

PAUL SCHERRER INSTITUT



Wir schaffen Wissen – heute für morgen

Electricity generation & supply in ecoinvent v3

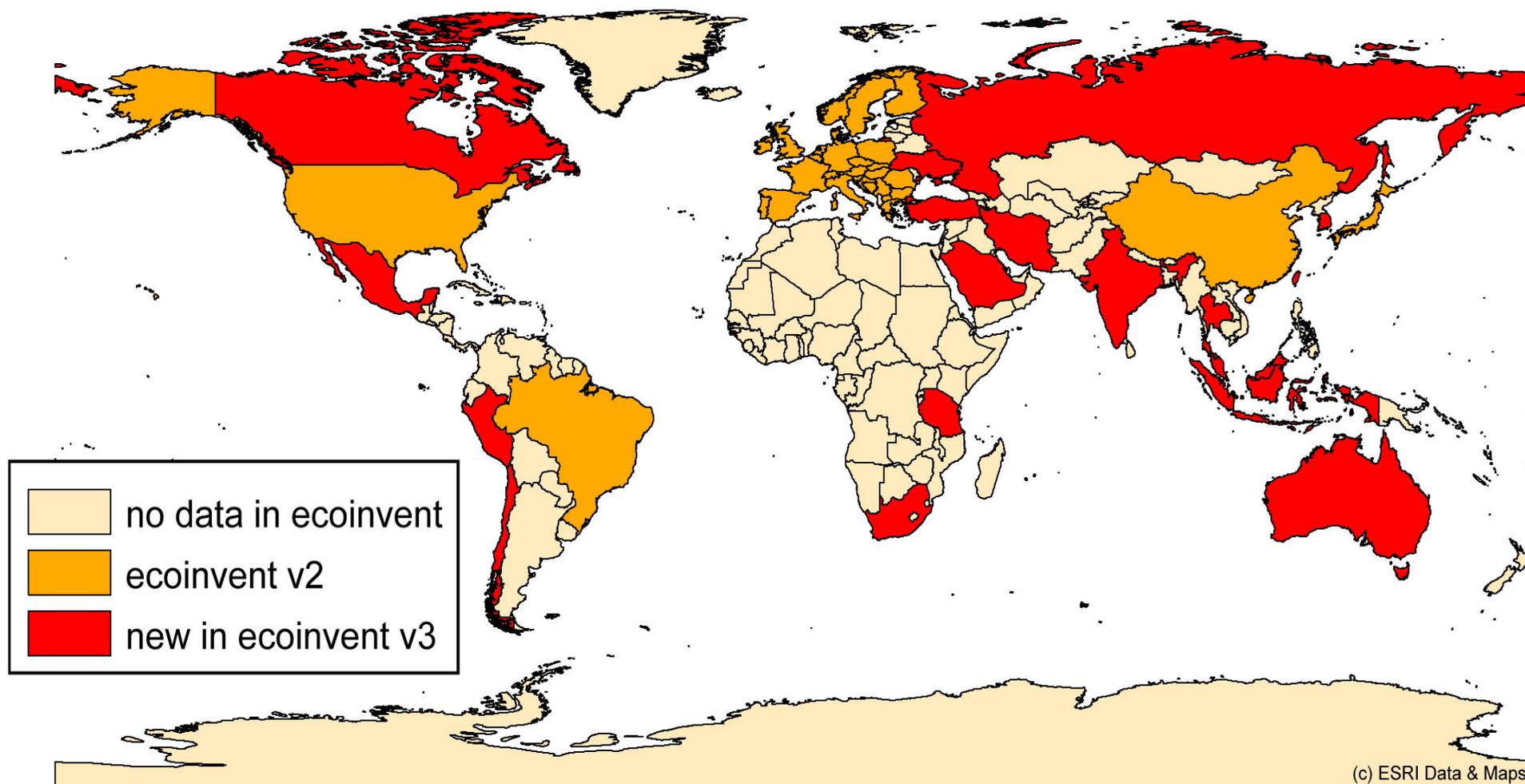
Christian Bauer, Karin Treyer, PSI



René Itten, Rolf Frischknecht, ESU-services Ltd.



Country specific LCI data for power generation & supply

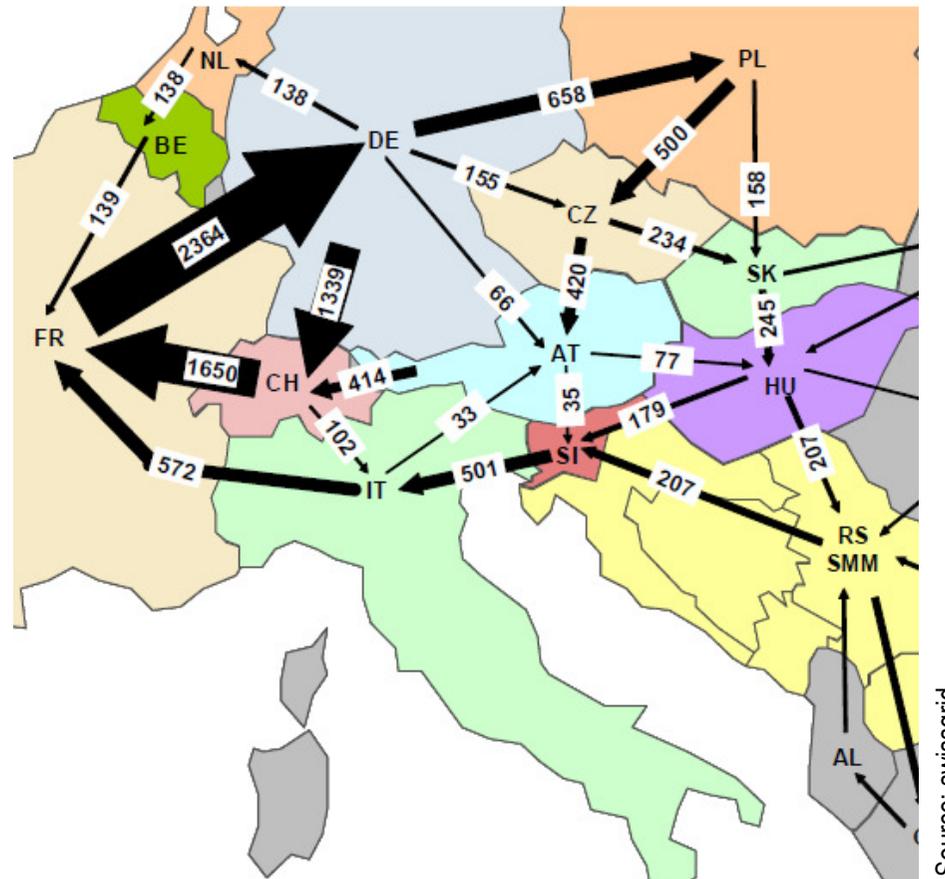


Electricity generation: country specific technologies



Power supply: country-specific market activities (electricity mix)

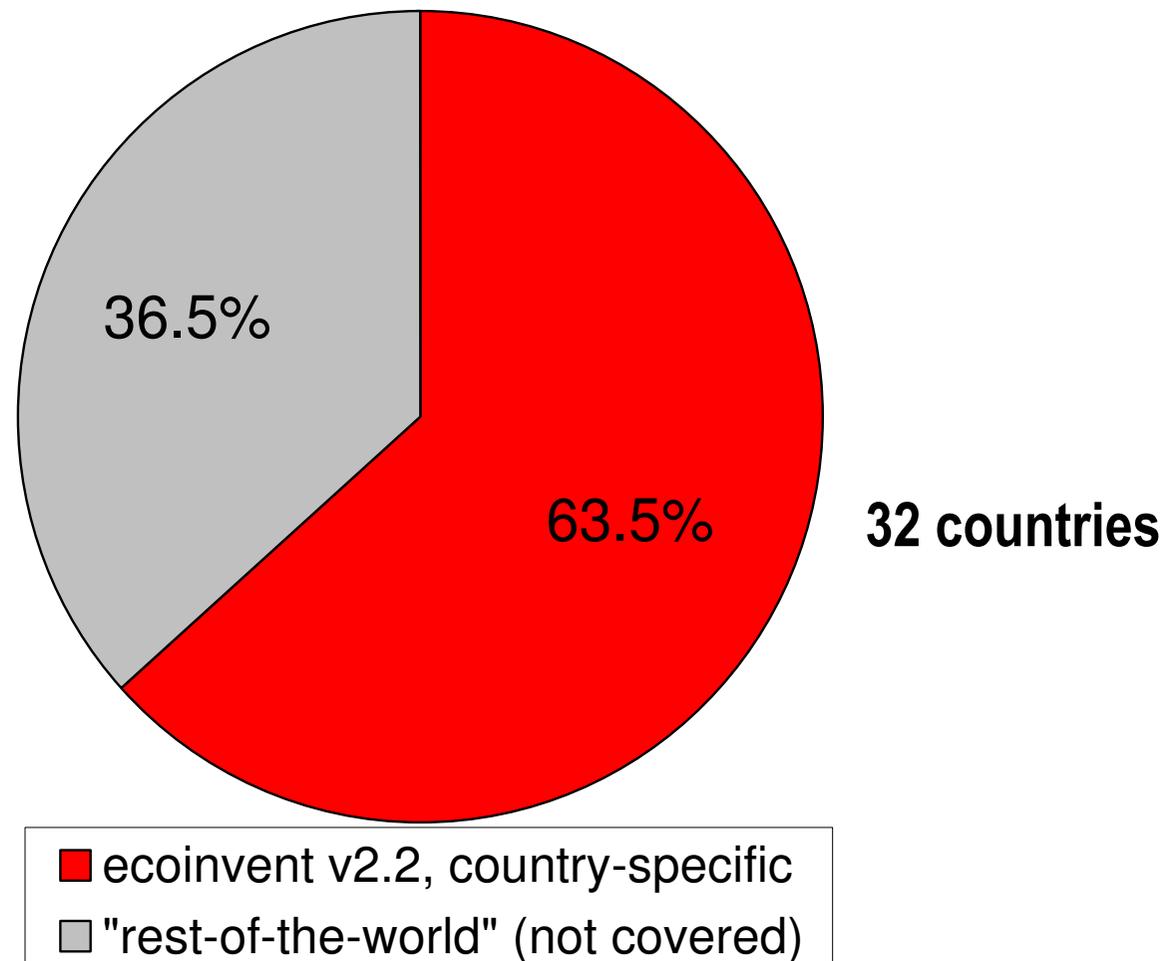
Domestic production mix + imports from markets from neighbour countries



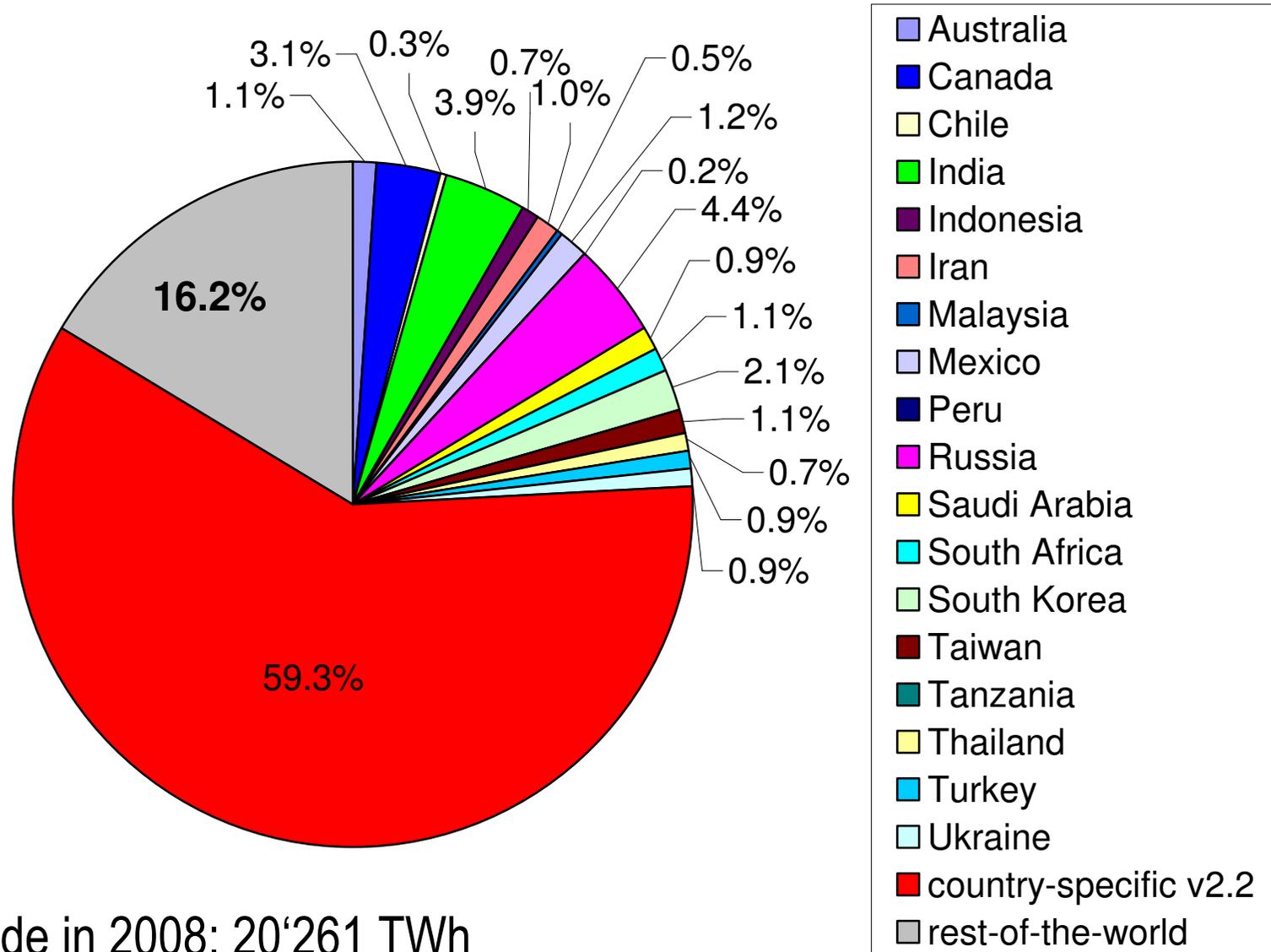
Based on annual production volumes 2008 for all (v2.2 & new) countries

Global electricity generation in v2.2

Corresponding to production in year 2004



Global electricity generation in v3



Total worldwide in 2008: 20'261 TWh

Generation technologies: what's new?

- Global activity unit process DS for all generation technologies
- Child DS in all relevant countries for most of the technologies
- Fossil fuels: no more „fuel, burned in,...“ DS, only „electricity production,...“
- Natural gas: CC & conventional generation datasets with & w/o CHP for new countries with country-specific efficiencies
- Hard coal & lignite: datasets for new countries with country-specific efficiencies and key emission factors (SO₂, NO_x, PM)
- Oil: datasets for new countries with country-specific efficiencies
- Nuclear: datasets for new countries with country-specific efficiencies
- Wind power: onshore turbines <1MW, 1-3MW, >3MW
- PV: new roof-top & open ground systems used in all countries
- Geothermal: Enhanced geothermal system (based on plant in Basel)
- Hydro, wood, biogas and waste: based on v2.2 DS for new countries

Data sources

- Natural gas: IEA statistics; expert judgement
- Hard coal & lignite: IEA statistics; national pollutant inventories; personal information; IEA clean coal center power plants database*
- Oil: IEA statistics
- Nuclear: WNA reactor database*
- Wind power: manufacturer's information; wind turbine database*
- PV: ESU-services - manufacturer's information; IEA PVPS
- Geothermal: data from EGS plant in Basel
- Hydro, wood, biogas and waste: ecoinvent v2.2

* contains data for all single plants operating

- Market activities: ESU-services - IEA statistics; country-specific information

New features in power generation activities

- Use of **parameters**:
 - efficiencies of thermal power plants
 - yield of solar modules & wind turbines
- **Parent – child** datasets for most country-specific generation activities
- Use of **tags** for technology classification
- Specification of **technology level**: „old“, „current“, „modern“
- Use of **activity links** for specific fuel supply (coal)

Electricity market activities: HV – MV – LV

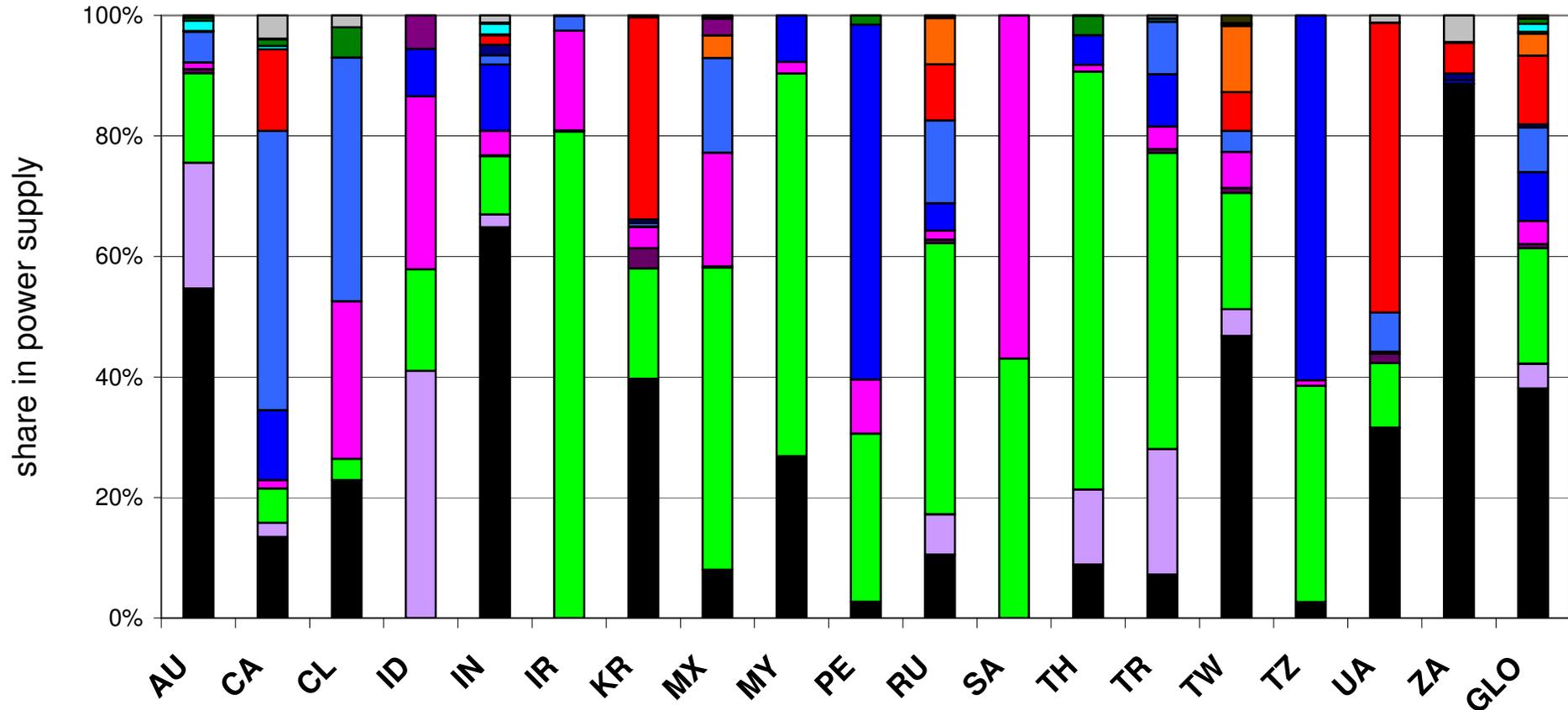
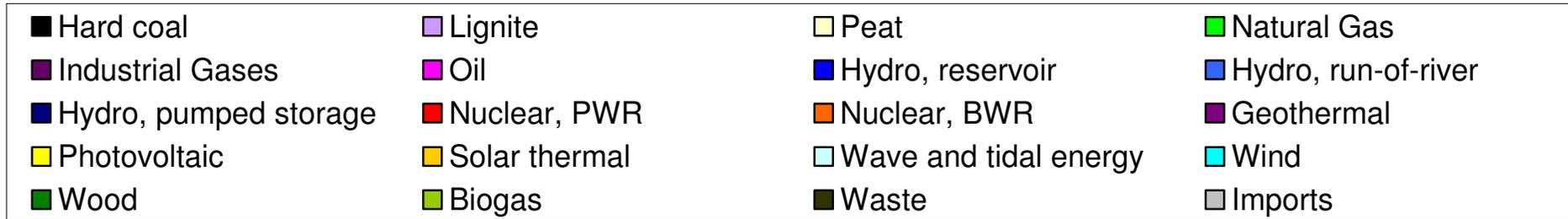
- Market activity datasets for **high (HV)**, **medium (MV)** and **low (LV) voltage** corresponding to „electricity supply mixes“
- Market activities **include electricity imports** from neighbour countries (via markets or activity links to specific generation technologies)
- Specified using the **annual production volumes (2008)** of generation technologies provided by IEA statistics and more country-specific information
- Updated also for v2.2 countries
- Transforming activities for transformation of HV to MV and MV to LV
- Main data source:
Itten & Frischknecht (2012) „Life Cycle Inventories of Electricity Mixes & Grid“

Report and datasets: www.lc-inventories.ch

Results for GHG emissions of CH mixes:

<http://www.bafu.admin.ch/klima/09608/index.html?lang=de>

Market activities (power mix): new countries (HV)



Conclusions & Outlook

- Availability of **electricity** generation technology & market datasets in **new countries** is an important step towards **internationalisation**
- Update of production volumes ensures **up-to-date electricity mixes**
- Use of new features increases user-friendliness and transparency

Potential for further improvement

- Update of generation technologies for “v2.2 countries”, e.g. China
- Update of fuel supply chains, also considering country-specific trade information
- Extension in terms of individual generation technologies, e.g. wave power
- Regular update of annual production volumes