# How to strengthen Renewable Heating and Cooling

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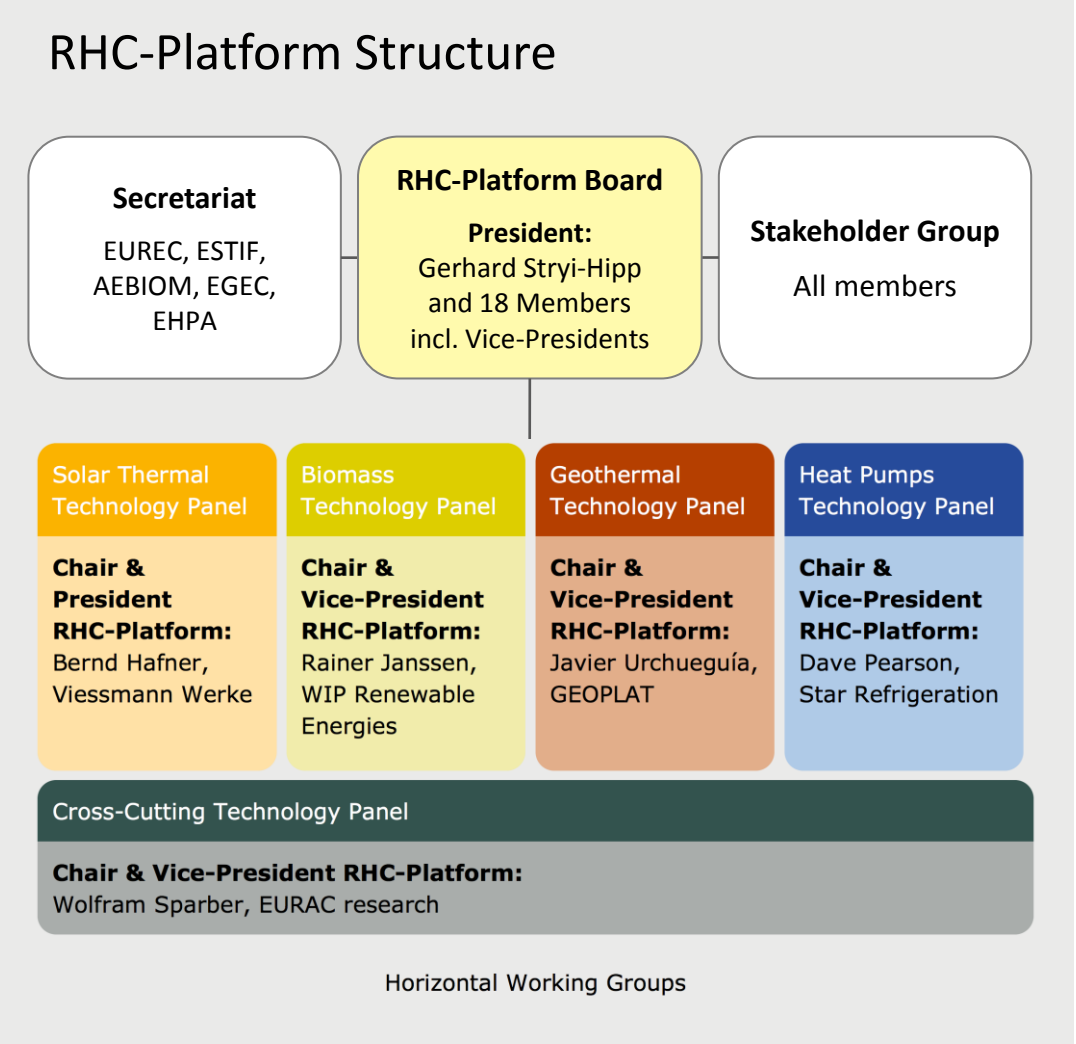
**REN21 Webinar Heating & Cooling**
21 October 2015

# Structure of the RHC-Platform

## Facts and figures

- Founded in 2008
- One of 35 officially endorsed technology platforms
- 5 panels, led by steering committees
- Supported by the European Commission
- More than 600 members

www.rhc-platform.org



# First steps of the RHC-Platform: Development of Vision, Strategy and Roadmaps

*Download: www.rhc-platform.org*


**Common Vision**
2020 - 2050


**Strategic Research Priorities** of Solar thermal, Biomass, Geothermal and Cross-cutting
➔ **Strategic Research & Innovation Agenda**


**Technology Roadmaps** of Solar thermal, Biomass, Geothermal and Cross-cutting
➔ **Common Implementation Roadmap**

2011 2012 2013 2014

# Solar Water Heating in Europe

**MARKET 2013** (EU-27 + Switzerland)

- Newly Installed: 3.1 Mio $m^2$ / 2.1 $GW_{th}$
- In operation: 43 Mio $m^2$ / 30 $GW_{th}$

**CHARACTERISTICS**

- Solar radiation: for free and everywhere
- Daily and seasonal solar variation
  *Storage and auxiliary heating source needed*

**CHALLENGES**

- Enlarge the type of applications
  *Large systems, district heating, process heat, higher temperature, solar assisted cooling*
- Increase the solar fraction per building
  *From hot water to Solar-Active-Houses*
- Ease operation and reduction of costs

**APPLICATIONS**

**Domestic hot water & space heating**

– One/two/multi family homes
– Hotels, hospitals, residential homes,…
– District heating
– Multifunctional façades
– PV-Thermal (PV-T) hybrid collectors

**Process heat**

– Low up to 100°C
– Medium up to 250°C
– Solar assisted cooling and refrigeration








# Biomass

**MARKET solid biomass 2013** (EU-27)

- Heat consumption from solid biomass: 71.7 Mtoe / 834 TWh
- Biomass consumed: 92 Mtoe / 1064 TWh

**CHARACTERISTICS**

- Stored renewable energy
  *Ideal as auxiliary heat for variable RES*
- Limited / sustainable production needed
  *Used for electricity and transport as well*
  *Imports & trade possible in & out Europe*

**CHALLENGES**

- Developing sustainable biomass supply chains for different sources
- Definition of sustainability criteria for biomass
  *Strong influence on the biomass potential*
- Increase efficiency of burning biomass
- Increase efficiency by using combined heat, power and cooling biomass plants
  *Most efficient way to use biomass*

**APPLICATIONS**

**Small burners**

– Pellets stove
– Wood chip boiler
– Log wood stove/boiler

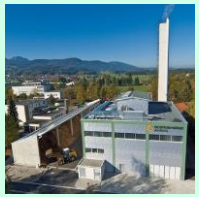

**District heating & cooling and process heat**

*Heat only or combined heat and power*

– Pellets boiler
– Wood chips boiler
– Waste & agricultural feedstock boiler








Use of

– Solid biomass
– Bio fuels / bio gas

# Geothermal

**MARKET 2012** (EU-27)

- Aerothermal heat pumps sold: 1.6 Mio
- Geothermal heat pumps sold: 0.1 Mio

**CHARACTERISTICS**

- Continuous heat source
  *Ideal for base demand, peak demand suitable*
- Resources principally everywhere
  *Quality of deep GT resources depending on local geology and depth*

**CHALLENGES**

- Improvements of exploration and underground reconnaissance
  *Investment risk of successful drilling*
- Increase of efficiency / cost reduction
- Deployment of EGS

**TECHNOLOGIES and APPLICATIONS**

**Shallow GT**

– Geothermal HP
– Underground thermal storage

Applications

– DHW, space heating & cooling
– process heat

**Deep GT (>400m)**

– Direct heat use
– Comb heat & power

Applications

– District heating
– Agriculture and industrial processes
– Balneology
– Cooling







HP = Heat pump, GSHP = Ground source heat pump, EGS = Enhanced geothermal systems, DHW = Domestic hot water

# Cross Cutting Technologies

## TECHNOLOGIES

- District heating and cooling (DHC)
- Thermal energy storage
- Hybrid systems and heat pumps

## CHARACTERISTICS

- Enabling technologies for high uptake of renewable energy
- Optimization / integration to framework conditions necessary

## CHALLENGES

- Develop smart solutions and ICT for complex systems
- Increase efficiency and COP
- Reduce costs

## APPLICATIONS

### DHC

– District heating
– District cooling
– DH&C with seasonal storage

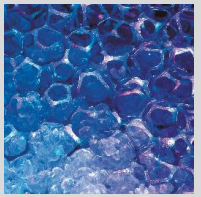
### TE Storage

– Water storage
– PCM
– Thermo chemical
– Underground storage (UTES)

### Hybrid systems heat pumps

– Innovative system design
– Ground, water and air heat pumps






COP = Coefficient of performance, PCM = Phase change material, GT = Geothermal , UTES = Underground Thermal Energy Storage

# The RHC potential is identified – Competitiveness of the single technologies is unclear

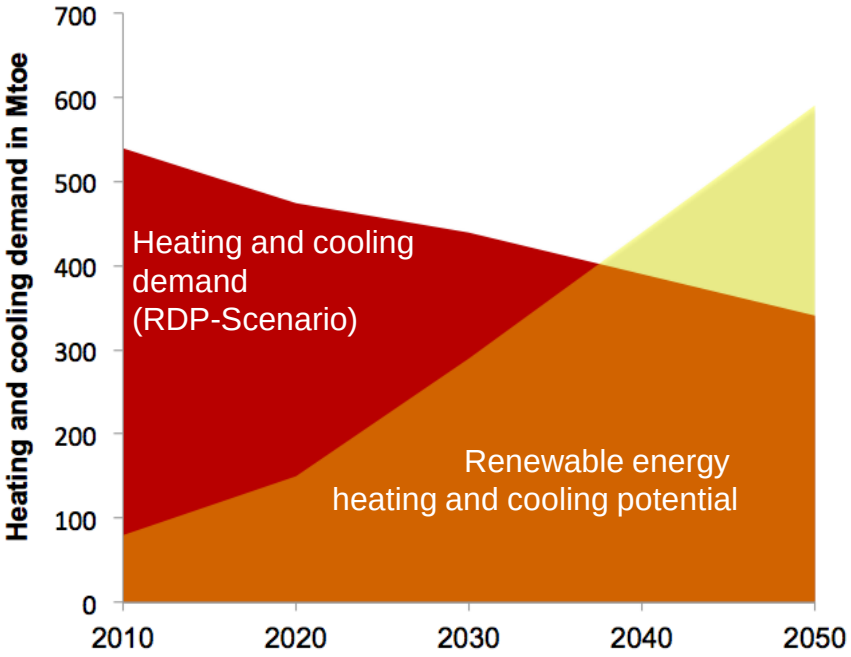
**1. Competition**: **fossil fuels against renewable energy sources (RES)**
Due to scarcity (peak oil), growing import dependency and/or climate change regulation fossil fuels will be replaced by renewable energy sources

➔ **Renewable energy sources will replace fossil fuels on the long run!**

**2. Competition: within the RES sector**
Solar thermal vs. Biomass vs. Geo thermal vs. heat by RES electricity and heat pumps

➔ **The single technologies/solutions must improve their competitiveness!**

**Renewable energy sources could deliver 100% of the European heating and cooling demand by 2040**

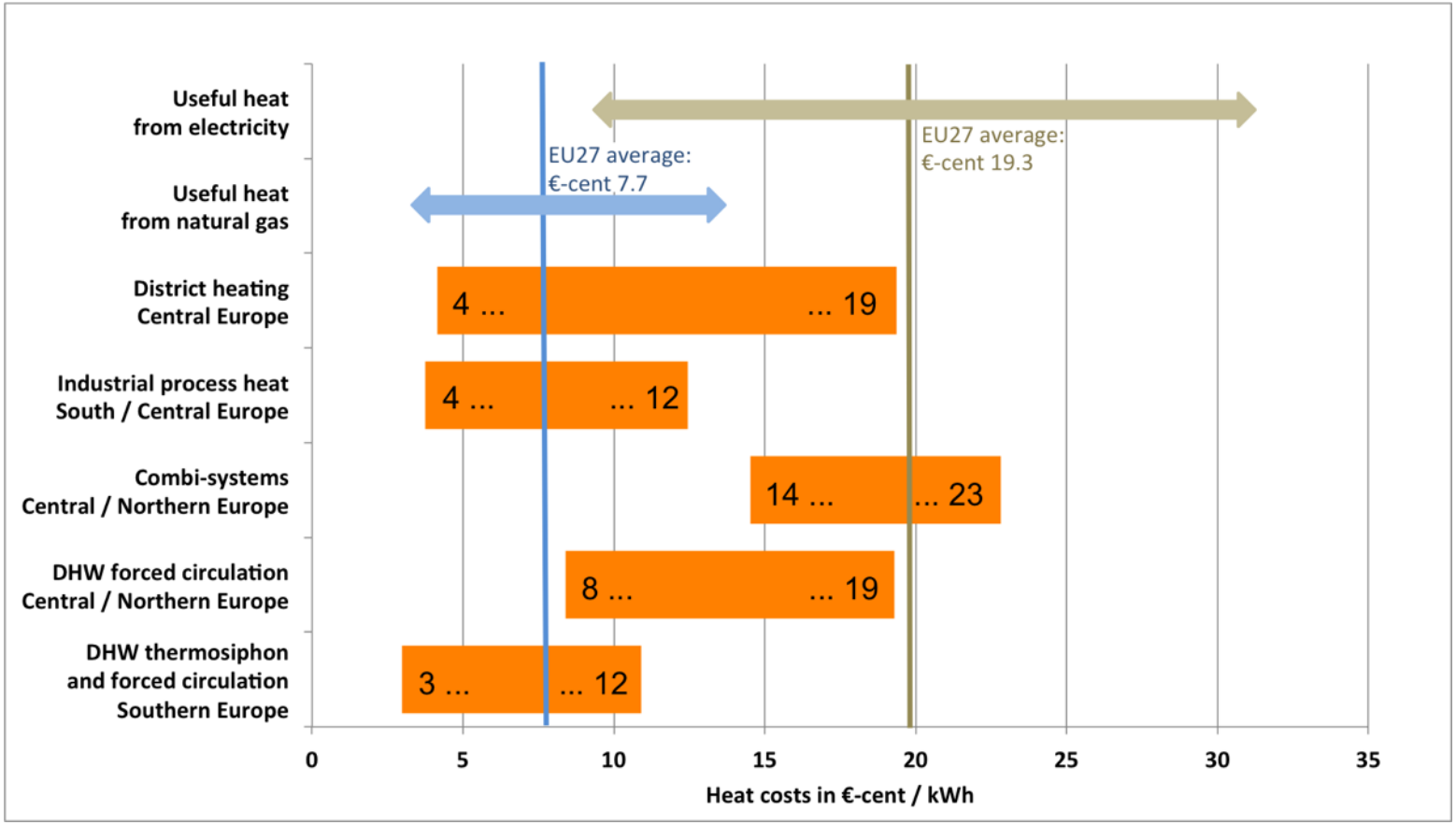



Source: EHC-platform, Common vision for the RHC-sector, 2011
RDP-Scenario = Full Research, development and policy scenario

# Main objective of R&D on RHC: Cost reduction

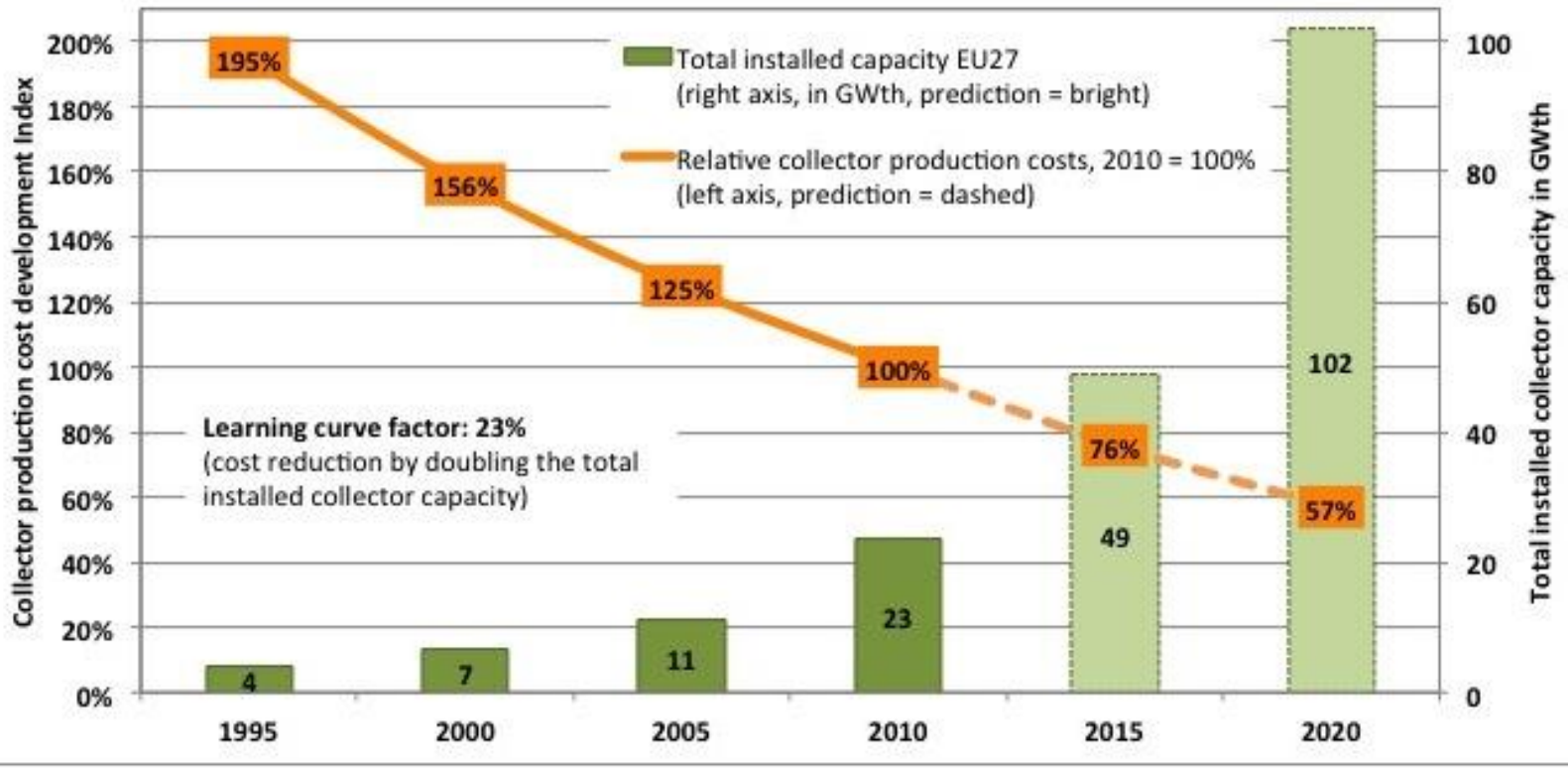
## Example: solar heat costs – diverse picture

Status solar thermal heat prices for different applications in different European regions in comparison to heat from electricity and natural gas



# Example solar thermal: Cost reduction on component level happened, but not on system level (energy costs)

**Production costs development for European standard collectors (2.0 – 2.5 m²)**

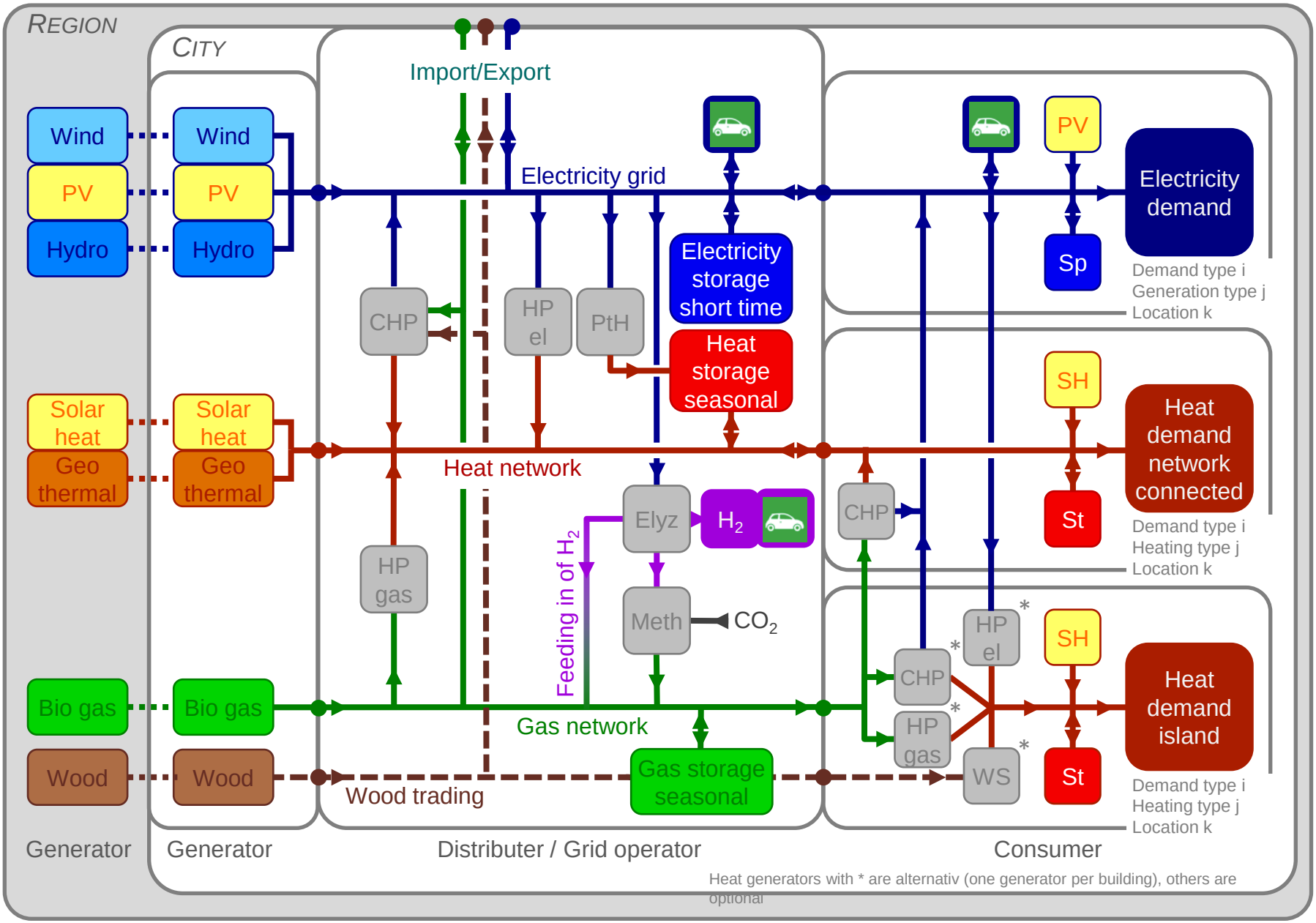



Source: ESTTP, Daten: Solrico, Trenkner (historical data) / ESTIF (market perspective based on NREAPs)

# Characteristic H&C markets and technologies

- **High heterogeneity, high complexity:** on owner, operator, technologies, equipment and system sizes, type and size of applications (room, district and process heating,...)
- **Strong dependency on international fossil fuel prices** (with uncertain forecasts)
- Growing **interdependency of the heating & cooling with the elctrictical sector** (heat pumps, combined heat and power, other power to heat technologies)
  ➔ **System solutions are necessary for the electric-heating-cooling system**
- **Future heating & cooling demand is difficult to forecast, because it is strongly dependent on efficiency and comfort requirements** (building insulation, efficient technology and distribution,...)
- **Renewable energy sources (RES) are able to deliver 100% of the H&C demand, but**
  - demand must be is limited = high efficient system,
  - energy system must be optimized (right mix of local resources) and
  - the entire electrical-heating-cooling system must be optimized
- **Development of technologies and markets in heating & cooling** is necessary
  - there is huge market potential and huge potential on technological innovations

# 100% RES: Electric-Heating-System must be optimized as a whole




HP el/gas = Heat pump electric / gas driven, CHP = Combined heat and power, WS = Wood stove, St = storage, SH = Solar heat, Elyz = Elektrolyzer, Meth = Methanation

Source: Fraunhofer ISE

# Experiences from the project SoPro India

SoPro India
Solar Water Heating for Industrial Processes in India

## Analysis of the Indian solar thermal market

- Indian solar water heating systems (SWHS) market is rather small, but has **high potential**
- Barriers are
  - **Lack of awareness**
  - **Concerns on the reliability**
  - **No reliable data on performance and cost savings** of SWHS
  - Available **roof space** is limited
  - **Financing**

## Project work

- Data gathering on 10 case studies
- Scientific Monitoring of 2 SWHS
- Information on website

# H&C technologies differs globally

SoPro India
Solar Water Heating for Industrial Processes in India

## Example: Differences in Solar Water Heater Systems in Europe and India

| | Central / North Europe | India |
|---|---|---|
| Pressurized* | Only **pressurized** systems | Almost only **non-pressurized** systems |
| Heat transfer fluid | Almost only **glycol mixture** (anti-freezing) | Almost only **water without freezing protection** (Often demineralized / reversed osmosis water used DM/RO) |
| Separation of heat circuits | Solar circuit is **separated** from other circuits by heat exchangers | **Often one circuit only**, water used in the process flows through collectors |
| Control | Only **automatically** controlled | Often **manually** operated |
| »Philosophy« | **»Heat generation oriented«** ➔ system is defined by collector area (solar yield increases with size) | **»Hot water supply oriented«** ➔ The system is designed to deliver a specific amount of water with a specific temperature a day (storage is sized with this volume SWHS sized with LPD = Litre per day) |

*A solar water heating system is called »pressurized«, if the collector or other hydraulic circuits are closed and an additional pressure of for typically 1 to 3 bars (100 to 300 kPa or 1.02 to 3.06 kg/Sq. cm) is added to the static pressure. If the system pressure is only created by statics e.g. by a make-up water tank, it is defined as »non-pressurized«.

# Conclusions

- **The renewable heating & cooling (RHC) sector is growing globally,** however much more slowly than the electricity sector
- **Main barriers are:**
  **- Competitiveness** (low or subsidized price for fossil fuels )
  **- Complexity of systems / Concerns on reliability**
  **- Integration of electric-heating-(cooling) system must be developed**
- **The development of RHC markets needs**
  - (local) **market oriented solutions**
    (know-how transfer means adaptation of technologies, not only transfer)
  - **increased political support for market deployment**
    (subsidy programs, reduction of fossil fuel subsidies)
  - More R&D, innovation and technological development
    (to reduce costs, increase efficiency and reliability, enter new markets,…)