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Focus group 3: Renewable hybrid systems **4.9.2009**

What are hybrid systems and which types are considered in the scope of this Focus group?

Working definition

a hybrid system is a system that combines two or more energy sources to provide heating, cooling and hot water to residential buildings or industrial processes. From 2020 (latest) onwards, hybrid systems in the scope of this work include 2 or more renewable energy sources.

For the transition period until 2020 hybrid systems can use **fossil fuels** as a backup/auxiliary heat source. In this case, a hybrid system can also consist of a renewable source augmenting or being augmented by a non-renewable source of energy. A combination of two non-fossil sources is out of scope.

pursued. There was no unanimous opinion whether heat pumps in this matrix should be seen as a general technology or be differentiated based on the heat source they use (see table).

Combination of renewable sources to form RE hybrid systems

A: Small scale applications (see table 1)

1. Heat pumps (aerothermal/hydrothermal/geothermal) and solar thermal (like addressed in IEA Annex 44 and offered as product packages by several manufacturers already)

2. Heat pumps and Biomass: combination of a DHW (air source) heat pump and a biomass boiler. Advantage: Better efficiency of the whole system. Biomass boiler is switched of over summer, when air temperature is high (= HP efficiency is high) and energy demand from DHW is too low to allow for efficient boiler operation.

3. Solar thermal and Biomass: combination of solar thermal collector and biomass boiler: Advantage: Better efficiency of the whole system. Biomass boiler is switched of over summer, when air temperature is high (= even small ST systems can provide 100% of energy for DHW easily) and energy demand from DHW is too low to allow for efficient boiler operation.

4. (geothermal) Heat pump and heat pump combination: Combination of any type of larger heat pump for heating with smaller (2,5kW) air source heat pump for DHW: Advantage is a more efficient system as both heat pumps can be optimized, possibly even a cost advantage, in case of the combination of geothermal HP for heating (less drilling meaters, lower capacity) and air source DHW-HP.

5. air source Heat pump and heat pump combination: Combination of any type of larger heat pump for heating with smaller (2,5kW) air source heat pump for DHW: Advantage is a more efficient system as both heat pumps can be optimized.

6. solar thermal - non renewable source (gas, oil) combination: integration of a share of RES (approx. 20%) into the heating system, heating supply by non-RES.

7. aereothermal/geothermal heat pump and non-RES combination: likely for the combination of aerothermal HP and non-RES. Gas or oil as a back up for peak demand.

8. aerothermal HP biomass oven combination: Special case of a biomass oven in the living room as a back up for peak demand,

	aerothermal (via HP)	biomass	geothermal (via HP)	solar thermal	non-renewable sources
aerothermal (via HP)	4	2, 8	5	1	7. nonRES as backup
biomass		./.	2	3	./.
geothermal (via HP)			./.	1	7. nonRES as backup
solar thermal			.	./.	6
non-renewable sources					./.

Table 1: possible combination options for RES and non-RES sources of energy in small scale systems. Read: Combination of (teach from row) with (tech from column) is possible.

B: large scale applications:

1. **Complex systems** with cascading energy use: Solar thermal, heat pumps, geothermal, biomass are combined to use the respective energy use to the fullest. Possible cascade: Solar thermal for hot water, (air) source heat pump for heating with biomass backup **or** solar thermal for hot water, ground source for 100% heating and cooling, other combinations possible.

2. **Cold source**: small district network providing 20°C water to independent HP units. Advantage: low temperature of grid needs little to now insulation,

20°C as source for HP allows for very high efficiencies. Cold source distribution can be fueled by Solar thermal, Biomass, geothermal, waste heat

3. District heating fuelled by solar thermal (dedicated or excess heat)

4. District heating fueled by Biomass burners

5. District heating fueled by large geothermal/hydrothermal HP

6. Thermal storage fueled by any source to bridge gap between supply and demand

Market segments to consider

Table 1: Market segments of RE hybrid systems

	New building	Renovation
Residential: single/double family house		
Residential: Multi-family residency		
Non-residential (commercial)		

Research requirement

General understanding exists that research is necessary to better understand the influencing factors of technical and economic efficiency of renewable RE systems as well as the requirements for their appropriate use in all segments mentioned above.

Research should be undertaken with the aim to reduce the size of hybrid systems, to improve their reliability and efficiency as well as focusing on the reduction of cost to make them competitive to existing solutions. Research programs should be designed having in mind the development of buildings energy demand in new and renovated buildings as well as in industrial processes.