

Sustainable energy policy and activities at ETH Zurich

ISCN-GULF Conference 2009, June 11, 2009

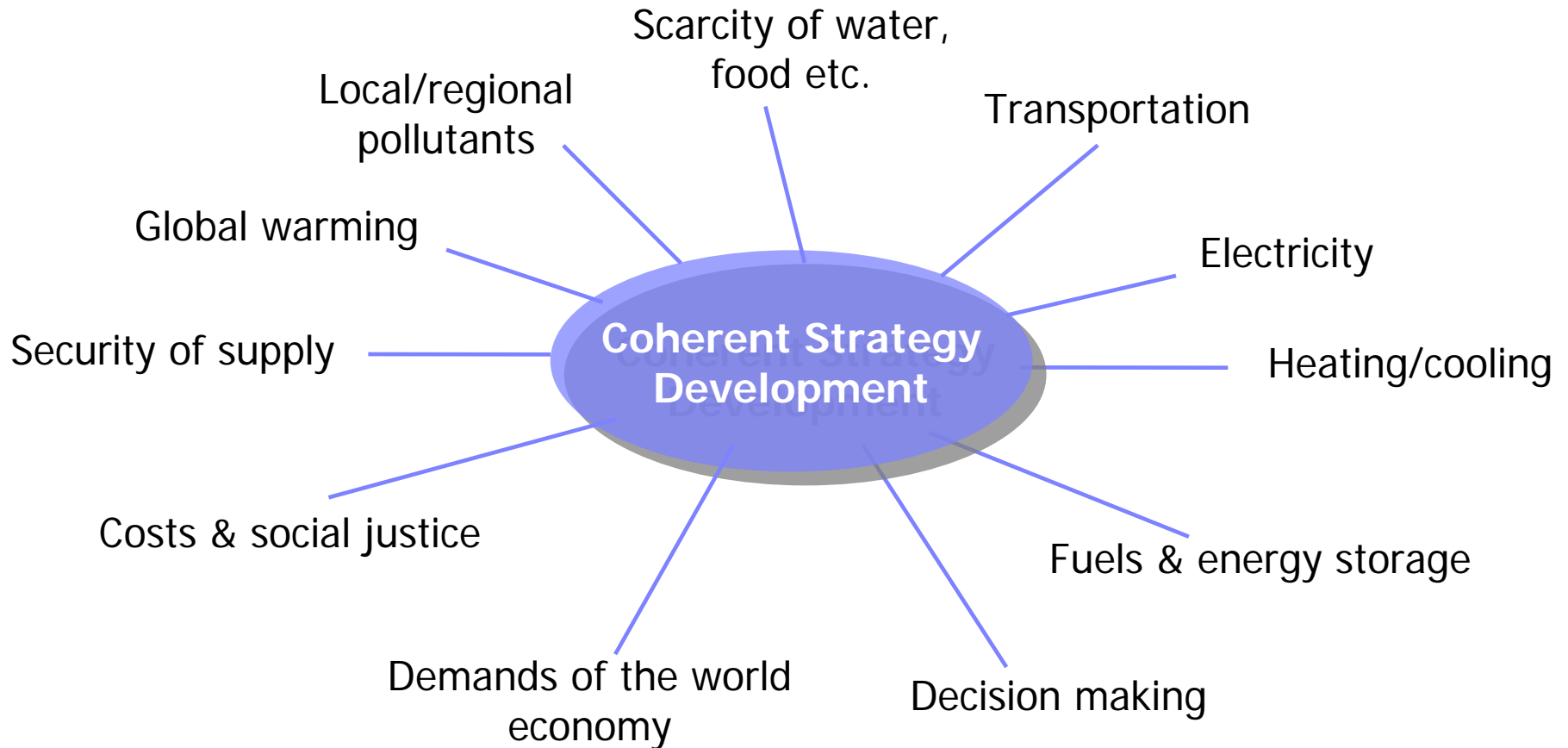
Prof. Dr. Ralph Eichler, President of ETH Zurich



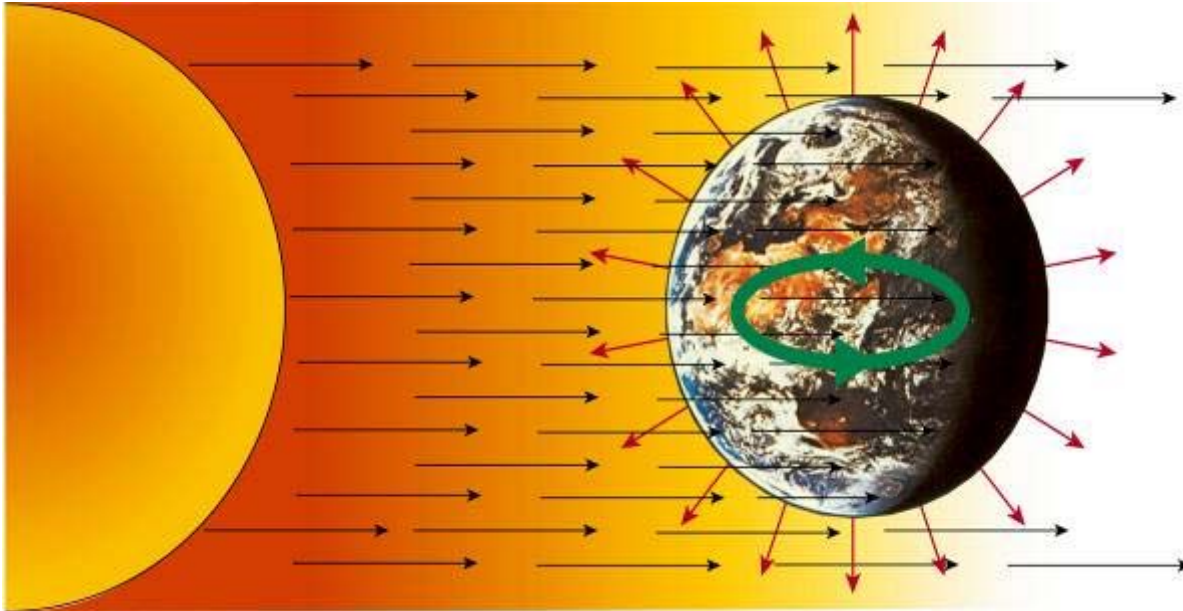
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Dimensions of the energy challenge



Energy and material flows

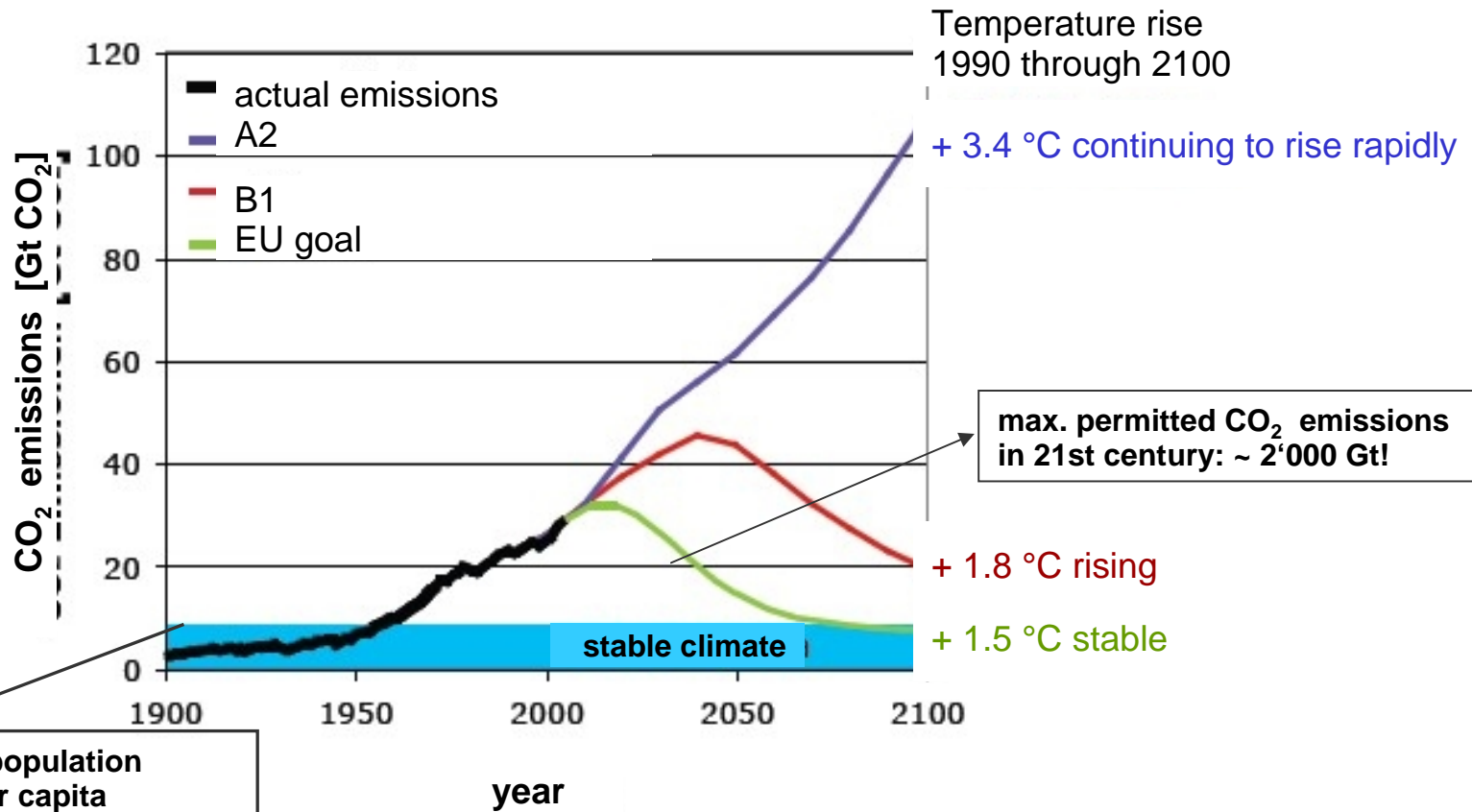


Energy consumption on earth is just a fraction of the sun's radiation (10^{-4}) and therefore does not upset the global energy balance.

Material flows cause the following problems:

- ⇒ Degradation of non-renewable energy sources
- ⇒ Emission of greenhouse gases
- ⇒ Discharge and storage of waste

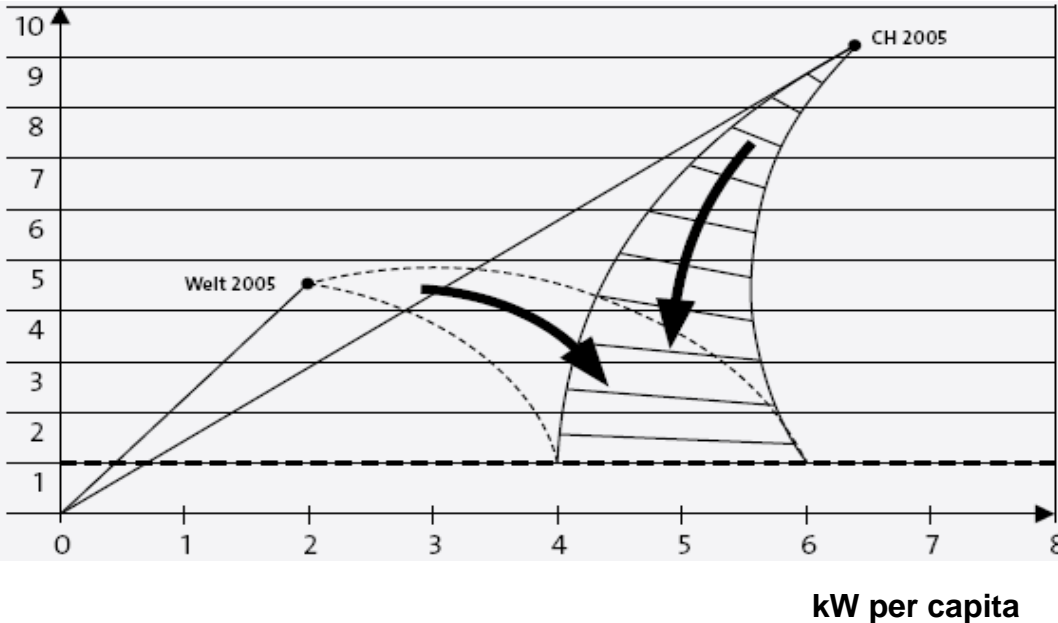
Control of climate change: Scenarios for CO₂ emissions and temperature rise



Source: IPCC

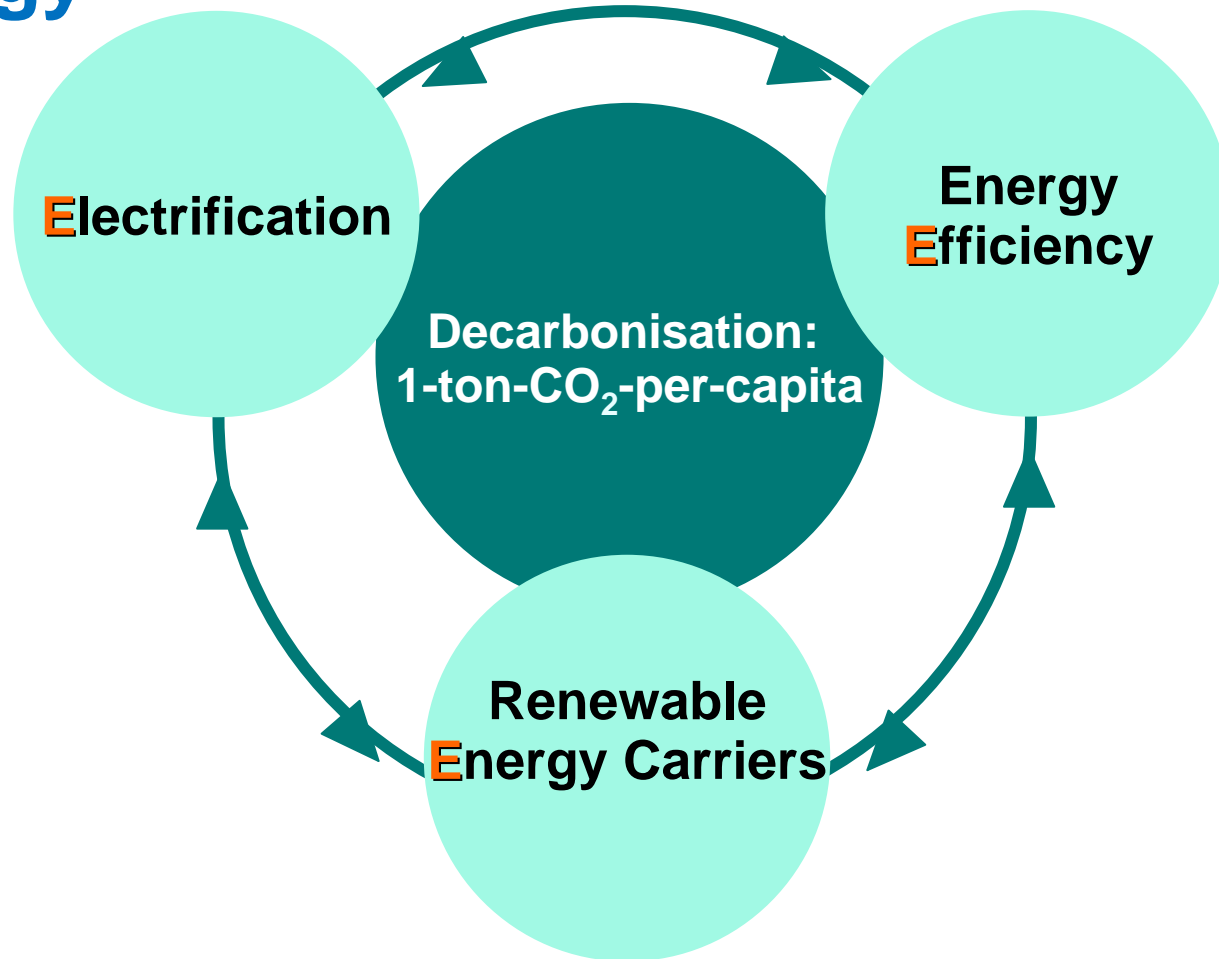
Target: 1 ton CO₂ per capita world consumption

CO₂ emissions [t CO₂ per capita]

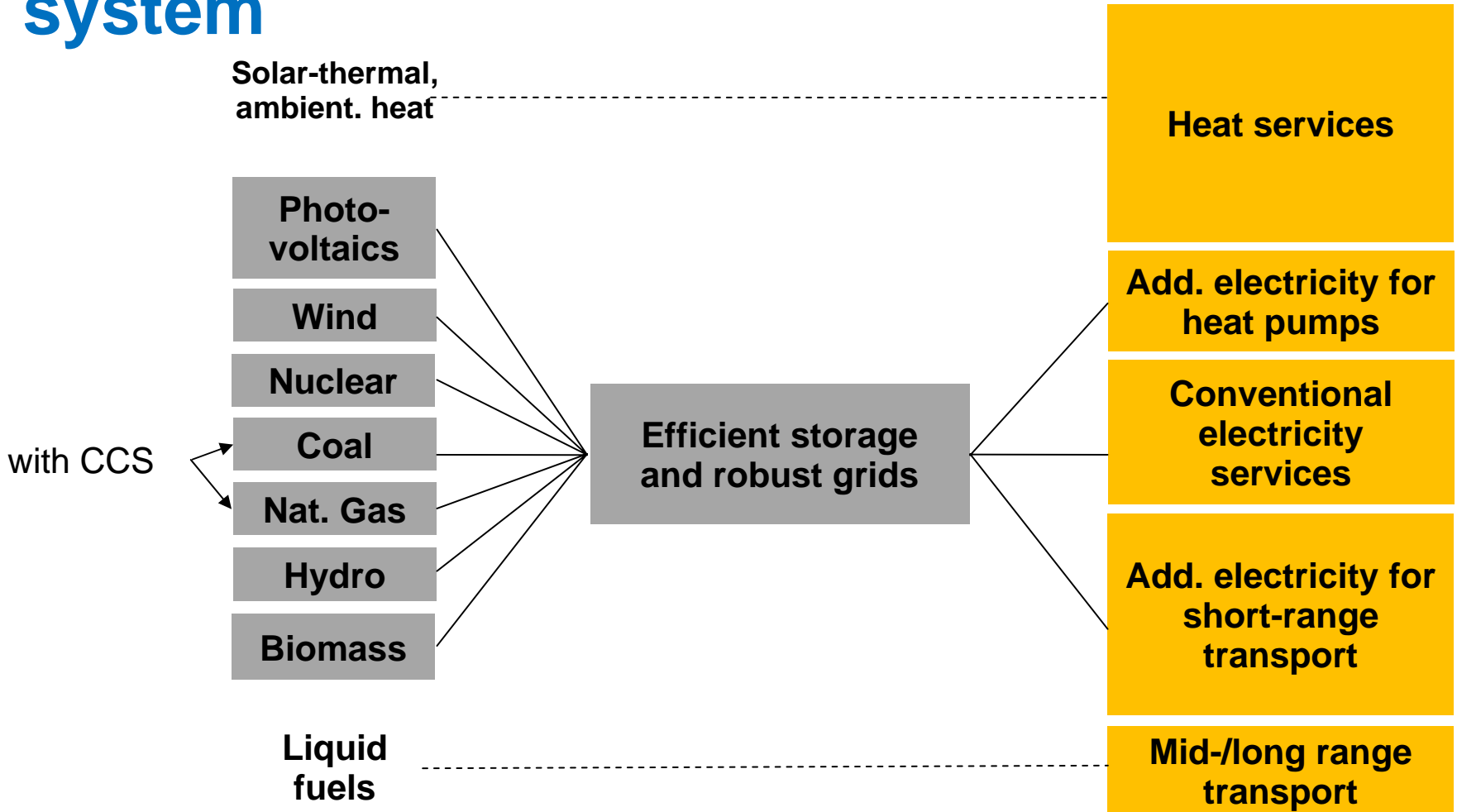


- 1 ton CO₂ per capita can be achieved towards the end of the 21st century in Switzerland and worldwide by fully exploiting realistic efficiency potentials and through targeted decarbonisation in all energy sectors to the greatest possible extent.
- Plausible primary energy range for 1 ton CO₂ per capita in year 2100, depending on electricity generation mix (fossil, nuclear, solar, wind, water).
- Assume not more than 10 billion people on earth

Building blocks of the ETH Zurich Energy Strategy



Electricity – backbone of the future energy system



4-6 kW/cap primary energy **2-2.5 kW/cap final energy**

Ecological footprint ETH Zurich (2008 usage)

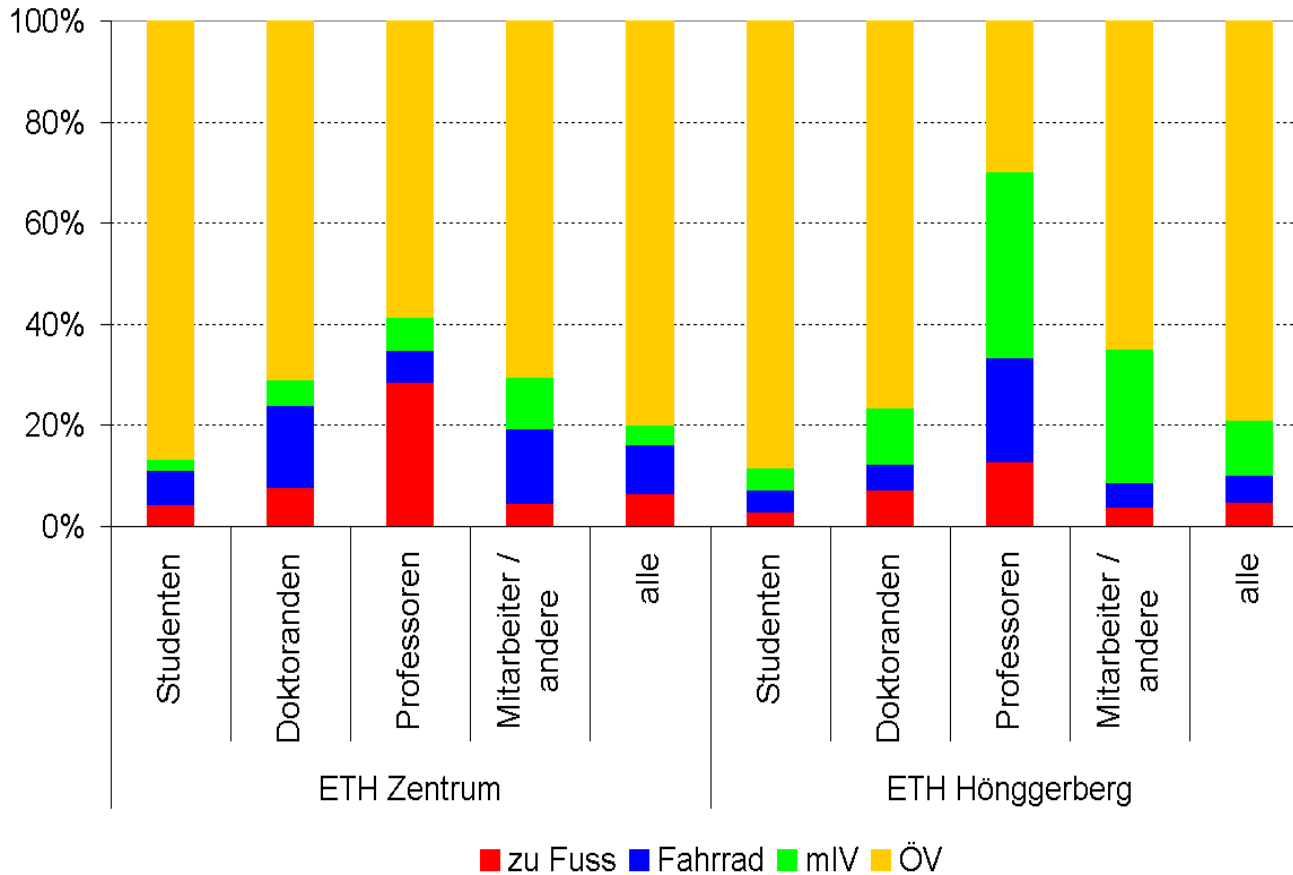
2008

Tendency (next 10 years)

Electricity	102 GWh	↑↑
Fossil fuels	42 GWh	↓↓
Gas/petrol	100 m ³	↓
CO ₂ -Emissions (total)	24'000 to (incl. flight-km)	↓↓
Air miles	50 mio km	↑
Solvents (2007)	62 to	↑
Drinking water	280'000 m ³	↓
Paper	64 Mio Pages A4	↓↓
Wastes	2'000 to	↓
Hazardous wastes	86 to	↑

Sustainable commuting at ETH

How eco-friendly we drive/go to work?



ETH Zurich:

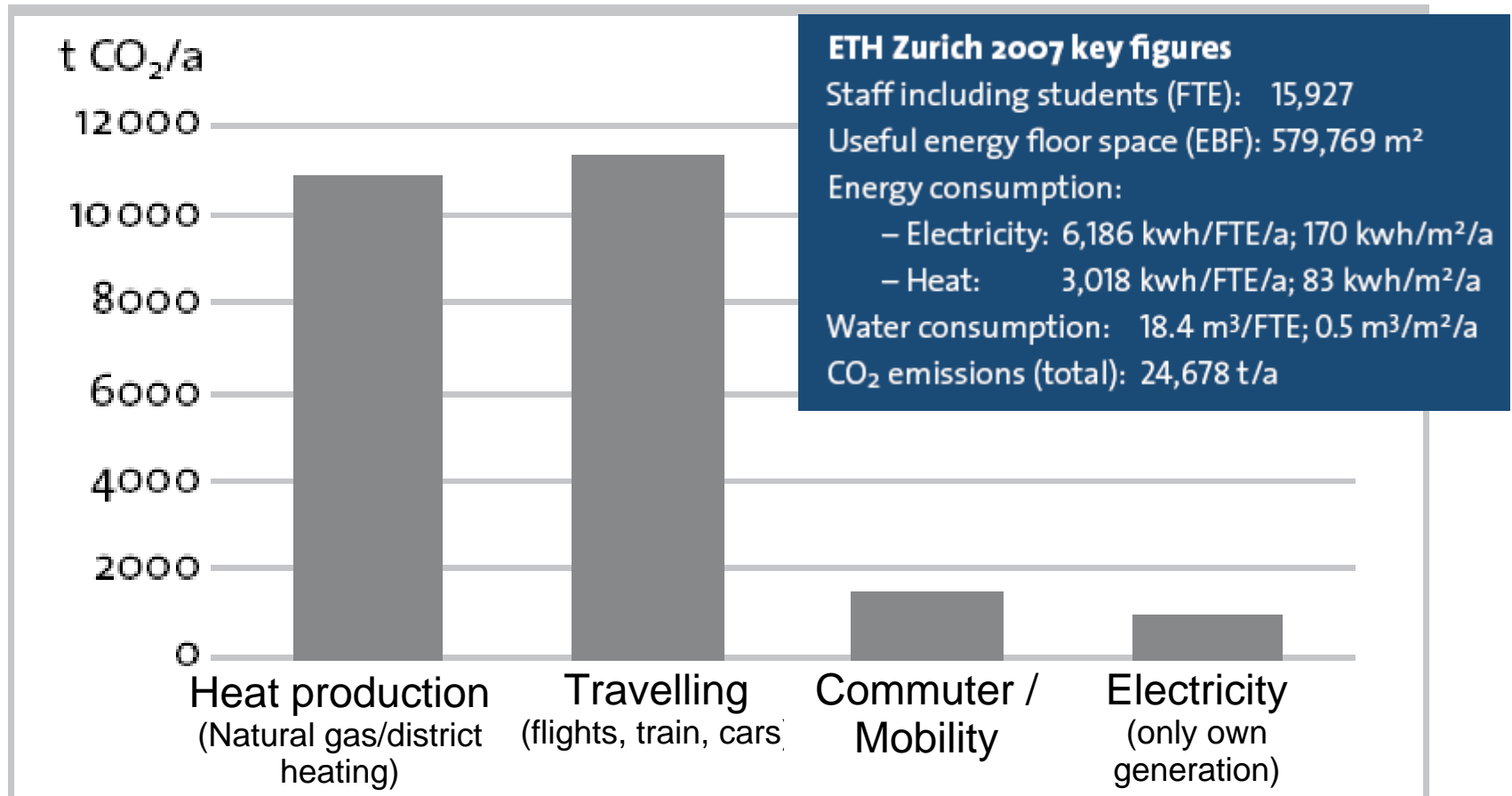
Public transport: 80 %

Bike: 8 %

Car: 6.5 %

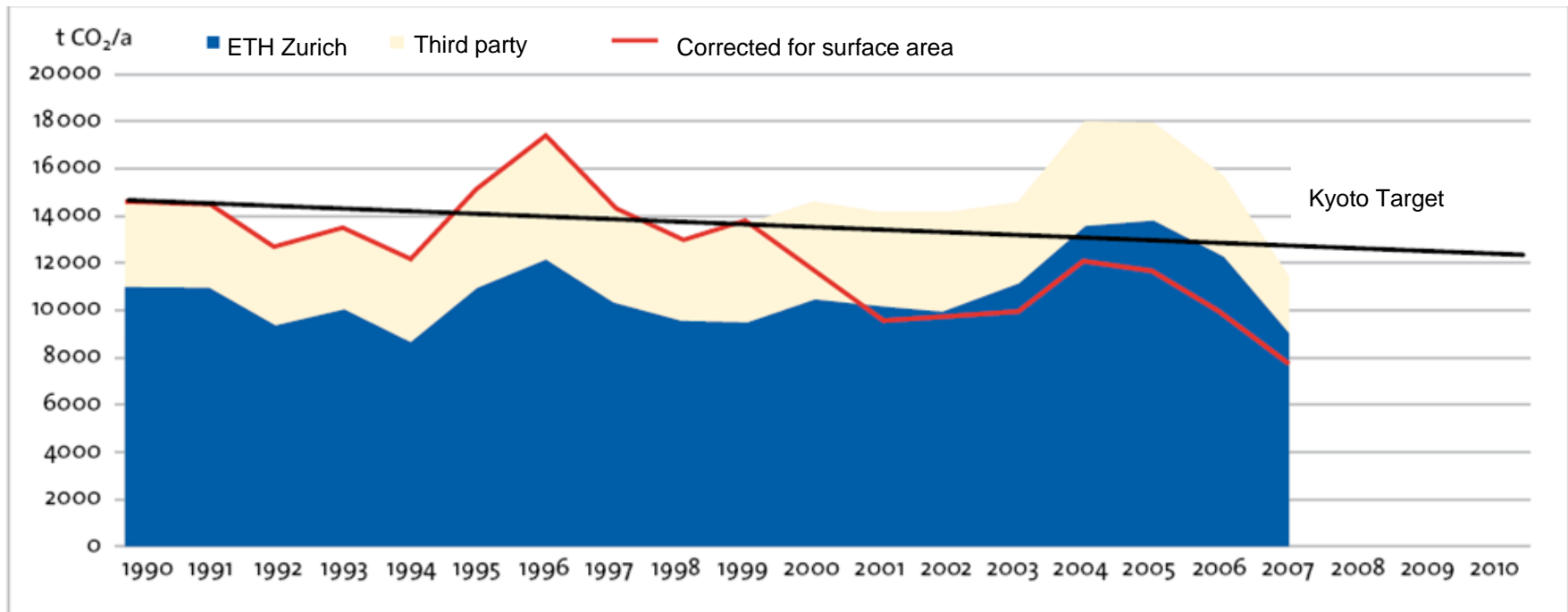
By foot: 5.5 %

Total CO₂ emissions of ETH Zurich



GHG reduction framework: progress to date

CO₂ emissions of ETH Zurich (heat & electricity production)
– (small cogeneration plant)



Campus GHG target

Overall: **comply with KYOTO protocol,**

- CO₂ emissions 10% below 1990

Specifically (project goals)

1. Reduce CO₂ emissions by 50% caused by heat production for the Science City Campus by 2020.
2. The imputable CO₂ emissions of all duty travel and excursions are to be cut by 50 per cent by 2009 (!), based on 2006 figures.

Campus GHG reduction efforts: summary of last 12 months

-1-

New concepts / buildings

- Further development of the energy concept for the Science City campus – concept is based on Underground Thermal Energy Storage.
- Kick-off for the new energy concept of the central ETH campus.
- Newly opened building complies with SWISS Minergy standard **(30 - 40 kWh/m²)**
- Ecoworks initiative. Sort of student/employee suggestion system for the reduction of GHG emissions at the ETH and in its „near“ environment.
- Promotion of train travelling (short haul flights) and video conference systems instead of air travel.
- New PV plant

Campus GHG reduction efforts: summary of last 12 months

-2-

Optimizations / Refurbishments

- Renovations of buildings have to comply with Energy Efficiency standards (Minergie).
- Lowering of fuel consumption of ETH car fleet by promoting hybrid cars.
- Optimization of chiller system (energy efficiency)
- Optimizations of lightning systems
- Buying of electricity, based on (certified) renewable electricity (PV, biomass, small hydropower plants)

Innovations and highlights

- **The new Monte Rosa hut** – advanced building technology at 3000 m above sea level



Innovative alpine hut

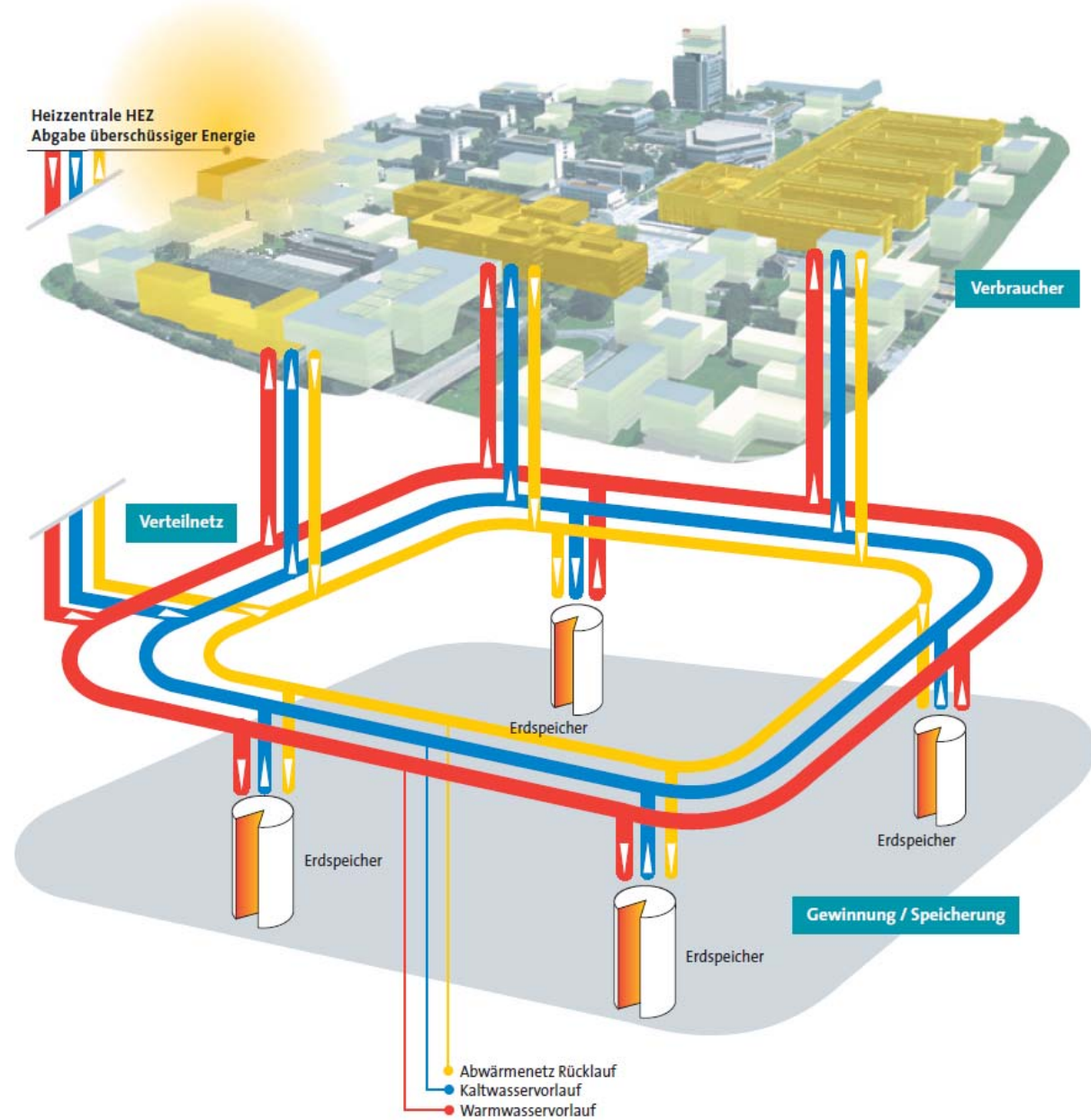
- **Science City** – the sustainable campus
www.sciencecity.ethz.ch



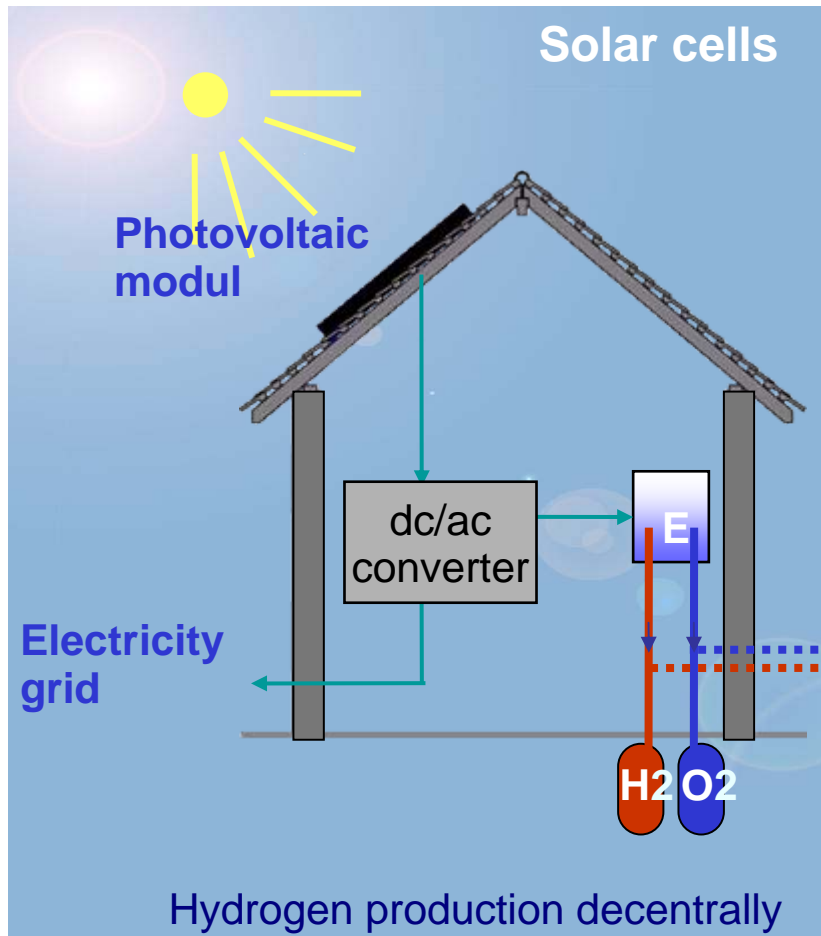
Student housing producing energy

Science City energy concept

with geothermal store system



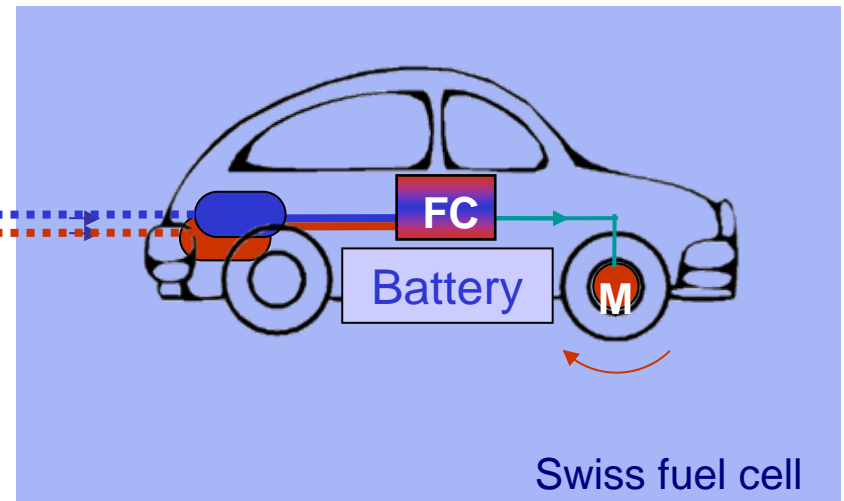
Development of a clean energy chain



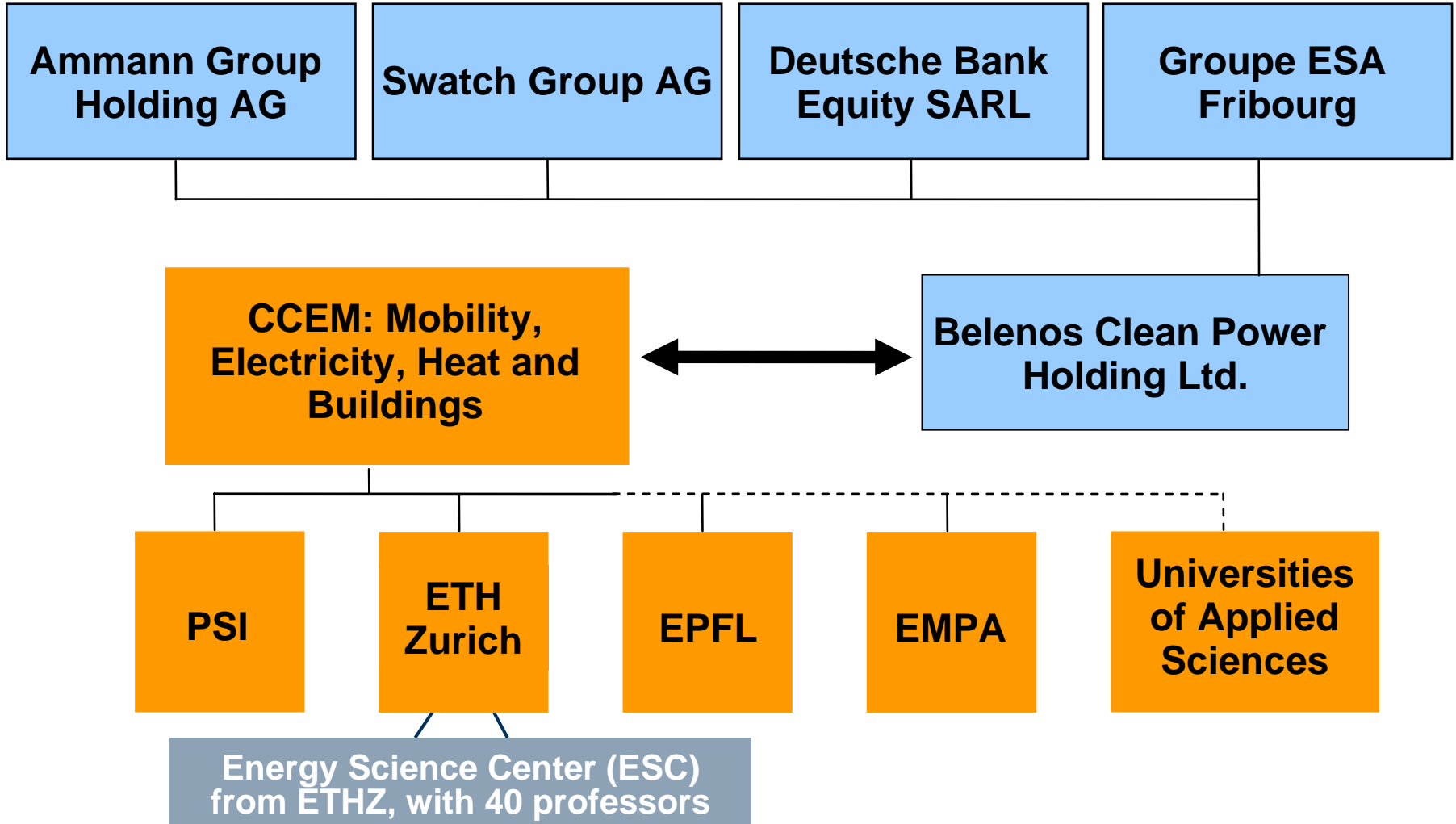
63 m² photovoltaic cells deliver the hydrogen for at least a range of

13'000 km / year

- Electricity
- Oxygen
- Hydrogen



Joint venture industry – ETH Domain



Science City energy concept

Made possible by the following measures:

- Technical measures such as the free-cooling system, retro-fitting of heat recovery equipment, optimization of the low-temperature system, installation of efficient lighting, etc.
- New and renovated buildings are heated using input temperatures of (max.) 30°C.
- No use at all of air conditioning systems with humidifying and dehumidifying functions. Air conditioned buildings fed with cold water temperatures of over 12°C.
- The (most efficient) systems possible are installed decentrally to supply processes with high temperature heat and low temperature refrigeration.
- Implementation of the geothermal store system requires an appropriate infrastructure that fulfils exoegetic as well as energy requirements. Construction of the system ends in 2020.
- Promoting sustainable mobility.