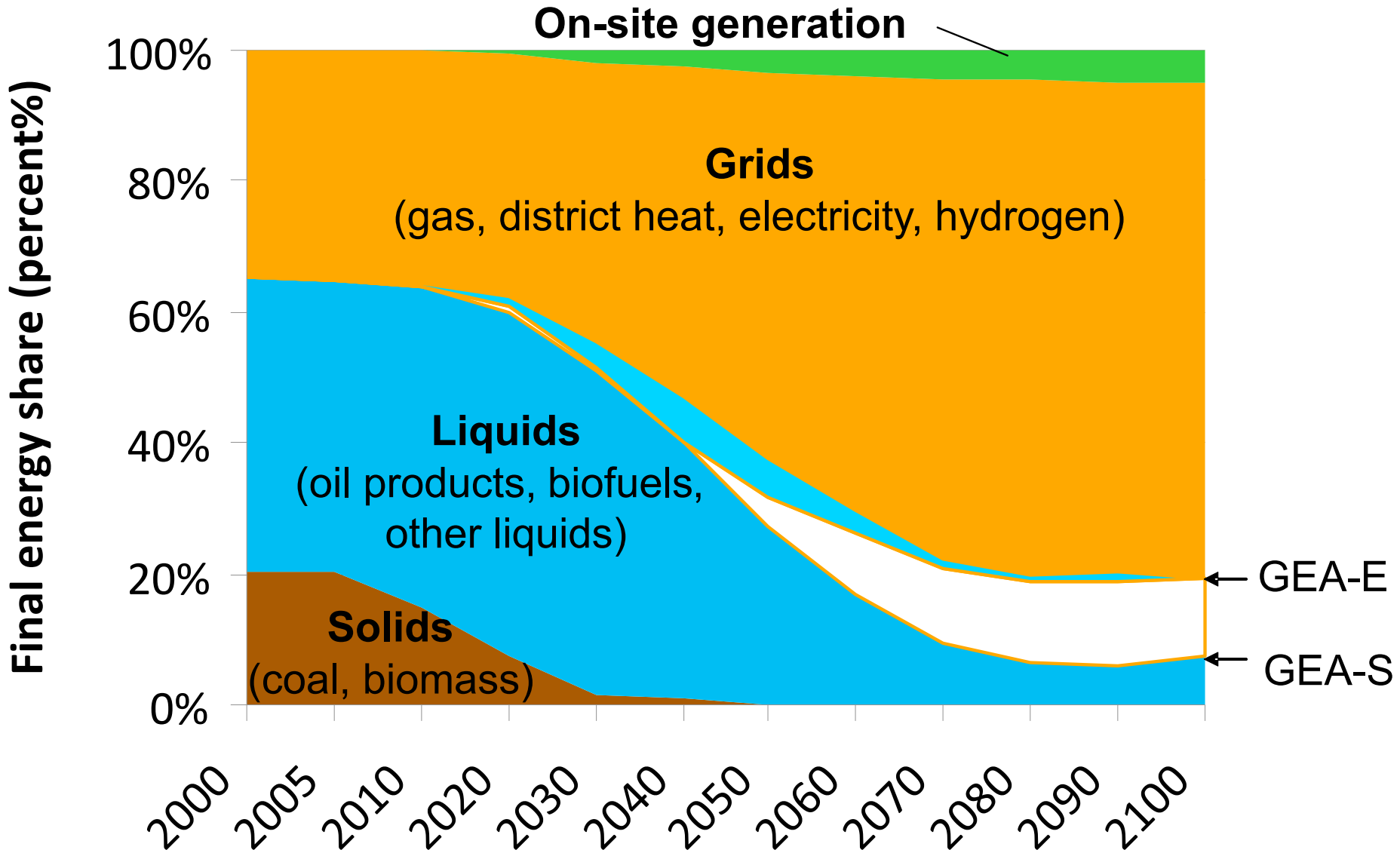


Global Primary Energy

Efficiency



Final Energy Transformations



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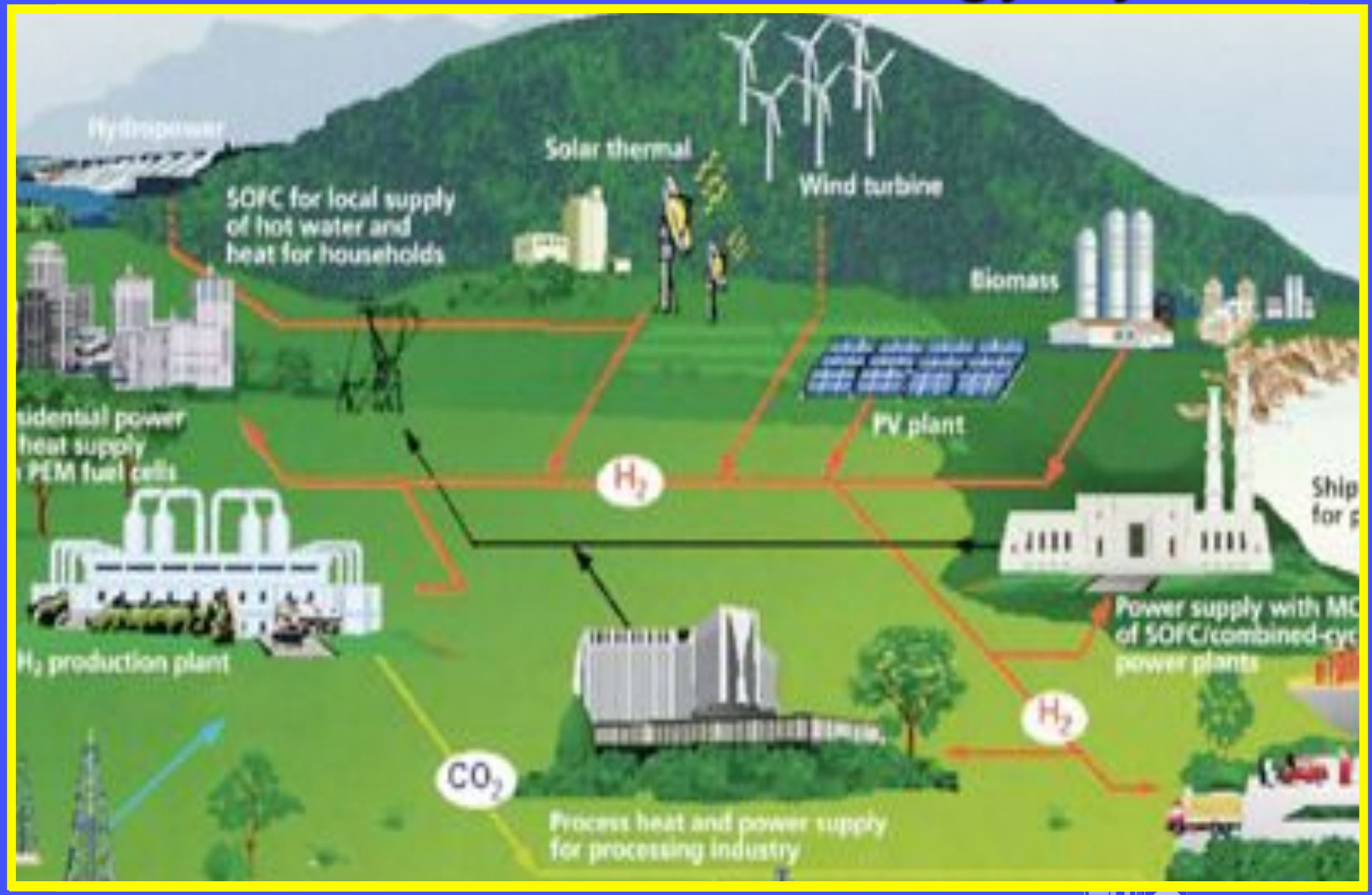
A Vision of a Future Energy System



Example of savings by reconstruction

Before reconstruction

over 150 kWh/(m²a)

-90%

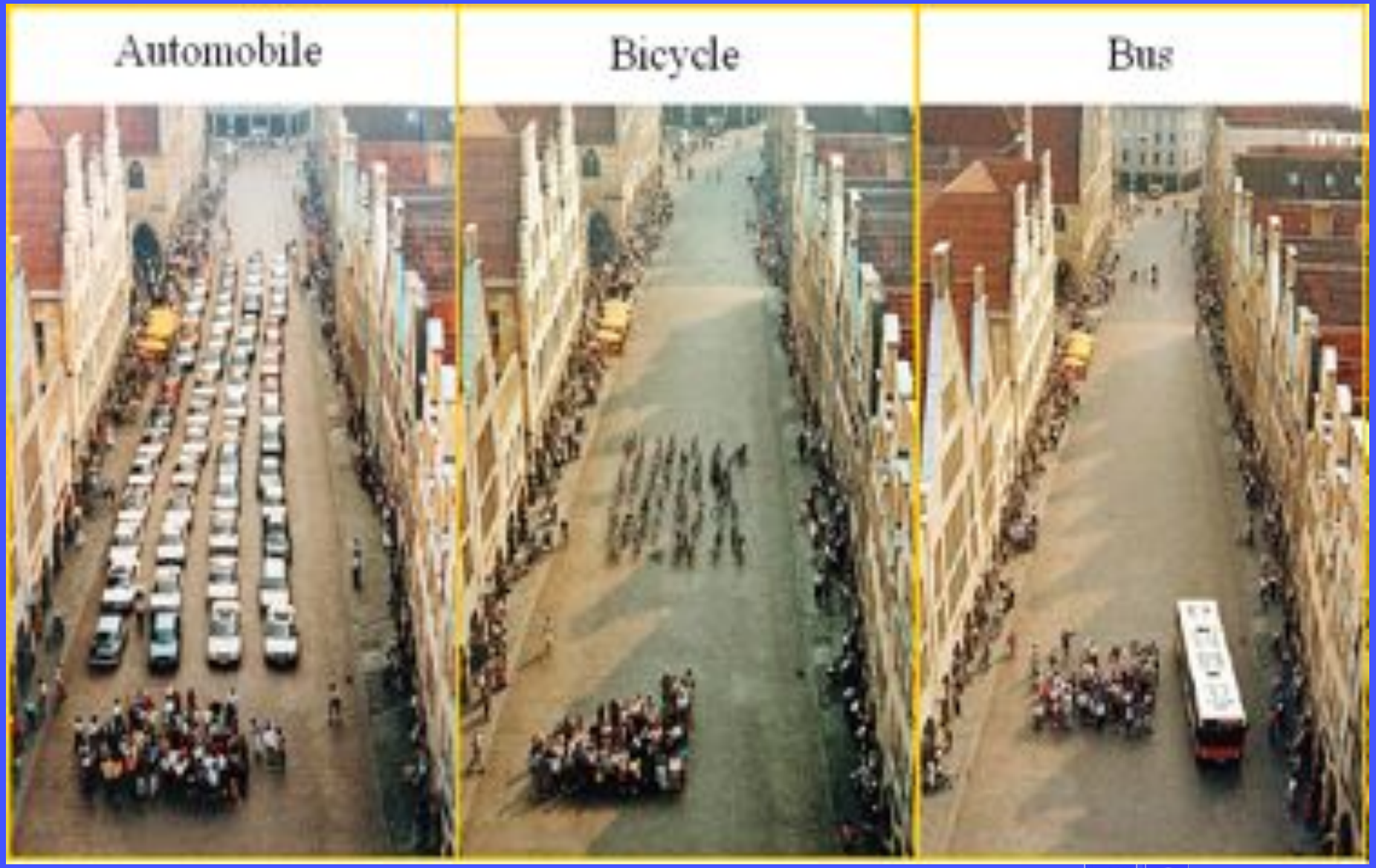
Reconstruction according to the passive house principle

15 kWh/(m²a)

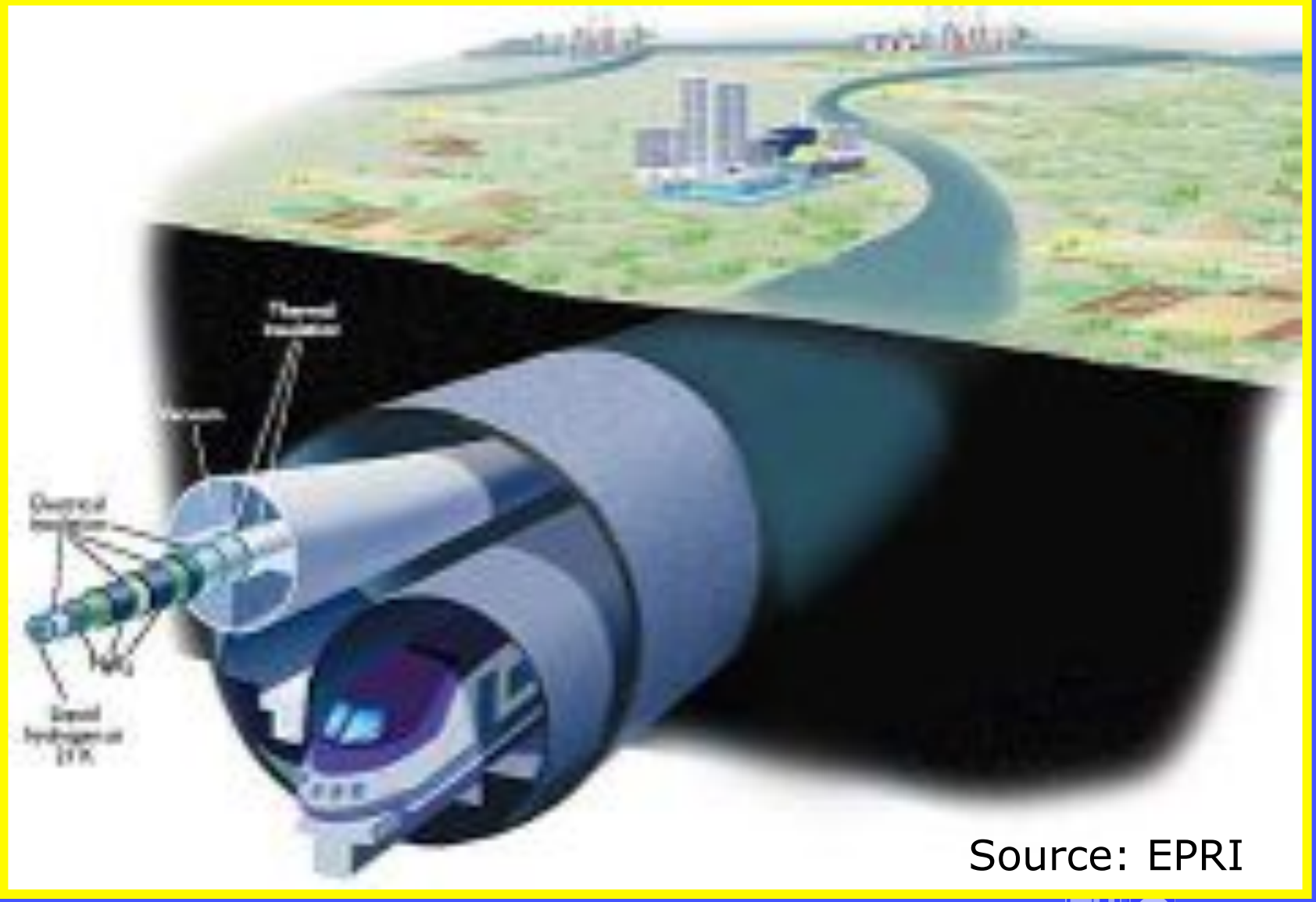
Source: Jan Barta, Center for Passive Buildings, www.pasivnidomy.cz, EEBW2006

CITARO H_2 Fuel Cell Bus

Area Occupied by Various Transport Modes

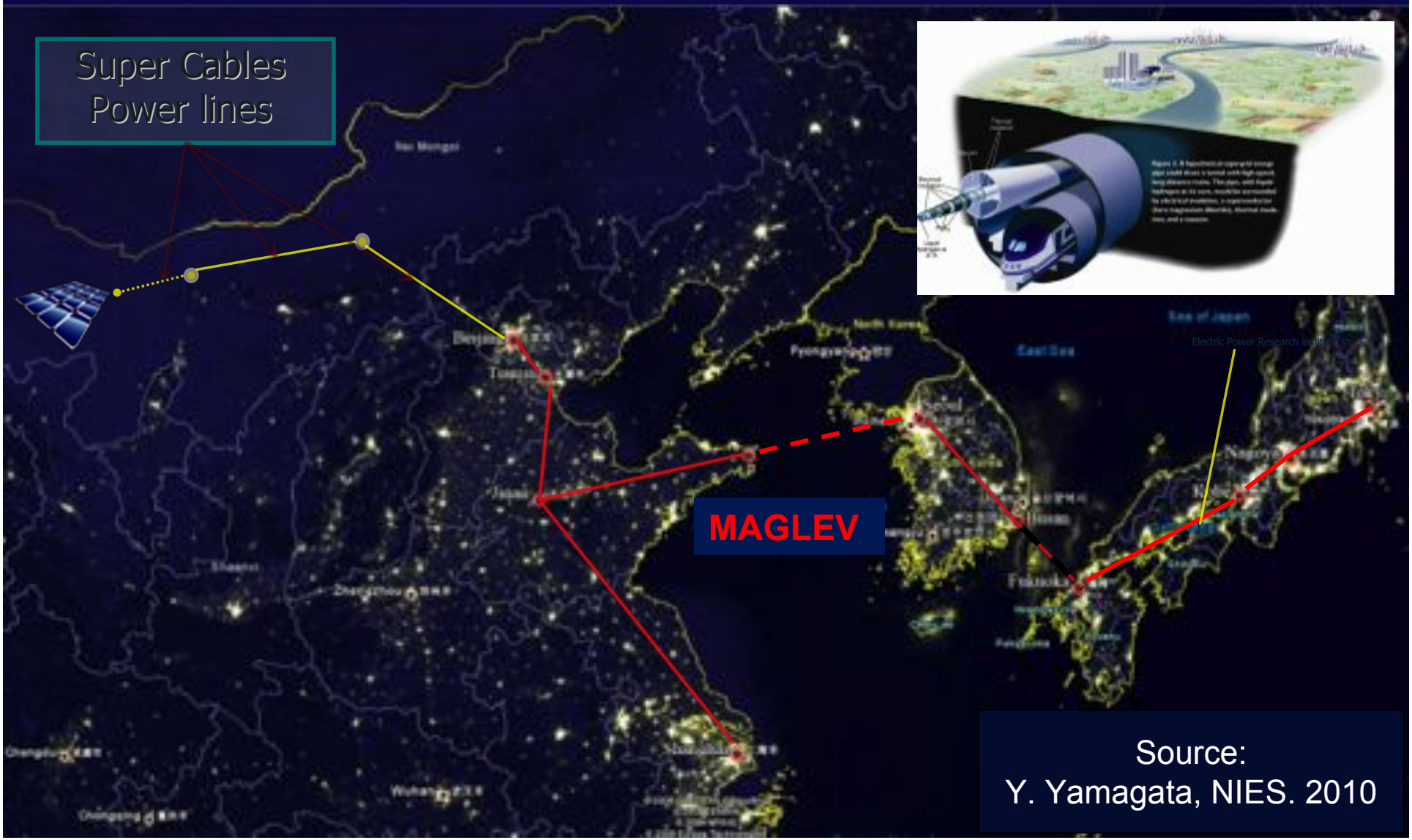


Energy SuperGrid and MagLev Trains



Source: EPRI

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



Energy Innovation and Investments

Worldwide, Billion $

	innovation (RD&D)	market formation	diffusion
End-use & efficiency	>>8	5	300-3500
Fossil fuel supply	>12	>>2	200-550
Nuclear	>10	0	3-8
Renewables	>12	~20	>20
Electricity (Gen+T&D)	>>1	~100	450-520
Other* and unspecified	>>4	<15	n.a.
Total	>50	<150	1000-<5000

Notes: * hydrogen, fuel cells, other power & storage technologies, basic energy research

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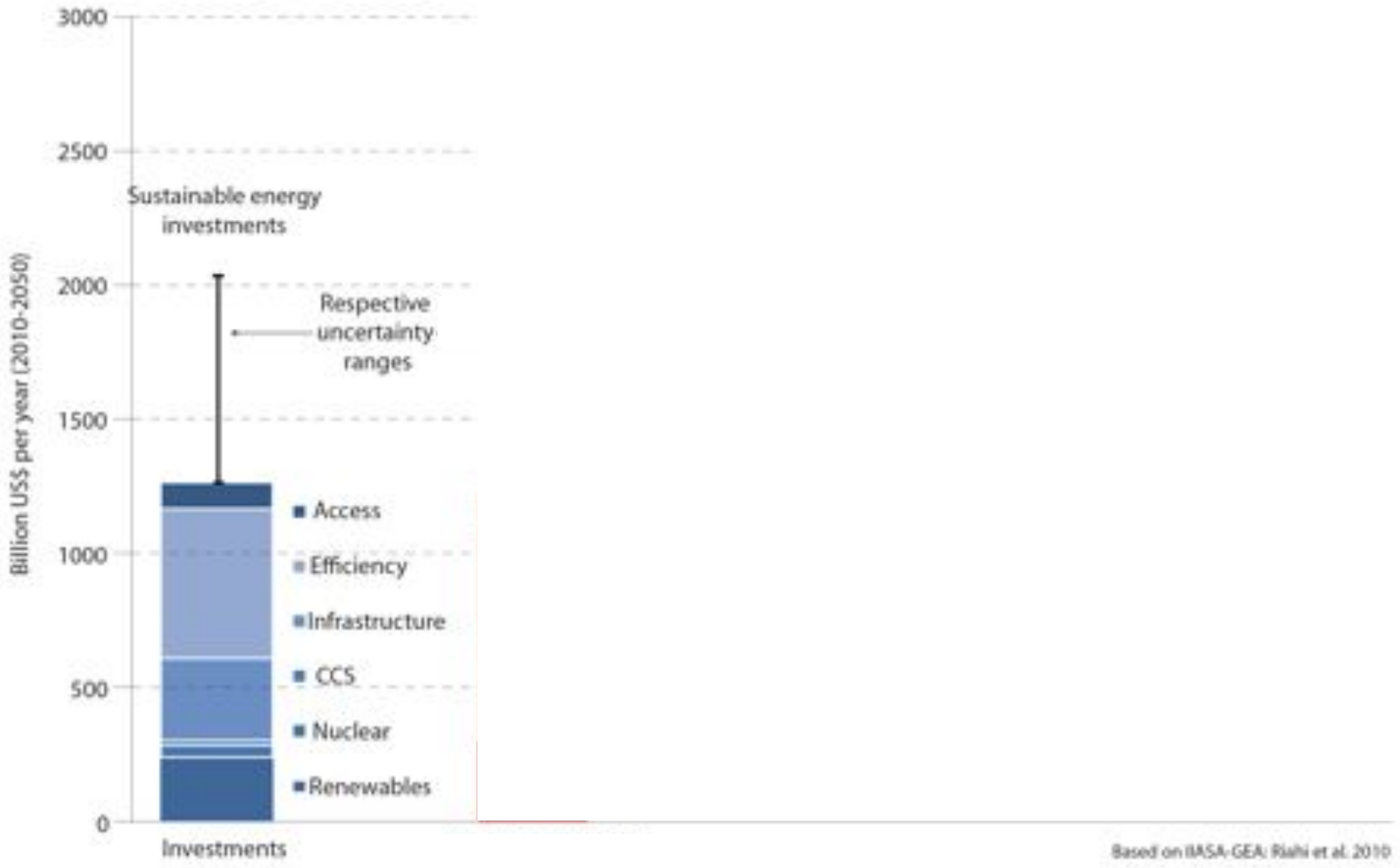
Co-Benefits of Energy Investments



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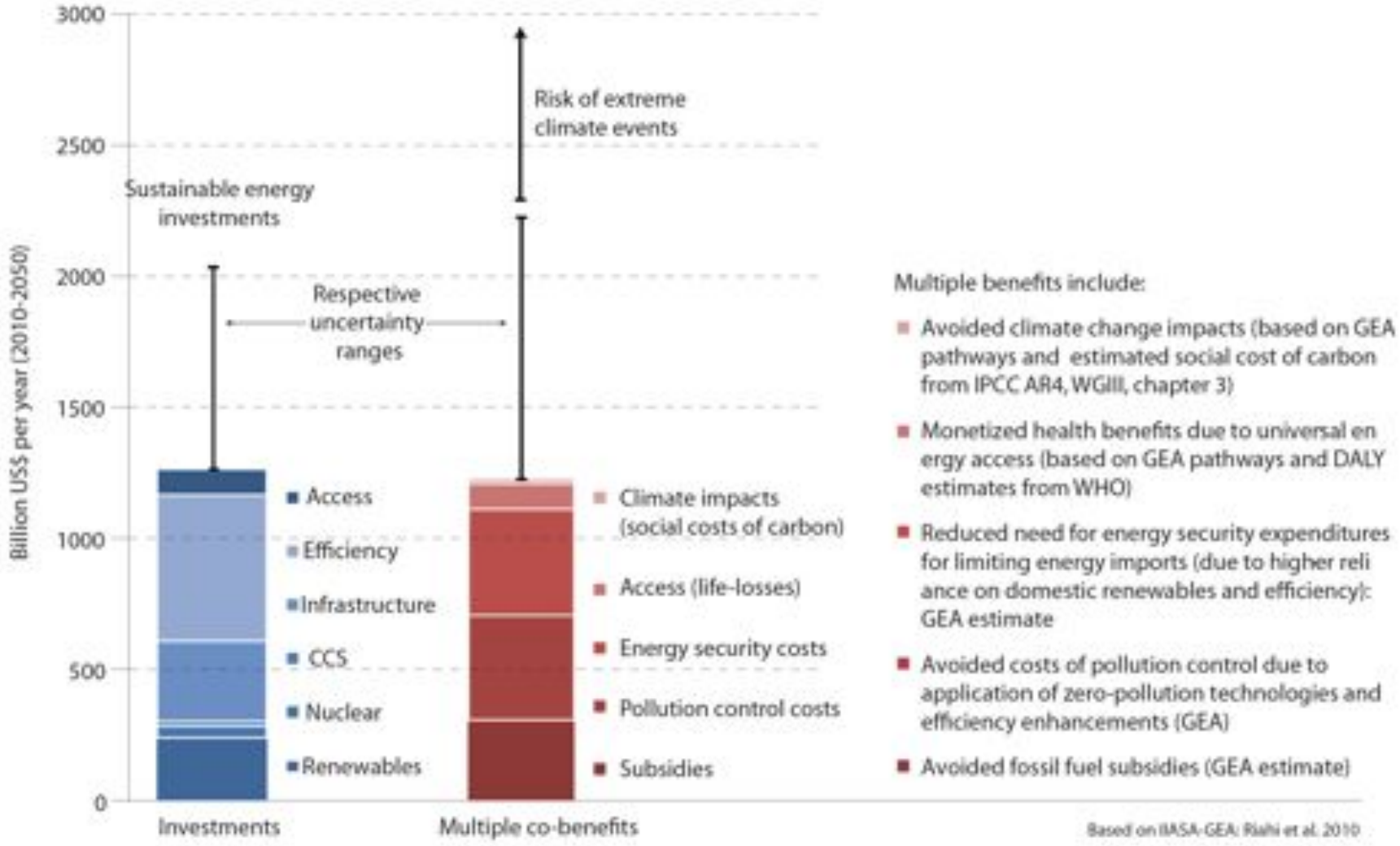
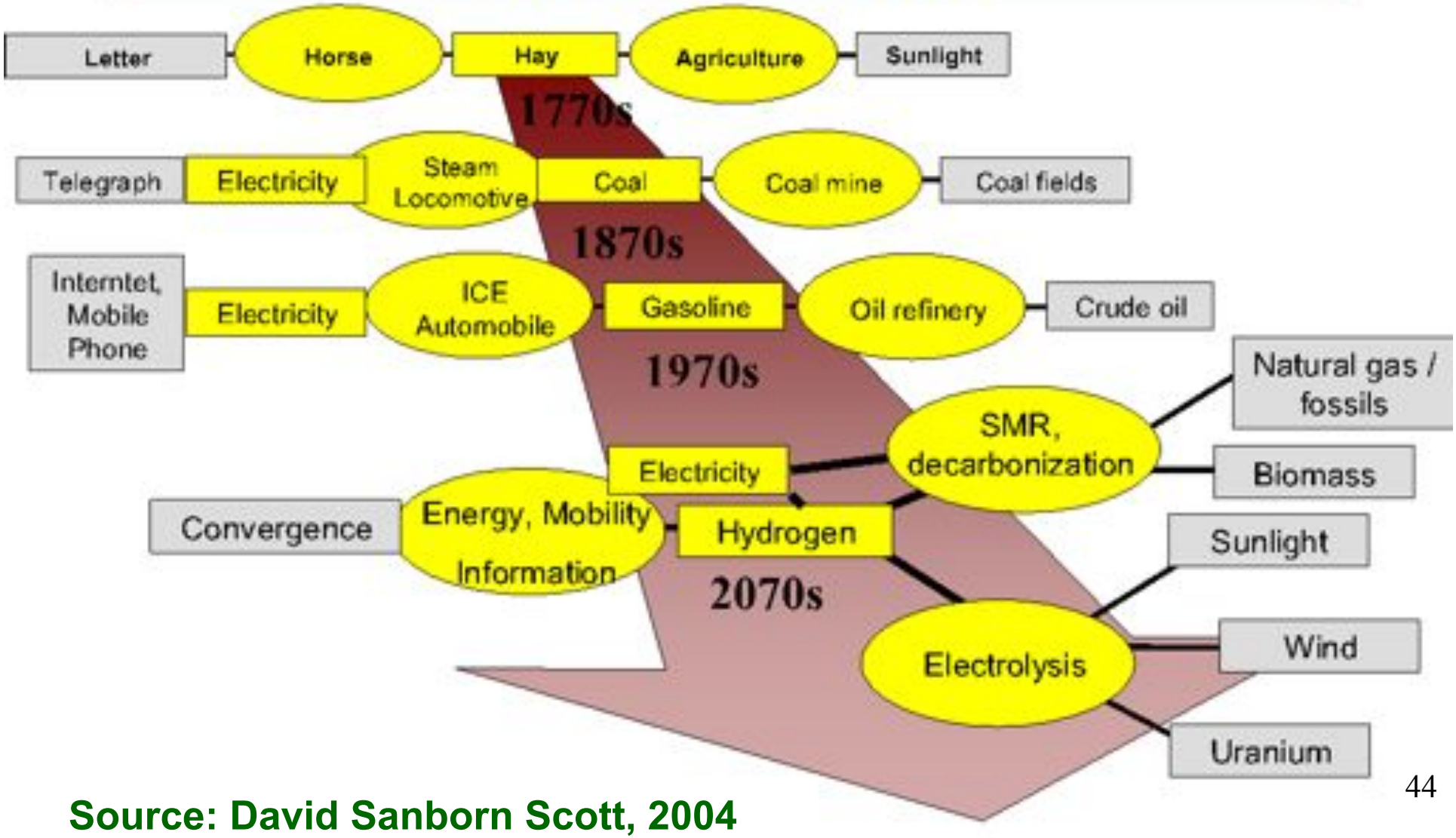


Mobility and Communication Through Time



Source: David Sanborn Scott, 2004

Geoengineering Options