

## Joint project: Heat utilization with solid sorption technology

### Overview

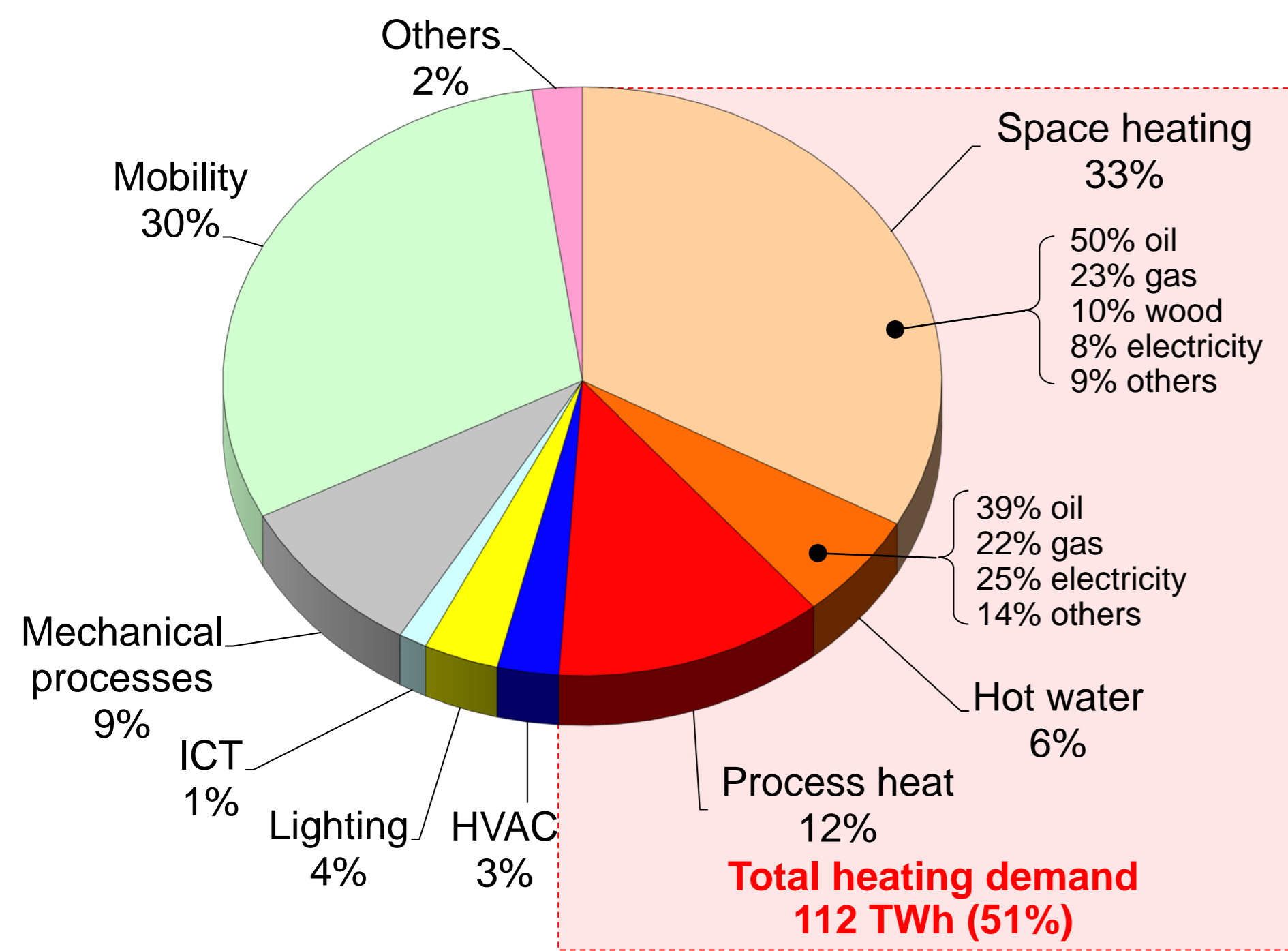
**THRIVE**

Thermally driven adsorption heat pumps for substitution of electricity and fossil fuels

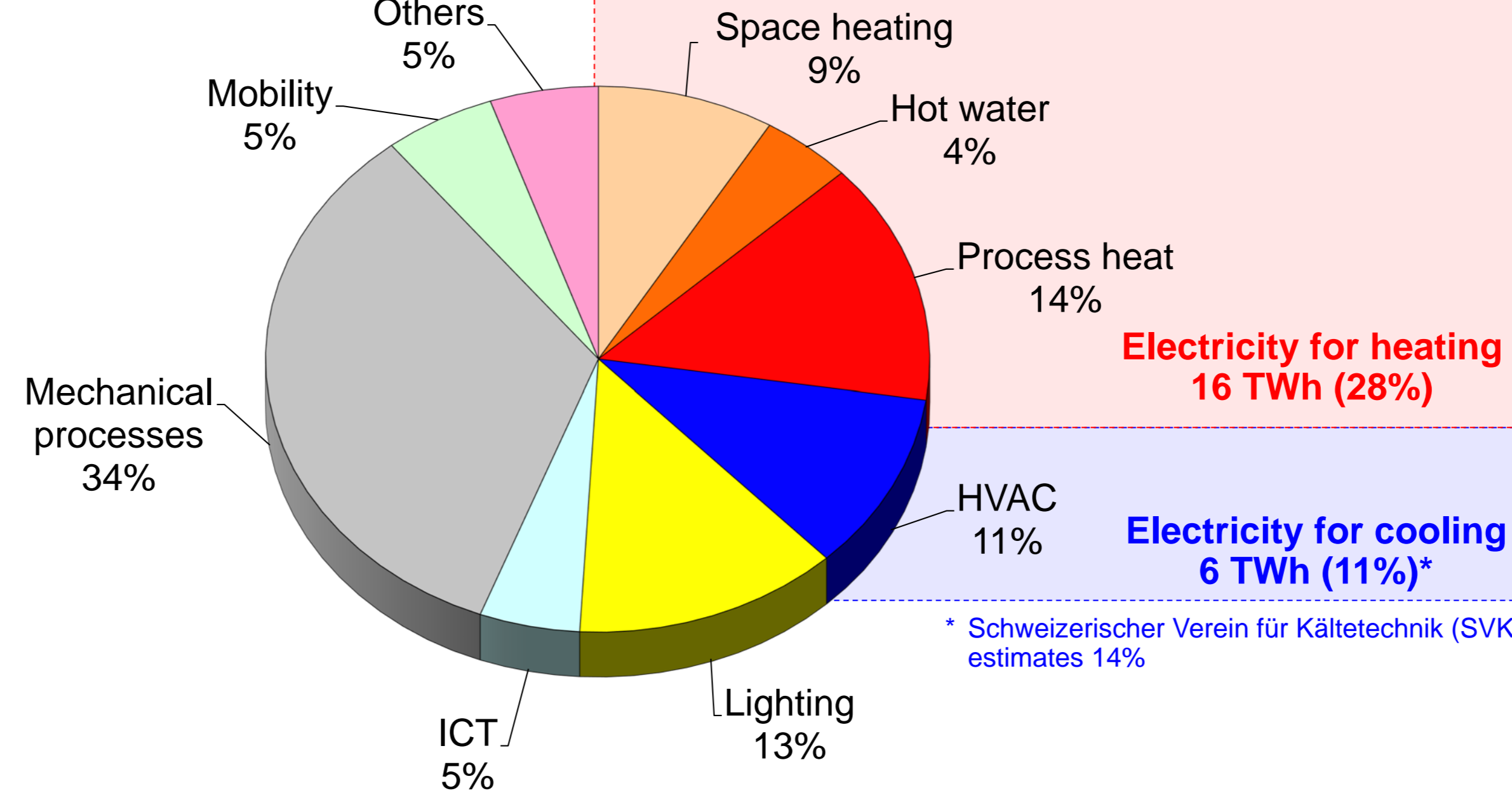


### Background: Energy consumption in Switzerland (2012)

Total end energy consumption: 220 TWh



Total electricity consumption: 57 TWh



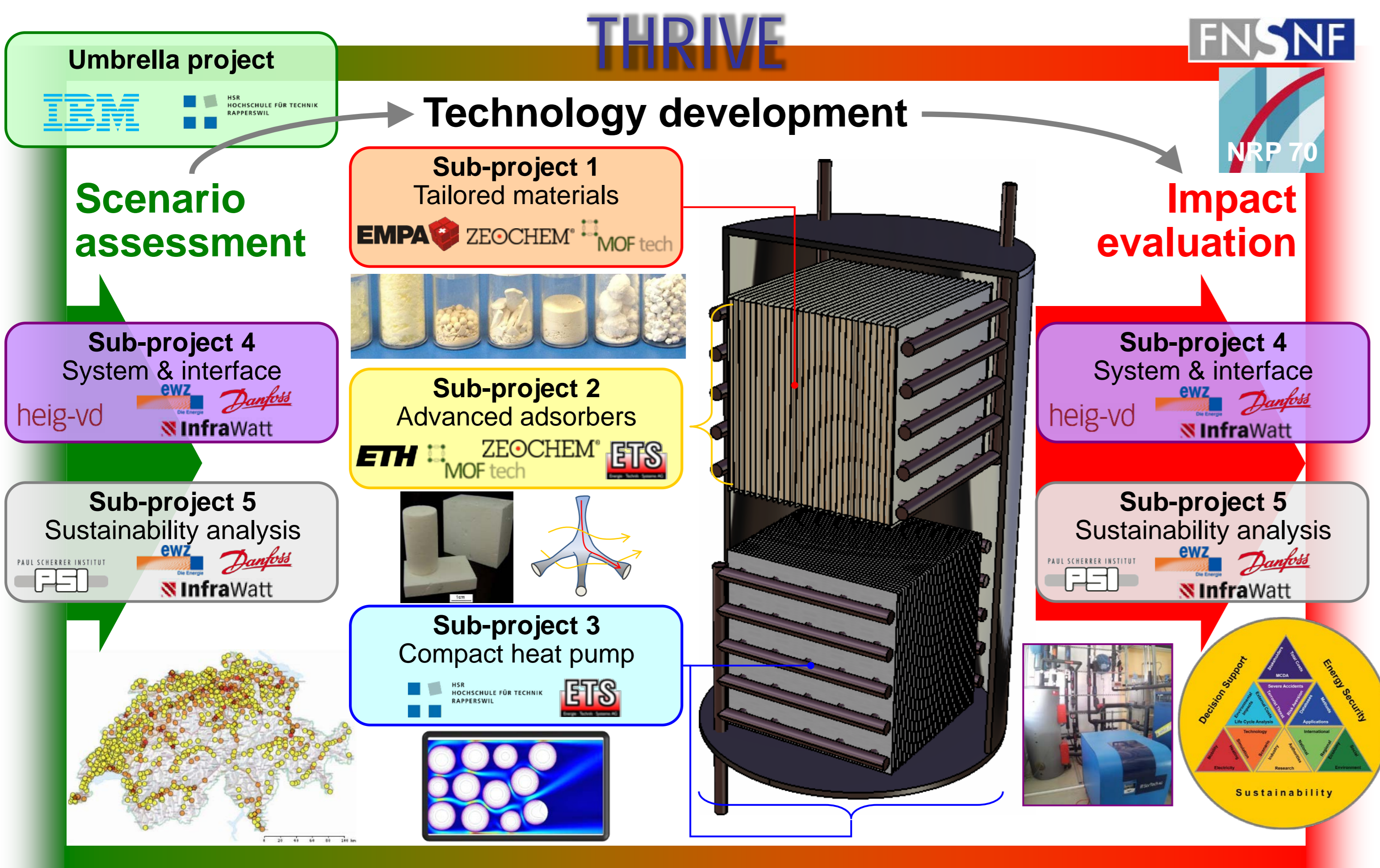
For the Energy Turnaround, the dependency on fossil fuels and electricity for heating and cooling applications needs to be reduced.

THRIVE concept:

- shift heating and cooling loads from electrical to **thermal grids**
- reduce fossil fuel consumption** for heating applications

Source: Prognos AG, Infras AG, TEP Energy GmbH, Analyse des schweizerischen Energieverbrauchs 2000 – 2012 nach Verwendungszwecken (2013)

### Main project objectives and strategy



THRIVE relies on the following main action fields:

- Identify application scenarios for thermally driven heat pumps in Switzerland as defined by demand and supply patterns
- Introduce thermally driven heat pump technology with minimum electricity needs and tailored for exploitation of specific energy sources and thermal demand
- Analyze the impact of the technology including a sustainability assessment and benchmarking against alternative technologies

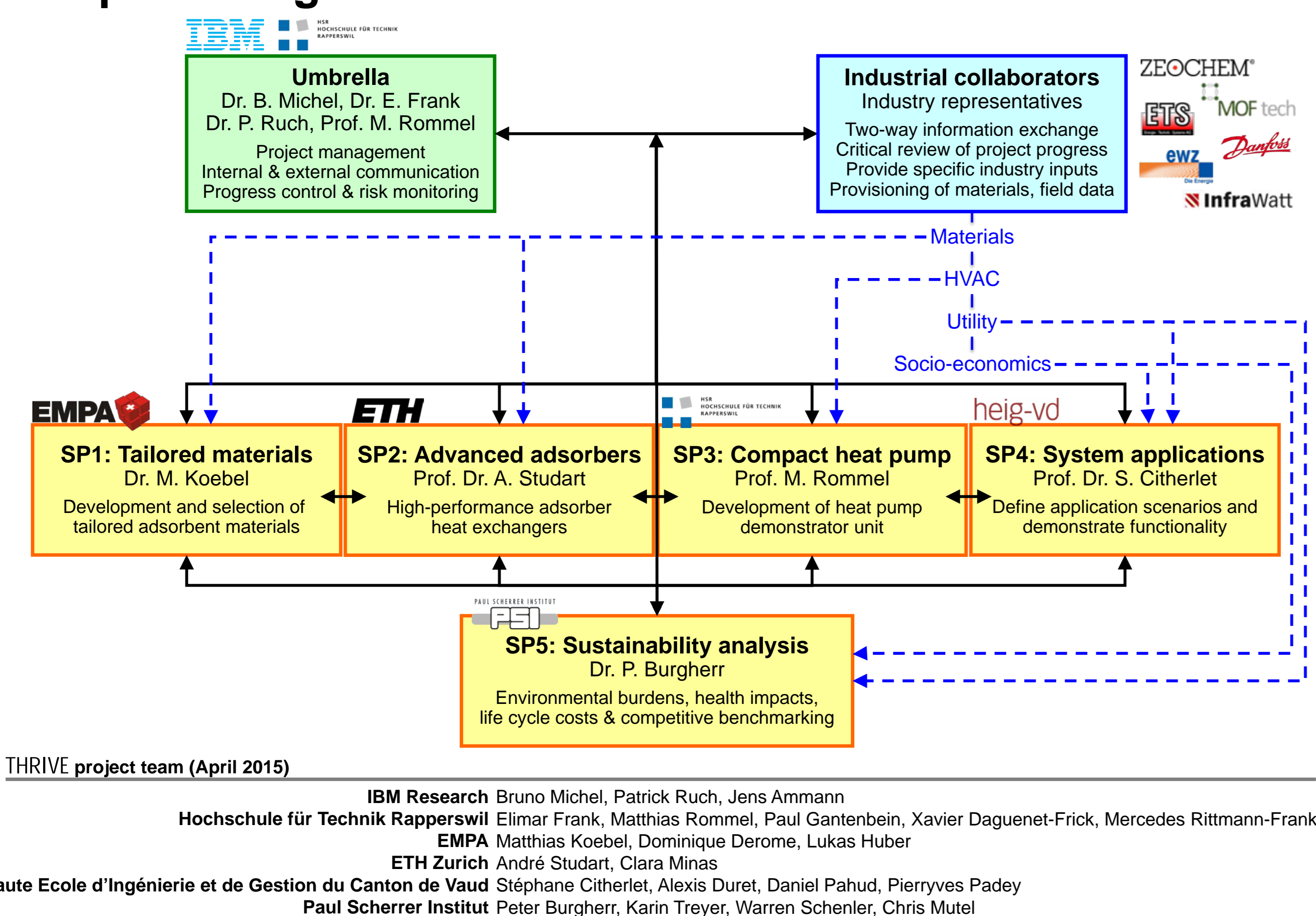
**Targeted energy sources:** (i) waste heat from industrial processes and (ii) thermal energy from cogeneration and renewables

**Key enabling technology:** Compact solid sorption heat pump

**Demonstrator targets:** 10 kW cooling at  $COP_{el} > 15$   
30 kW heating at  $COP_{el} > 40$

### Subprojects

#### Simplified organizational chart



THRIVE project team (April 2015)

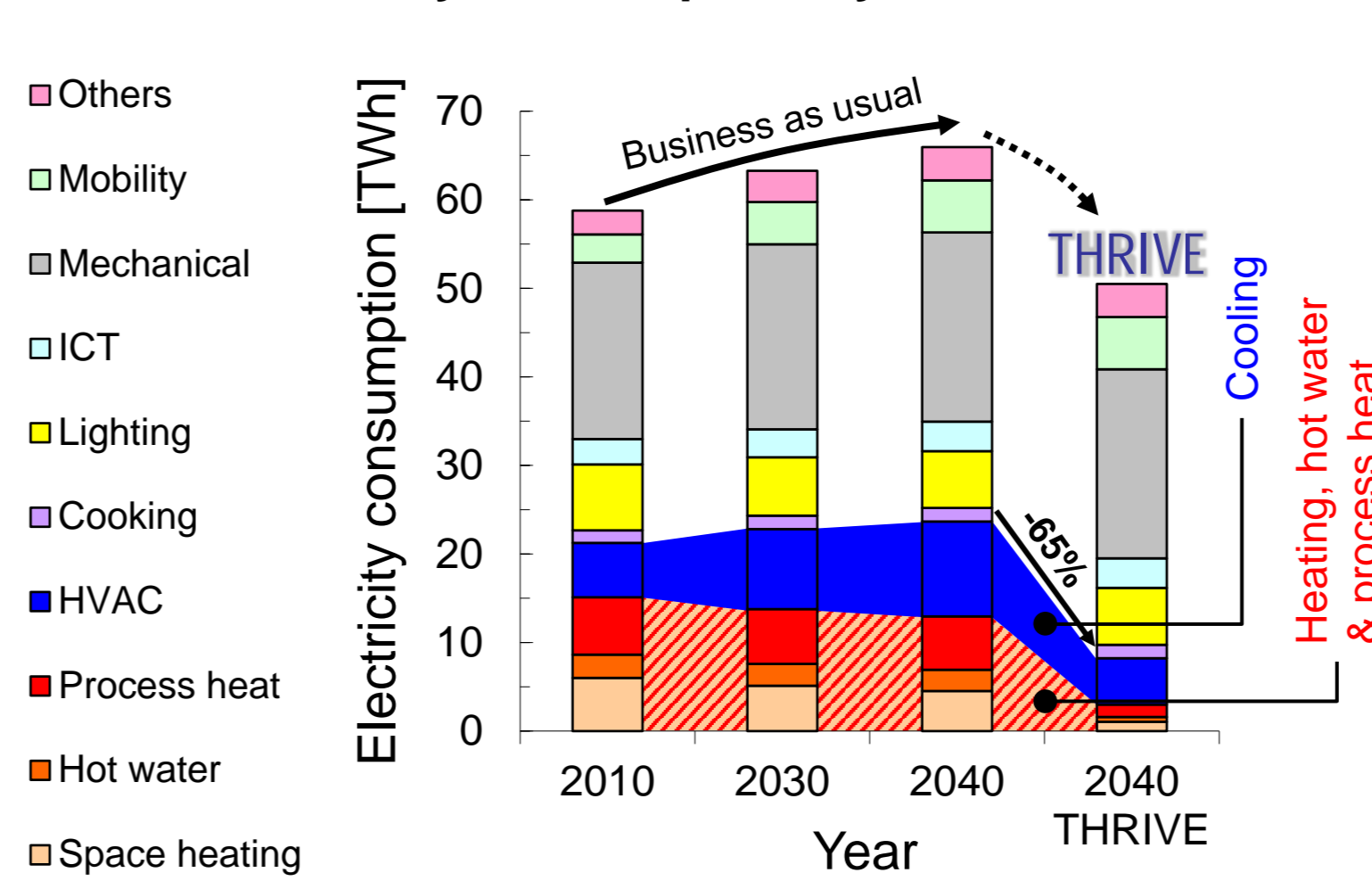
IBM Research Bruno Michel, Patrick Ruch, Jens Ammann  
Hochschule für Technik Rapperswil Elmar Frank, Matthias Rommel, Paul Gantenbein, Xavier Daguene-Frick, Mercedes Rittmann-Frank  
EMPA Matthias Koebel, Dominique Derome, Lukas Huber  
ETH Zurich André Studart, Clara Minas  
Haute Ecole d'Ingénierie et de Gestion du Canton de Vaud Stéphane Citherlet, Alexis Duret, Daniel Pahud, Pierryyes Padey  
Paul Scherrer Institut Peter Burgherr, Karin Treyer, Warren Schenler, Chris Muel

### Energy Turnaround

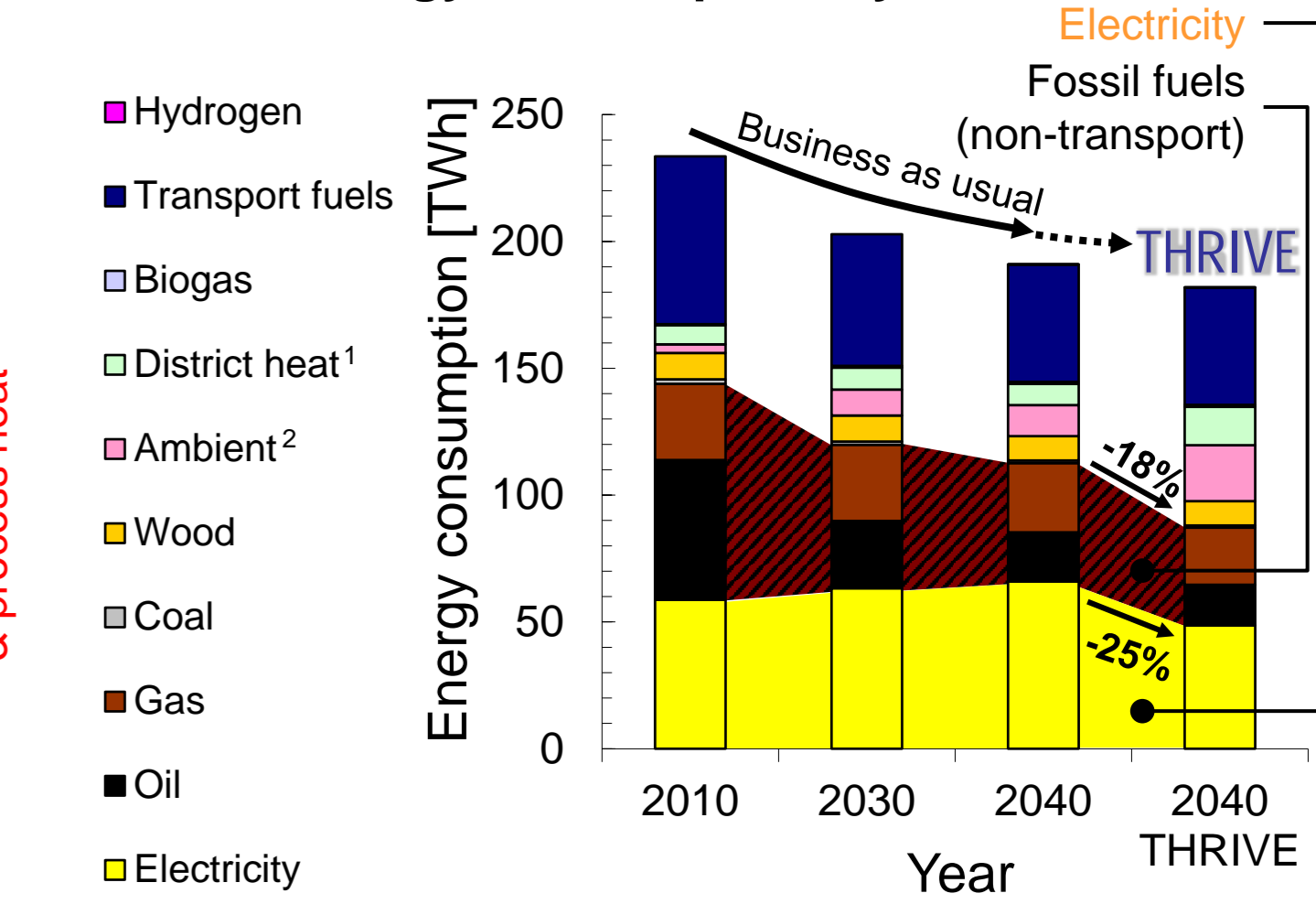
THRIVE will contribute toward "Energy Strategy 2050" as follows:

- Improved energy efficiency by exploiting waste or renewable heat and minimizing fuel consumption
- Integration of renewables through usage of heat from solar thermal, biomass, cogeneration and waste incineration
- Reduction of fossil fuel consumption and CO<sub>2</sub> emissions
- Reduction of electricity consumption for heating and cooling

Electricity consumption by end use



Energy consumption by carrier



Source: Prognos AG, Die Energieperspektiven für die Schweiz bis 2050 (2012)

<sup>1</sup> Includes waste incineration <sup>2</sup> Includes solar thermal

### Contact

#### Principal investigators

Dr. Bruno Michel  
IBM Research – Zurich  
bmi@zurich.ibm.com

Dr. Elmar Frank  
Hochschule für Technik Rapperswil  
efrank@hsr.ch

#### Project management

Dr. Patrick Ruch  
IBM Research – Zurich  
ruc@zurich.ibm.com

Prof. Matthias Rommel  
Hochschule für Technik Rapperswil  
matthias.rommel@spf.ch