



Wir schaffen Wissen – heute für morgen

Paul Scherrer Institut

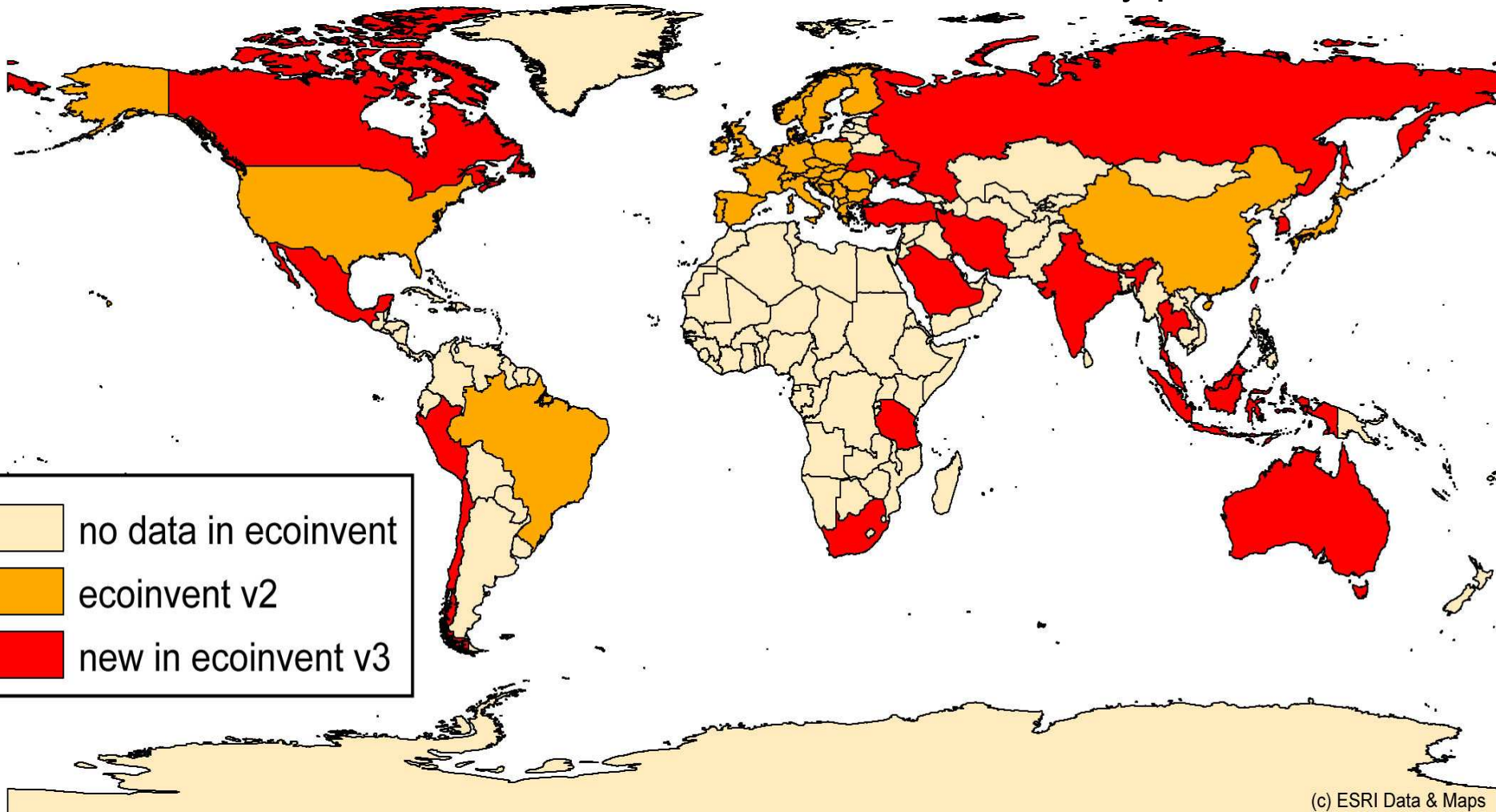
Karin Treyer, Christian Bauer

Laboratory for Energy Systems Analysis

**Basic LCI data for life cycle thinking in energy strategies:
Electricity datasets in ecoinvent version 3**

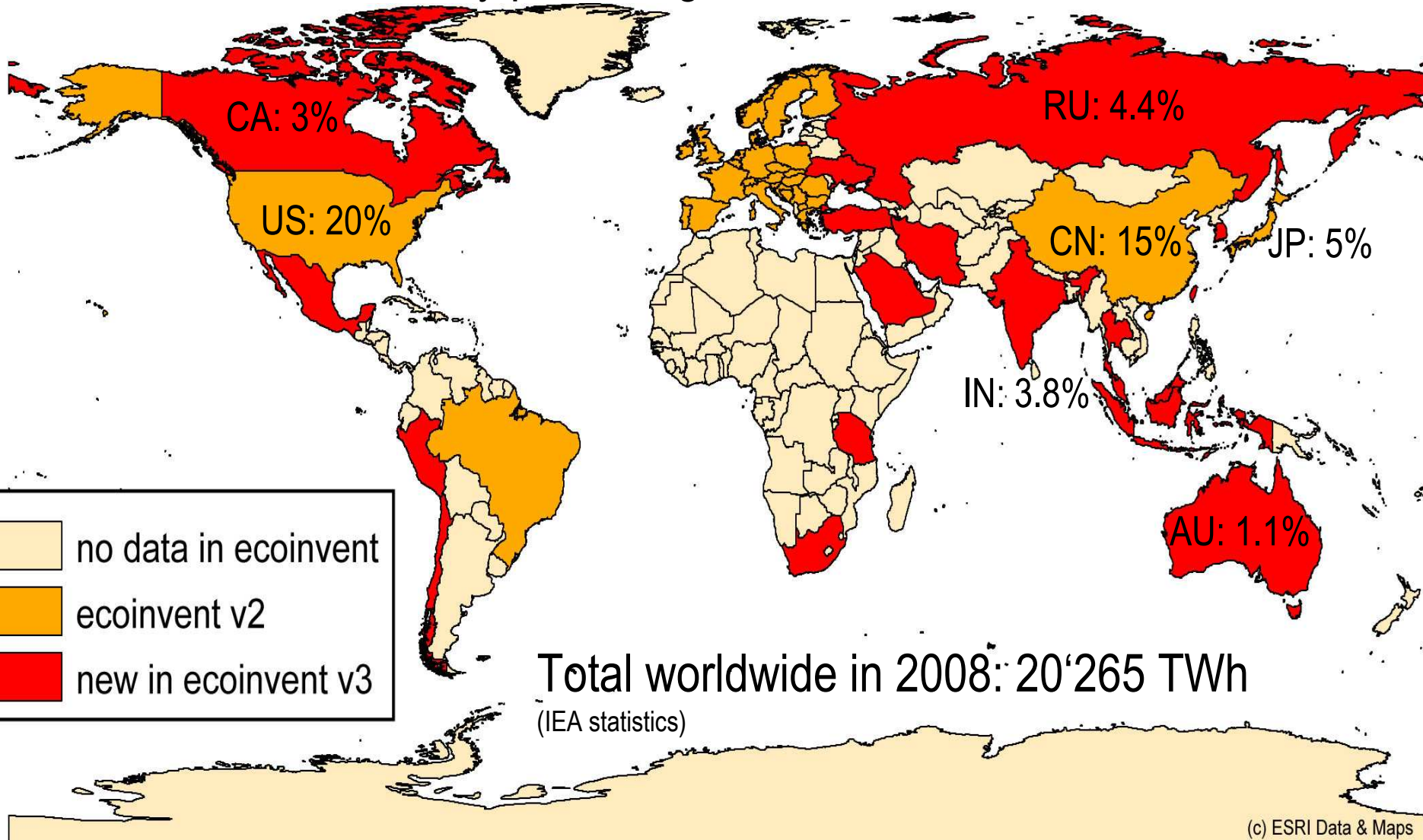
v2: 32 countries – ca. 65% of 2004 worldwide electricity production

v3: 50 countries – ca. 83% of 2008 worldwide electricity production

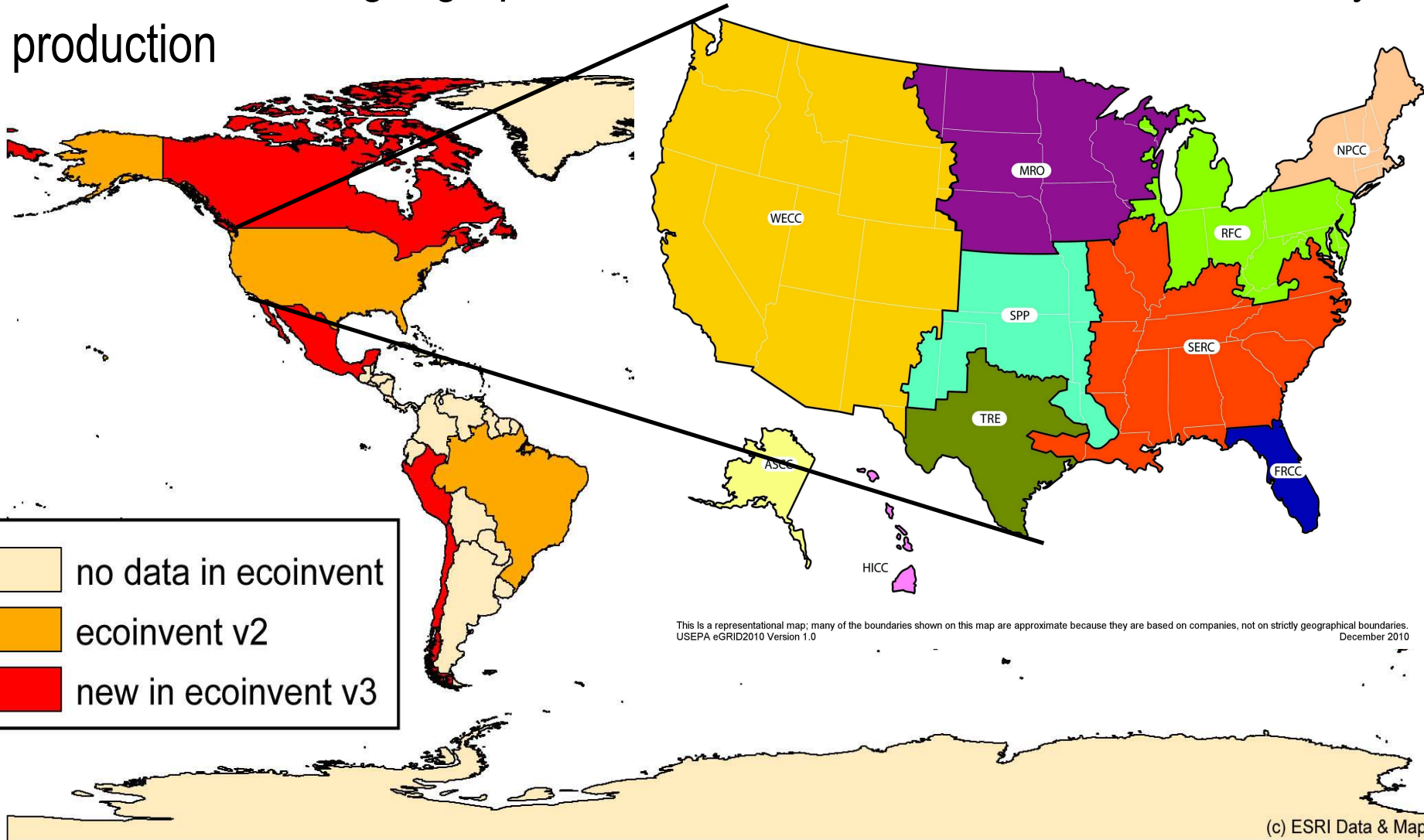


(c) ESRI Data & Maps

50 countries – no country producing >1% omitted

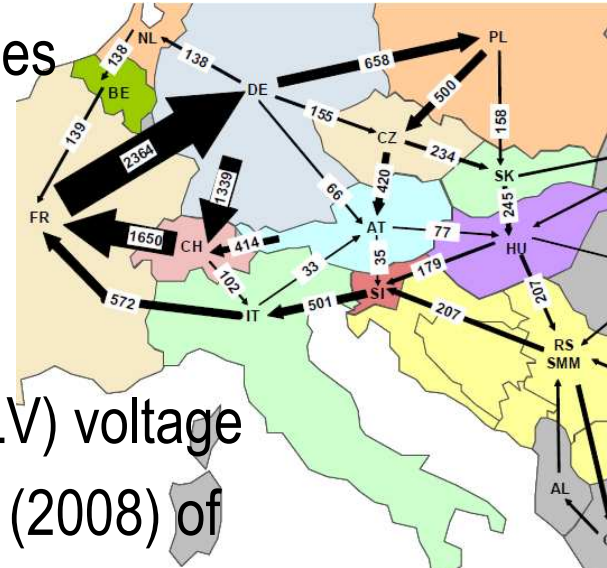


50 countries – 71 geographies – ca. 83% of 2008 worldwide electricity production



Electricity market =

Domestic production mix + imports from markets from neighbour countries – transformation and transmission losses



Source: swissgrid

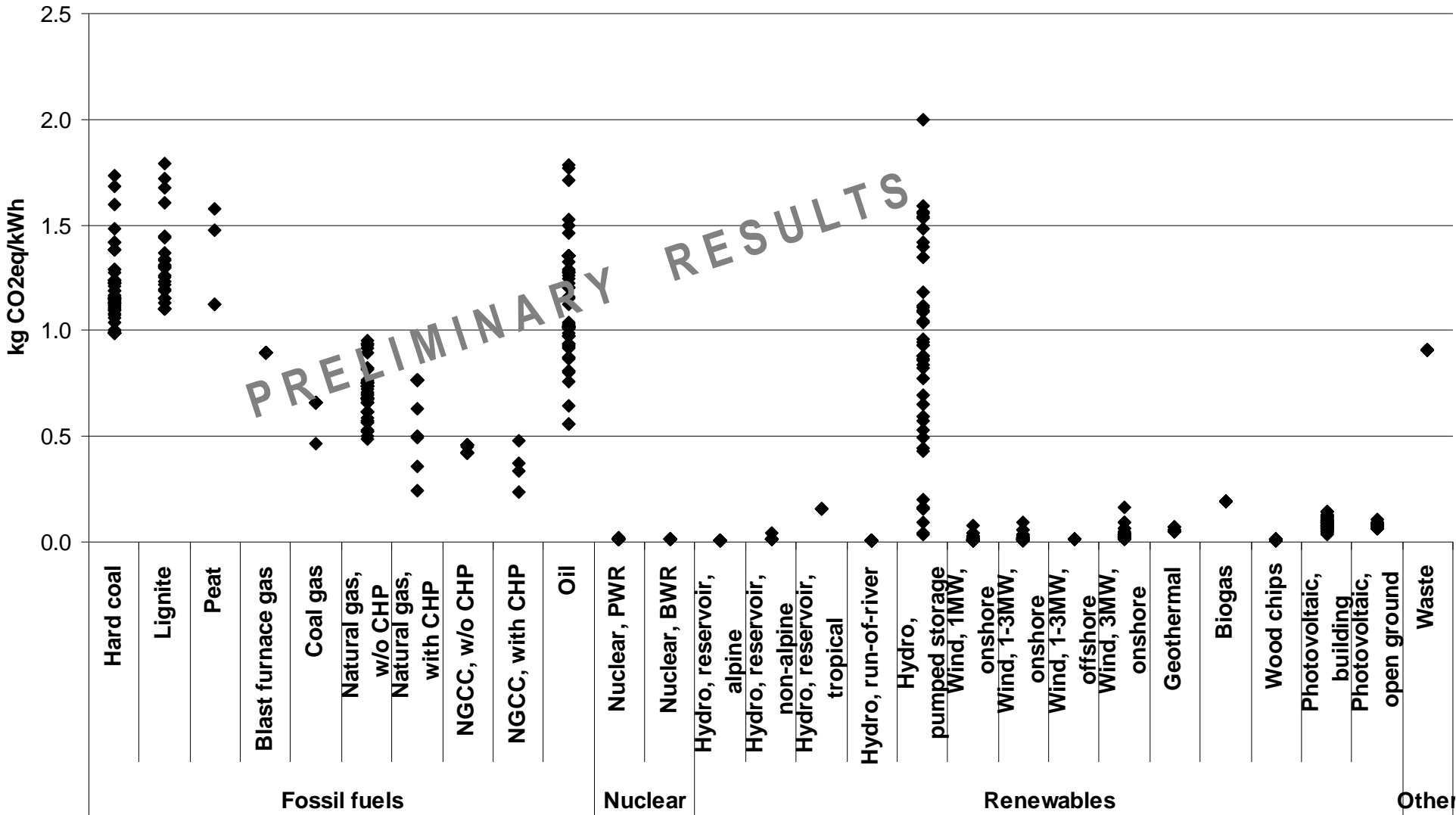
- Markets for high (HV), medium (MV) and low (LV) voltage
- Specified using the annual production volumes (2008) of generation technologies provided by IEA statistics
- Main data sources: Itten et al. (2012) „Life Cycle Inventories of Electricity Mixes & Grid“ and IEA statistics

Electricity generation: country specific technologies

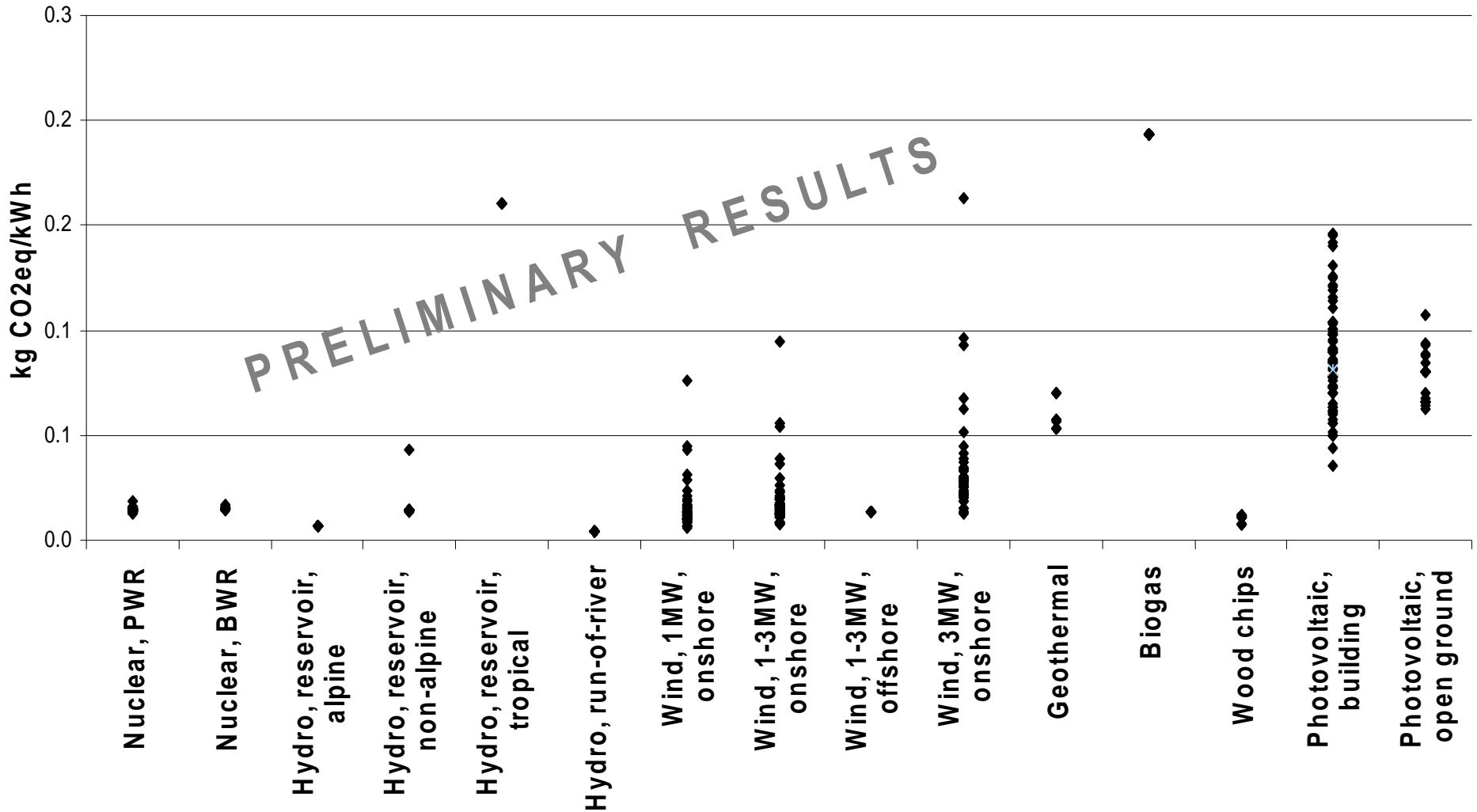


Fossil fuels	Coal	Hard coal	Renewables	Hydropower	Reservoir power plants: alpine/non-alpine/tropical region
		Lignite			Run-of-river power plants
		Peat			Pumped storage power plants
	Industrial gases	Blast furnace gases		Geothermal	Hot-Dry-Rock (EGS)
		Coke (coal) gases		Solar	Photovoltaic: Building integrated and open ground
	Oil				<i>Solar thermal (no data)</i>
	Natural gas	Conventional gas power plant, with/without CHP		<i>Wave and tidal energy</i>	<i>(no data)</i>
		Combined cycle gas power plant, with/without CHP		Wind	Onshore, capacity class <1MW / 1-3MW / >3MW
Nuclear		Pressurised water reactor (PWR)			Offshore, capacity class 1-3MW
		Boiling water reactor (BWR)		Wood	Wood chips, with/without extensive emission control
				Biogas	Biogas from biowaste, sewage sludge and landfill gases
			Waste	Waste incineration	Municipal and industrial waste

IPCC 2007, GWP 100a for technologies



IPCC 2007, GWP 100a for technologies (nuclear and renewables)



ecoEditor for ecoinvent version 3

File Edit View Extras Help


 Activity Description Modelling and Administrative Exchanges Exchange Properties **Parameters** Tasks

 Add Remove Column Layouts: Amount Only Compact **Extended** Customize Current Column Layout...

Parameter		electricity production, wind, >3MW turbine, onshore, GLO 2008					
Name	Unit	Amount	Variable Name	Mathematical Relation	Uncertainty	Comment	
distance	km	200	distance		Lognormal (...)	Estimation.	
gross electricity production in 2008	kWh	2.3631E+11	gross_electricity...		Lognormal (...)	Literature value. Total	
Installed capacity	MW	1.2119E+05	capacity_install...		Lognormal (...)	Literature value. Total	
losses from gross electricity production	dimensionless	0.01	gross_net_elect...		Lognormal (...)	Estimation. The factor	
Percentage of onshore wind power plant class capacity o...		0.105	percentage_cla...		Lognormal (...)	Literature	
share of wind turbine 4.5 MW in >3 MW class	dimensionless	1	share_turbine_4...		Lognormal (...)	Parameter introduced	
use of lubricating oil for maintenance	kg	354.38	lubricating_oil_...	62*(4.5/0.8)	Lognormal (...)	Estimation of the use of	
Wind load hours	hour	1930.4	wind_load_hours	{ gross_electric... }	Lognormal (...)	Calculated value.	

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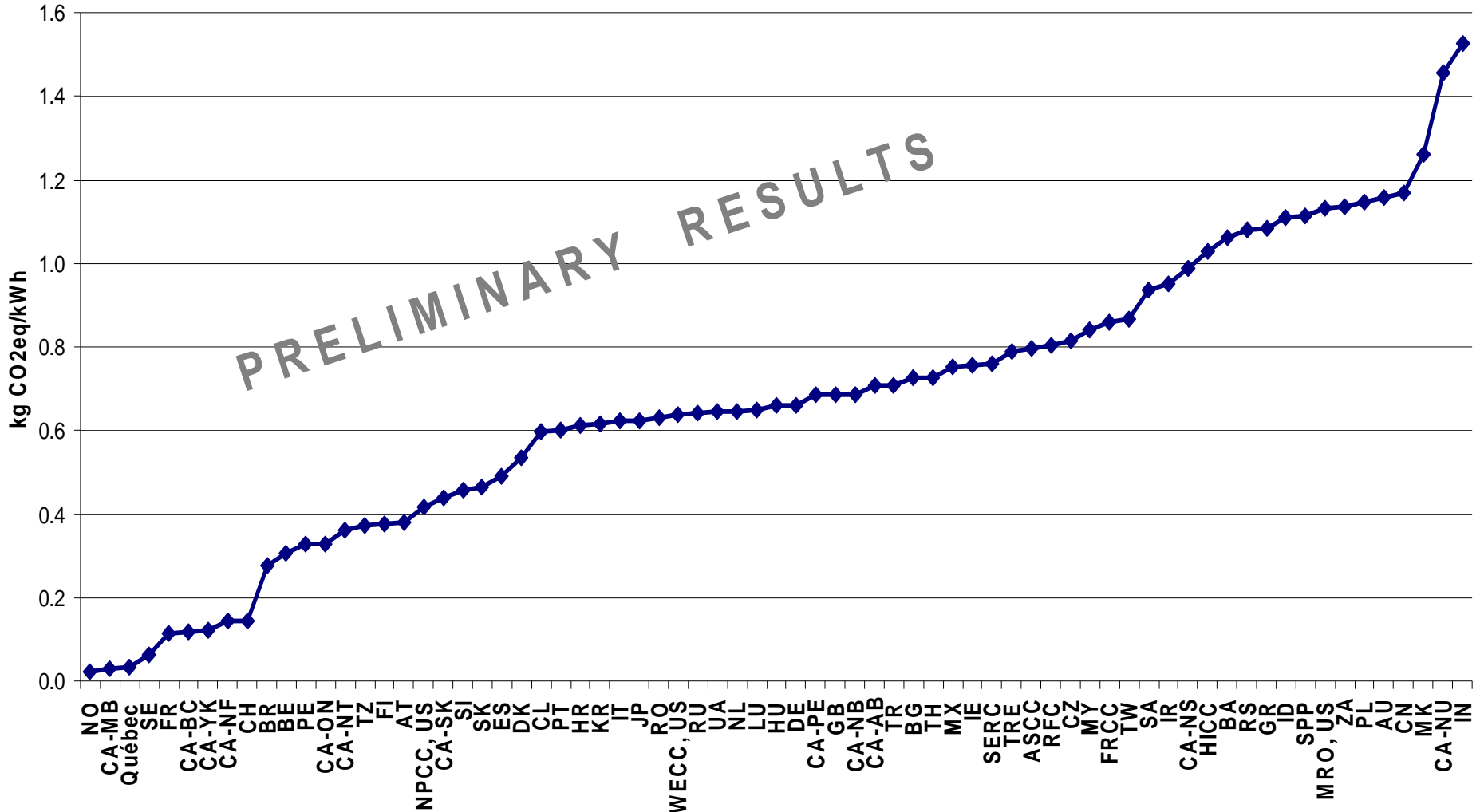
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Open Dataset From Database...

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Exchange			electricity production, wind, >3MW turbine, onshore, GLO 2008									
Type	Name	Unit	Amount	Variable Name	Mathematical Relation	Comment	Uncertainty	Source	Annual Production Volume	Production Volume Variable Name	Production Volume Mathematical Relation	Produ... Volu Comm
0 - Referenc...	electricity, high voltage	kWh	1					< None...	2.4564E+10	APV_electricity	gross_electricity_2008* (1...	Calculat...
2 - ByProdu...	waste mineral oil	kg	4.0795E-05	waste_m...	lubricating_oil	Calcu	Lognorma...	< None...	1.0021E+06		waste_min_oil_10* APV_el...	Calculat...
5 - FromTec...	lubricating oil	kg	4.0795E-05	lubricatin...	lubricating_oil	Calcu	Lognorma...	< None...				
5 - FromTec...	wind turbine network connection, 4.5M...	unit	5.7558E-09		1/(lifetime)*...	Calcu	Lognorma...	< None...				
5 - FromTec...	transport, freight, lorry 7.5-16 metric ton...	metric...	9.3923E-13		(lubricating_oil...	Calcu		< None...				
5 - FromTec...	wind turbine, 4.5MW, onshore	unit	5.7558E-09		1/(lifetime)*ca...	Calcu	Lognorma...	< None...				

IPCC 2007, GWP 100a for low voltage markets

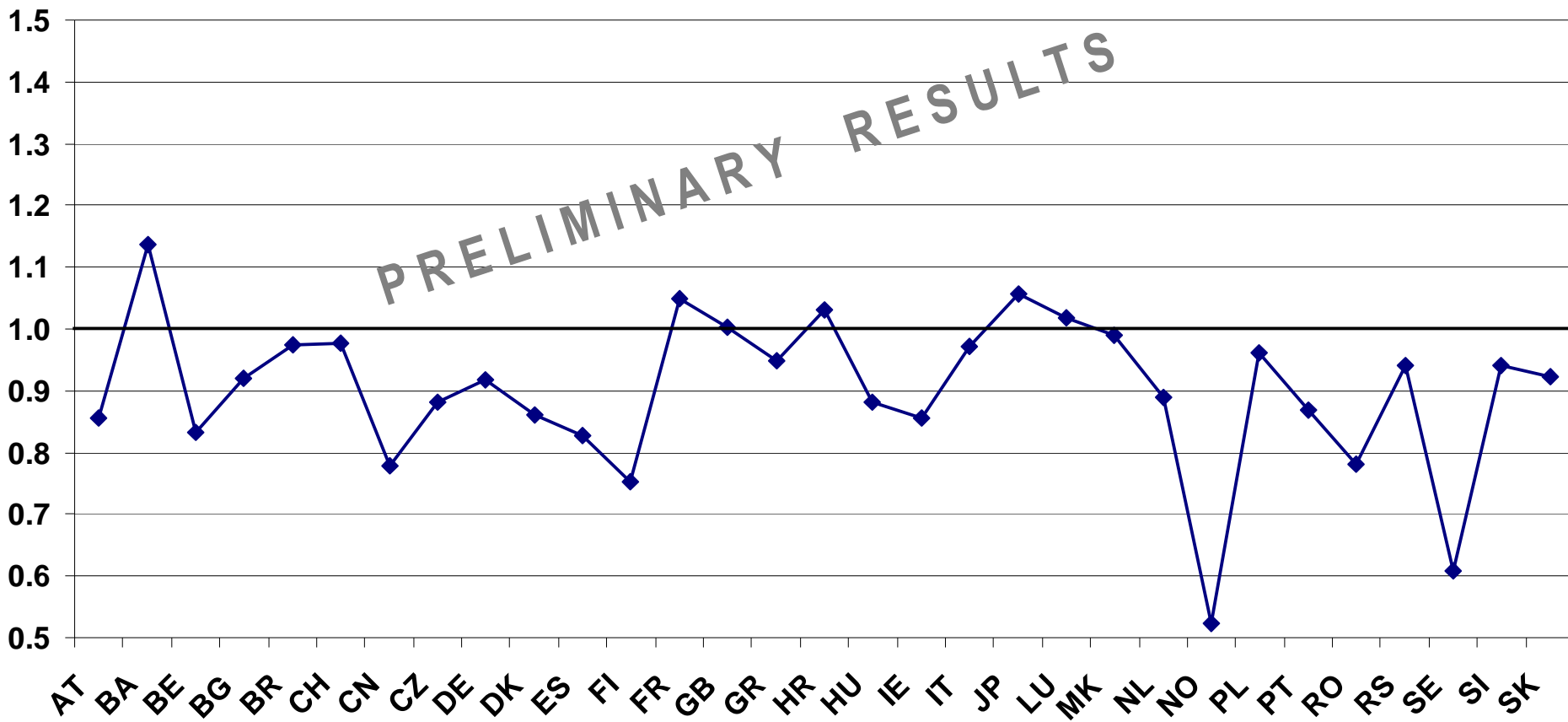


IPCC 2007 GWP 100a results in relation v3/v2 for electricity at low voltage:

v2 dataset name: „electricity, low voltage/XX U“

v3 dataset name: „market for electricity, low voltage, XX“

XX = Geography



- Higher geographical coverage of global electricity production in v3
- Geography– specific LCI data are important
- The differences between LCIA results of electricity mixes version 2 and version 3 are explainable
- LCI data:
 - basis for determining the status quo of environmental impacts of electricity production
 - and basis for long-term energy strategies
- Easy to adapt datasets support modelling of future electricity scenarios.

Potential for further improvement

- Data on fuel supply chains should be made even more country-specific
- Extension of the database in terms of
 - generation technologies, e.g. wave power, solar thermal
 - specific power plant types used in a certain geography
 - electricity mixes of more geographies
- Regular update of annual production volumes

Thanks to Christian Bauer, ecoinvent staff, treeze/ESU-services

-- Thanks for your attention!

