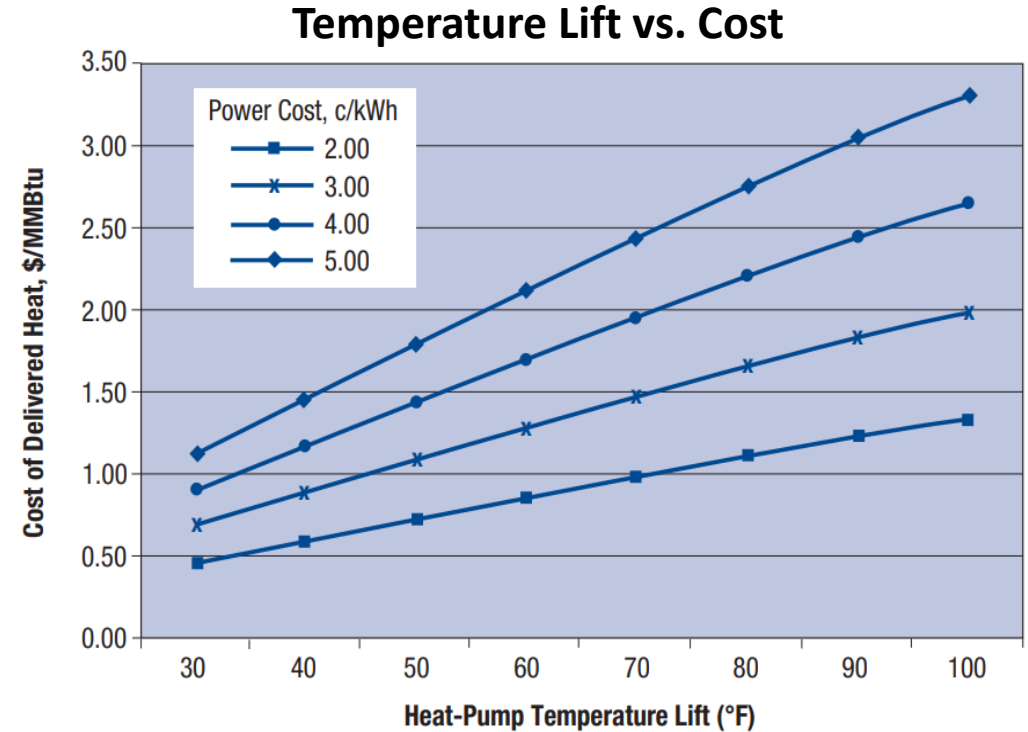
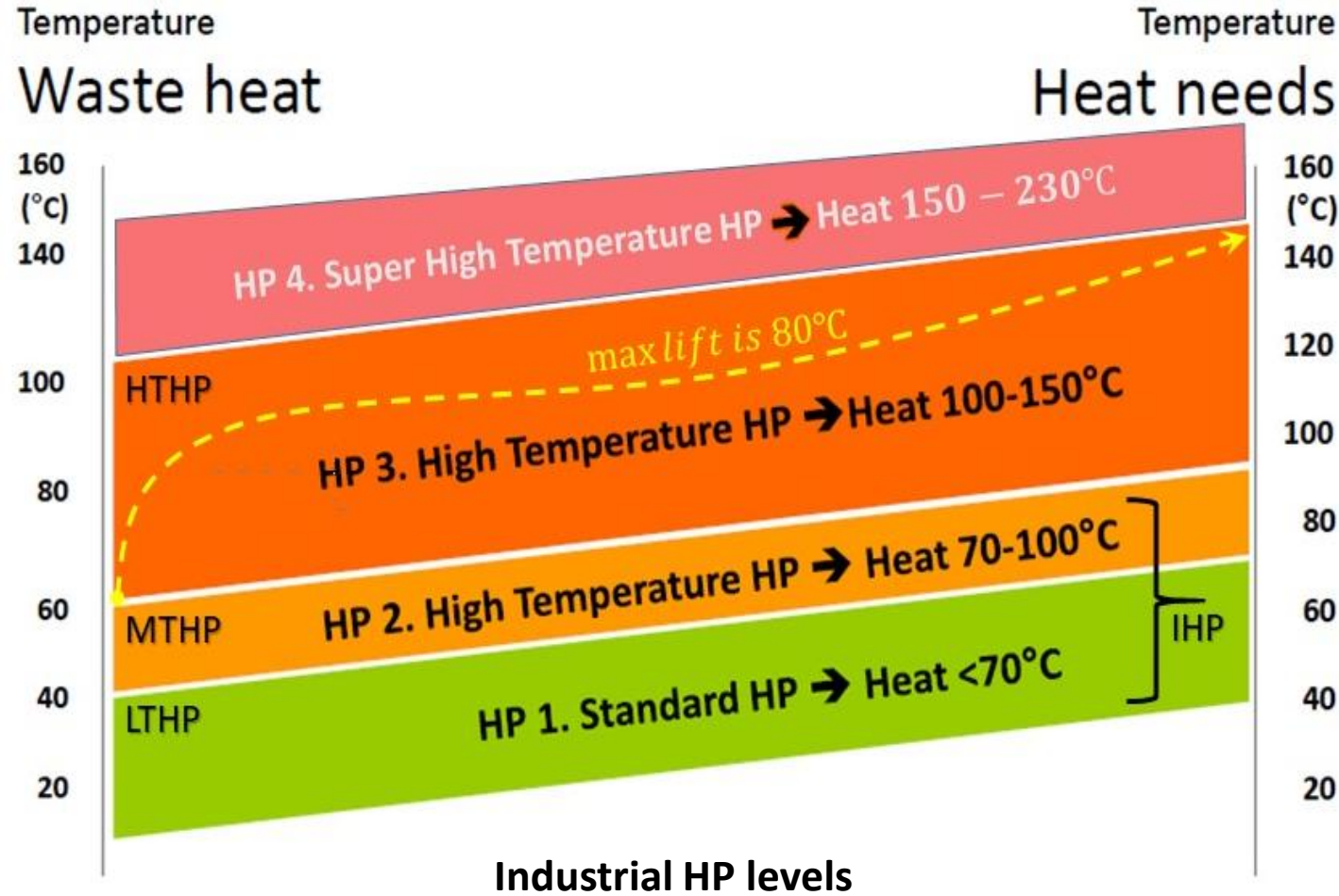




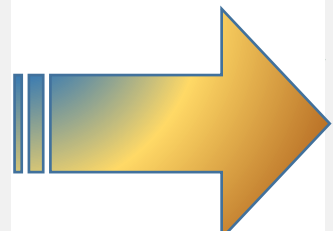
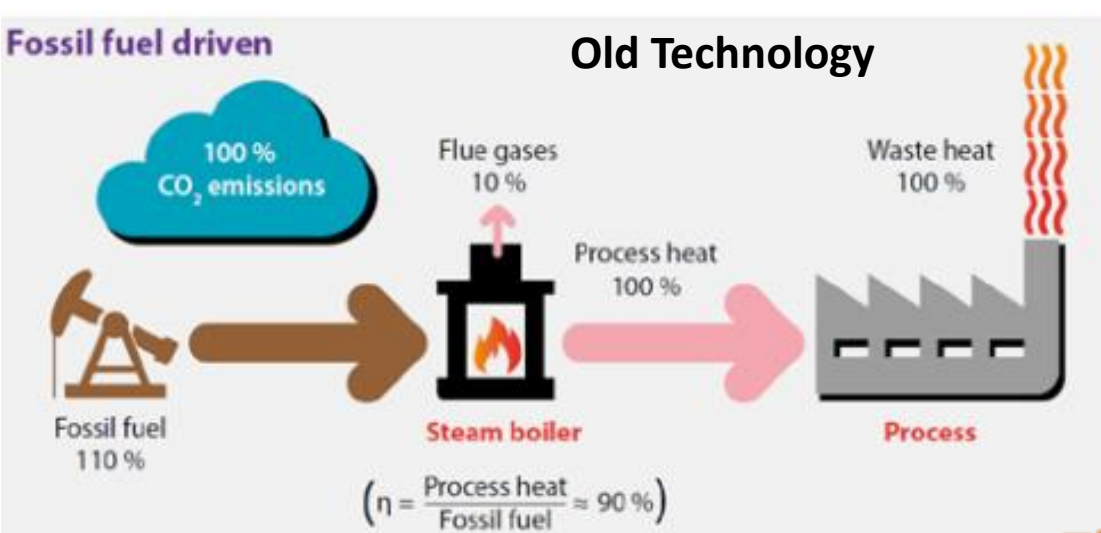
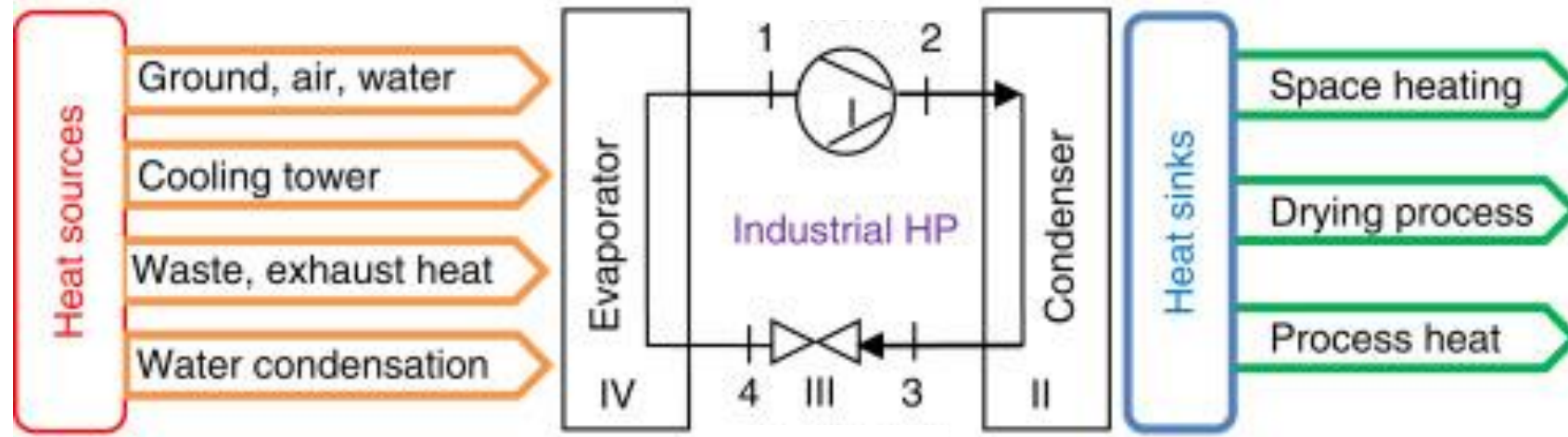
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Industrial Heat Pump Technology for Industrial Direct Electrification

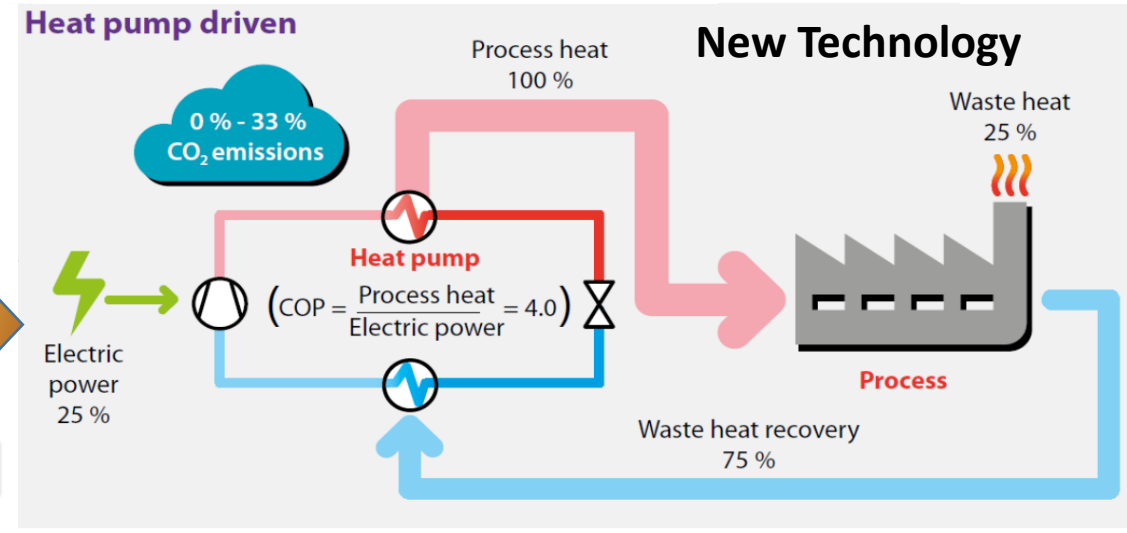
Industrial HP Classification



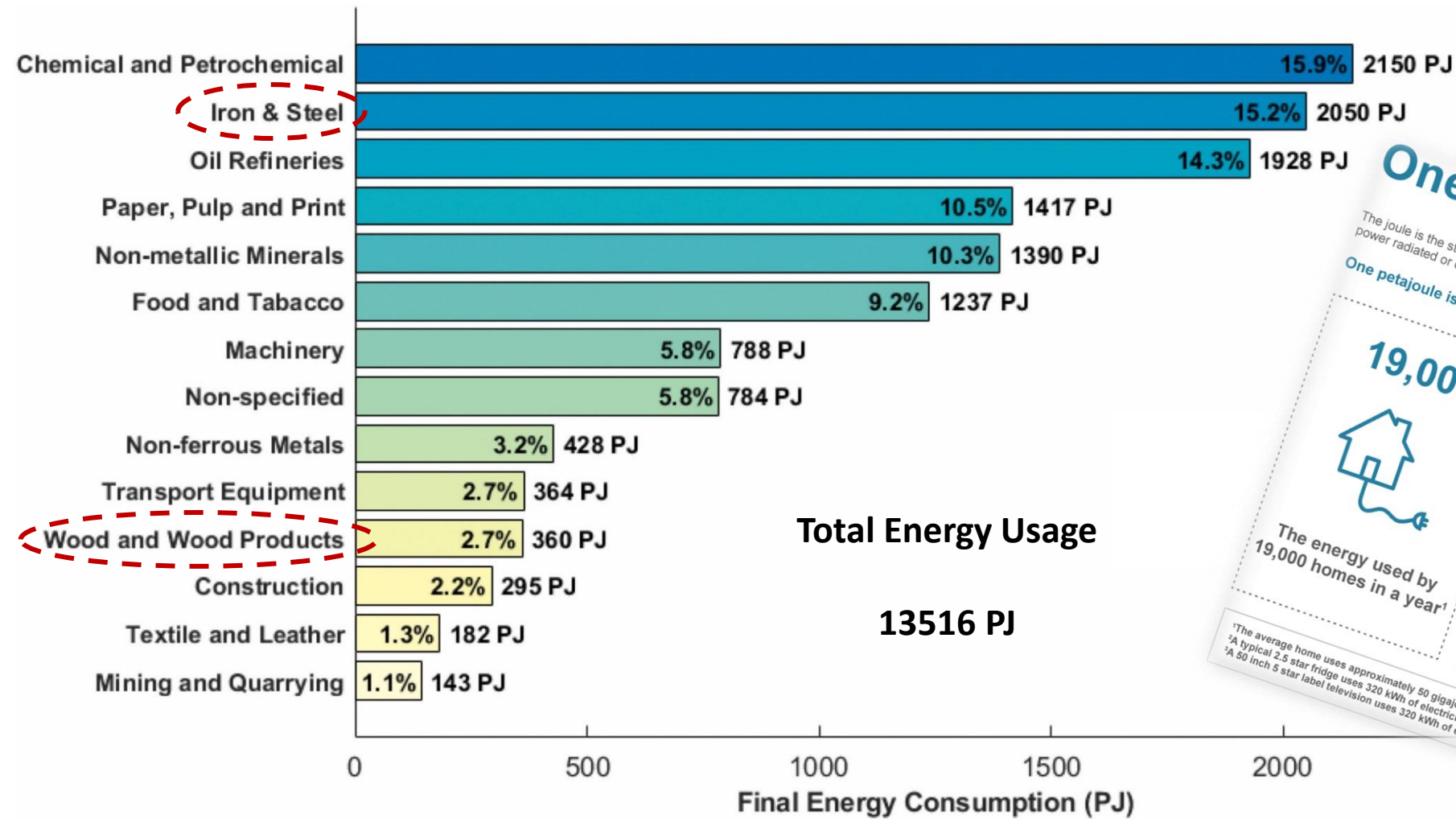
Industrial HP/Direct Electrification



Industrial Electrification



EU28 Energy Consumption



One petajoule (PJ) explained

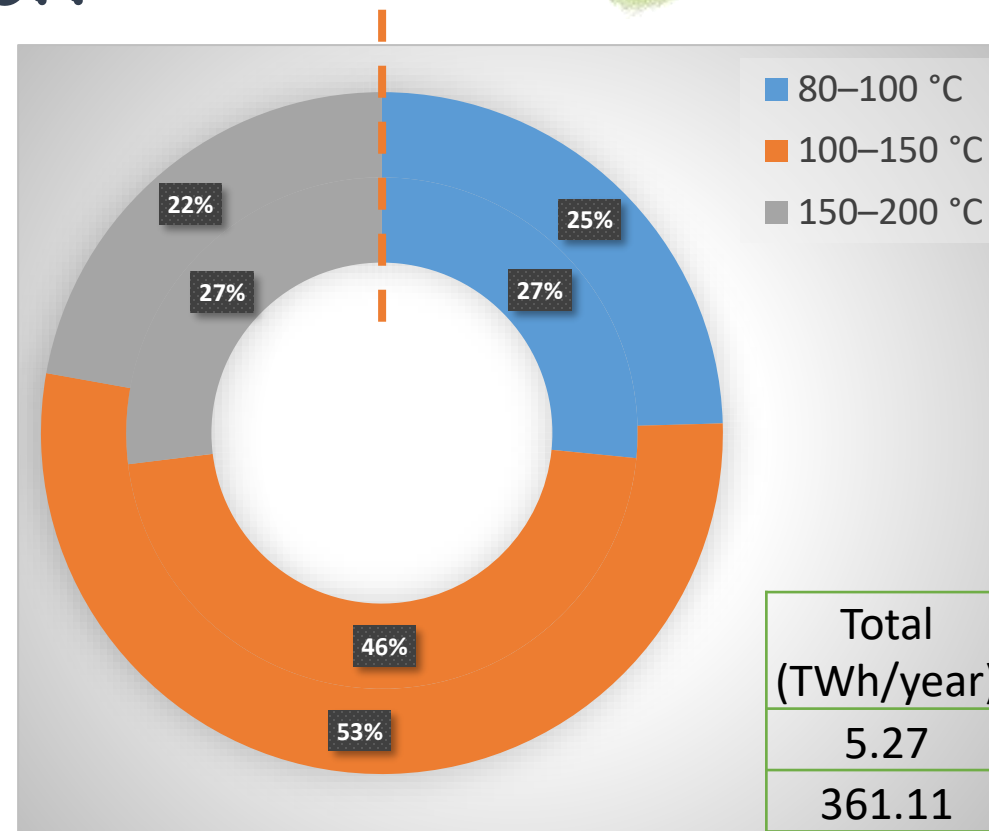
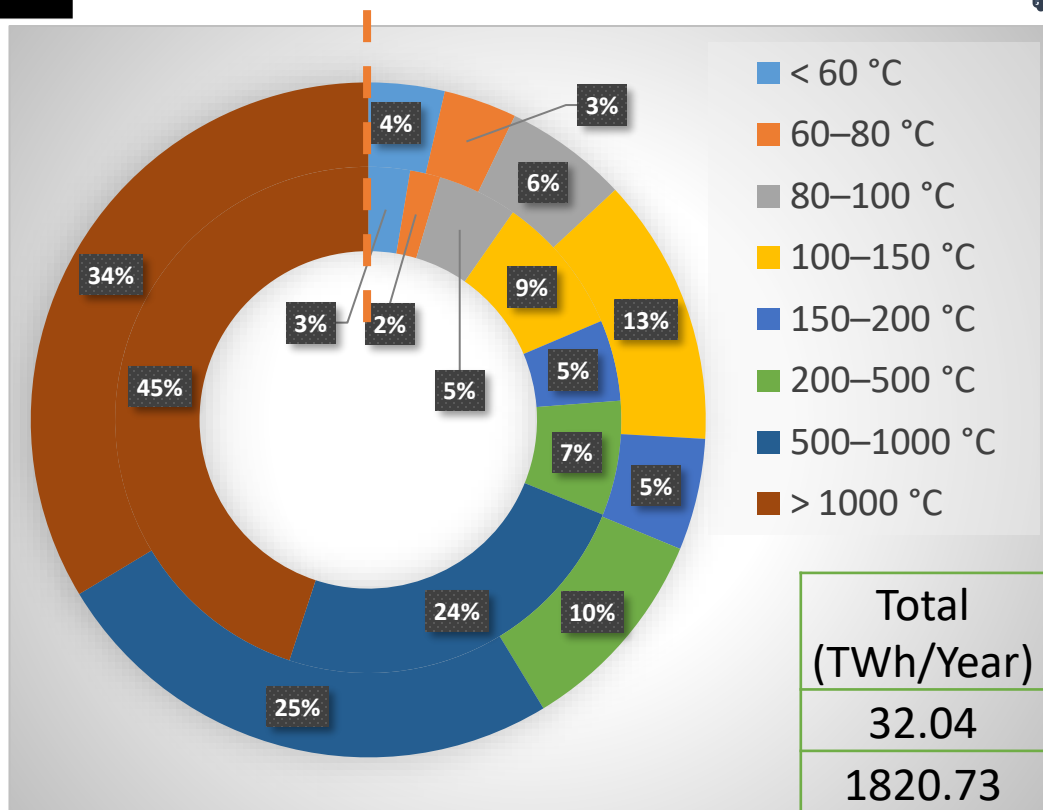
The joule is the standard unit of energy in general scientific applications. One joule is the equivalent of one watt of power radiated or dissipated for one second.

One petajoule is 10^{15} joules (1 million billion) or 278 gigawatt hours.

- 19,000 homes in a year¹
- 868,000 refrigerators in a year²
- 2,354,000 televisions in a year³

¹The average home uses approximately 50 gigajoules of energy in 2014-15
²A typical 2.5 star fridge uses 320 kWh of electricity per year
³A 50 inch 5 star label television uses 320 kWh of electricity per year

EU28 Heat Consumption



Reference: Kosmadakis, Estimating the potential of industrial heat pumps, (2019)

Heat consumption fractions in EU industries per temperature band (TWh/year)

	< 60 °C	60–80 °C	80–100 °C	100–150 °C	150–200 °C	200–500 °C	500–1000 °C	> 1000 °C
Sweden	0.73	0.53	1.4	2.45	1.42	2.01	6.57	12.34
EU-28	54.69	52.54	88.64	192.36	80.11	150.96	375.57	504.14
%	1.33	1.01	1.58	1.27	1.77	1.33	1.75	2.45

Industrial HP For Drying Processes

HP specifications based on heat demand carrier.

Heat Carrier	Temp. range (°C)	Process	Industrial sectors	Suggested (main) heat pump specifications	
Hot water	40–90	Distillation, pasteurization, boiling	Food, chemical	Type:	Water-to-water HP
				Refrigerants:	CO ₂ , R1234ze(E)
				Cycle design:	standard single-stage
Steam	110–200	Drying, distillation, pasteurization, boiling	Paper, food, iron and steel, textiles, non-metallic minerals, non-ferrous metal, wood	Type:	Water-to-air HP
				Refrigerants:	R1234ze(Z), R1336mzz(Z)
				Cycle design:	single-stage with IHX for a lift up to 60–70 K. Two-stage for higher lifts
Hot air	60–150	Drying	Paper, food, iron and steel, textiles, non-metallic minerals, non-ferrous metal, wood	Type:	Air-to-air HP
				Refrigerants:	CO ₂ , R1234ze(E) for temperature below 90–100 °C, R1234ze(Z), R1336mzz(Z) for higher.
				Cycle design:	single-stage with IHX

Industrial HP For Drying Processes

HPT TCP / Annex 59

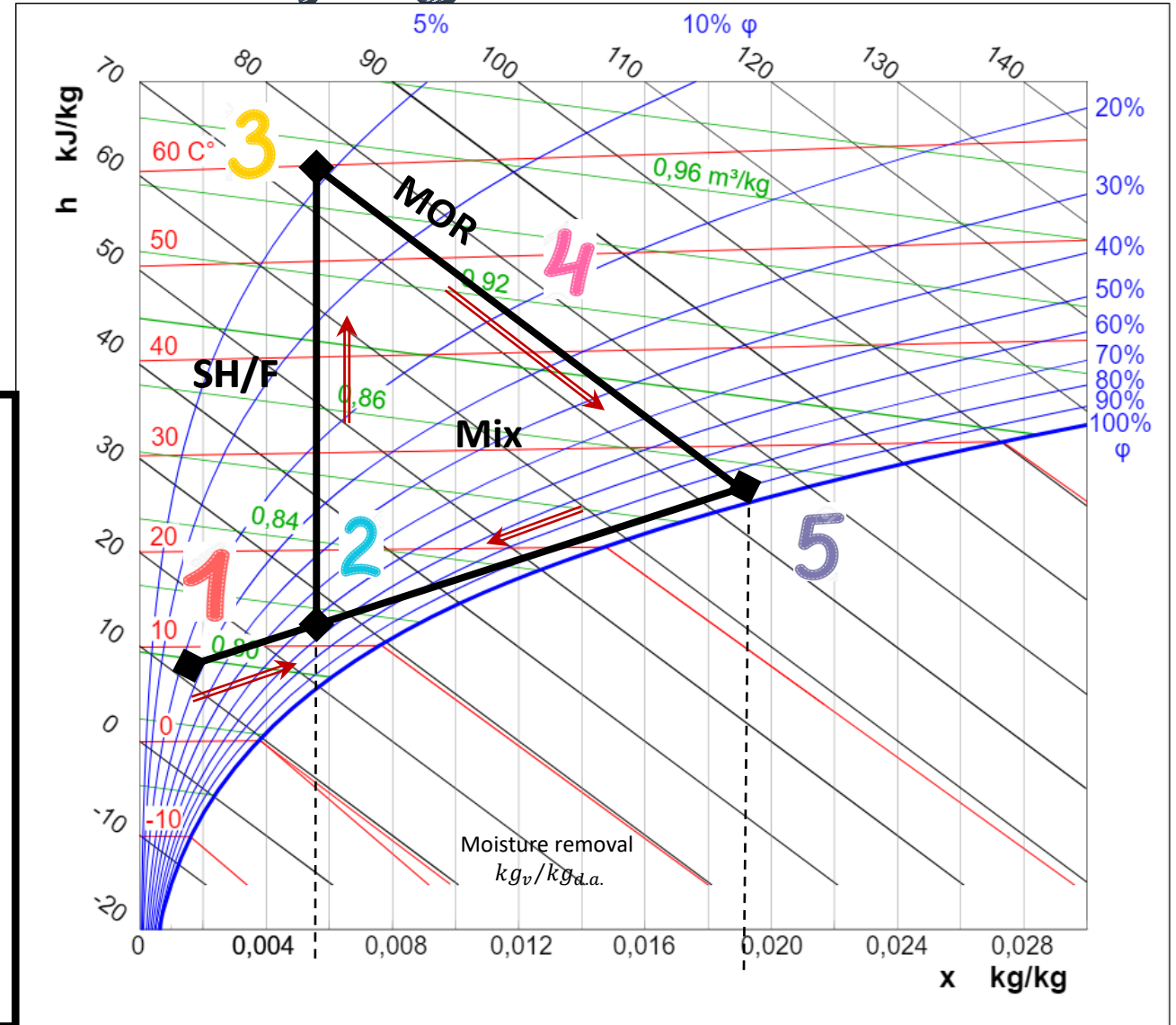
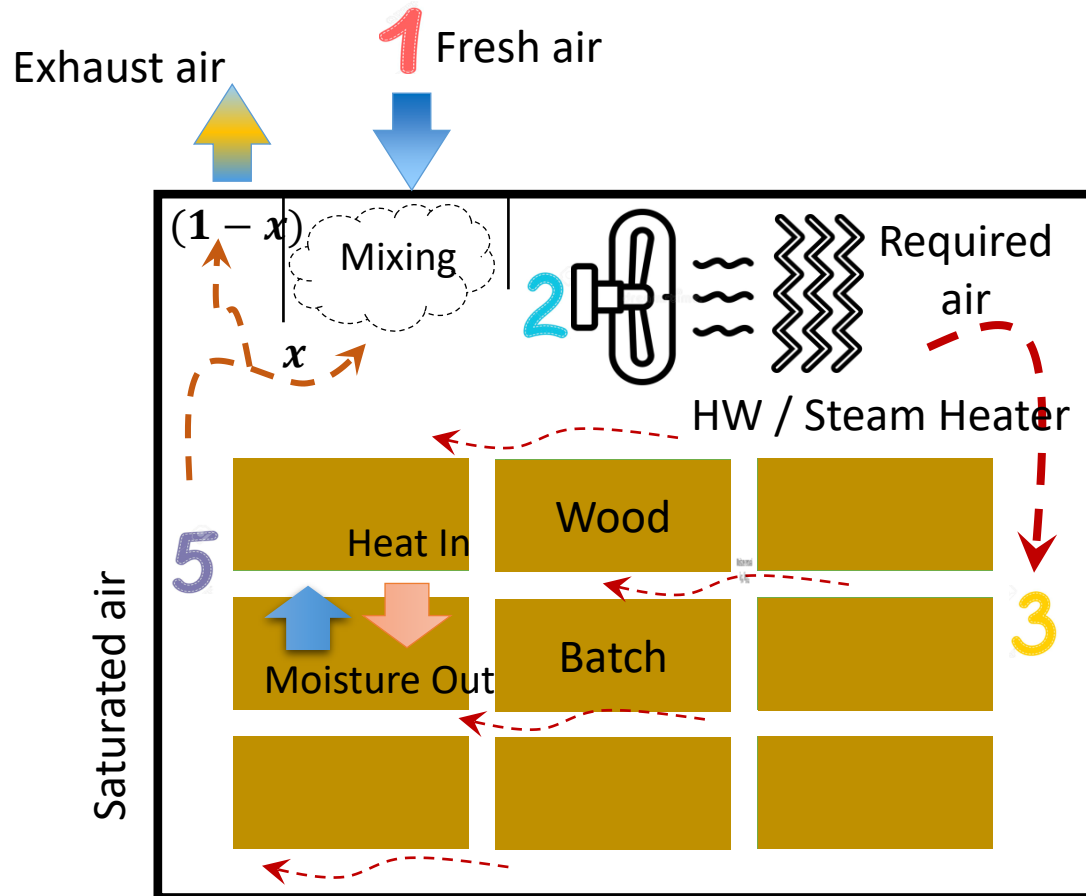
ANNEX 59

Heat Pumps for Drying

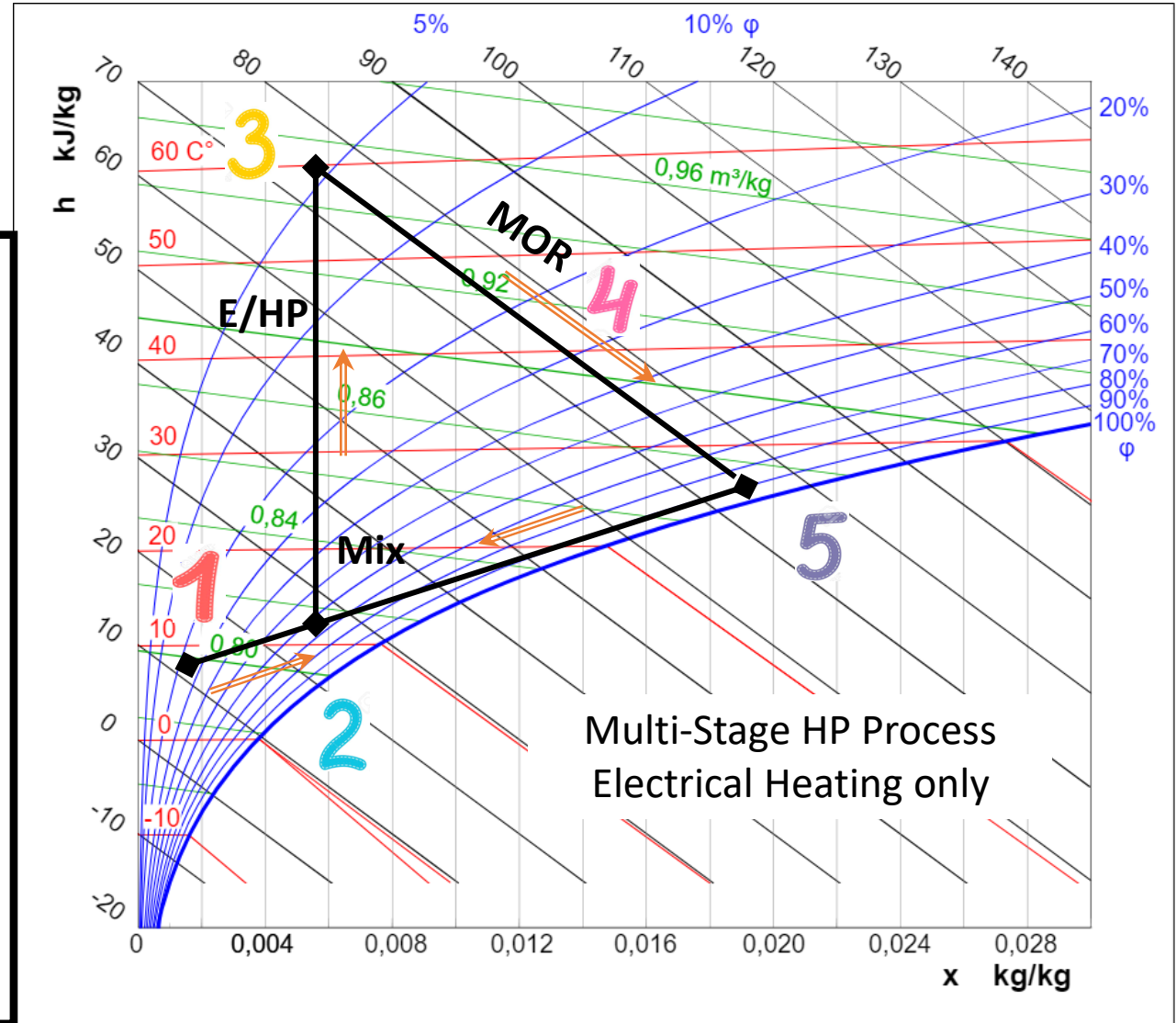
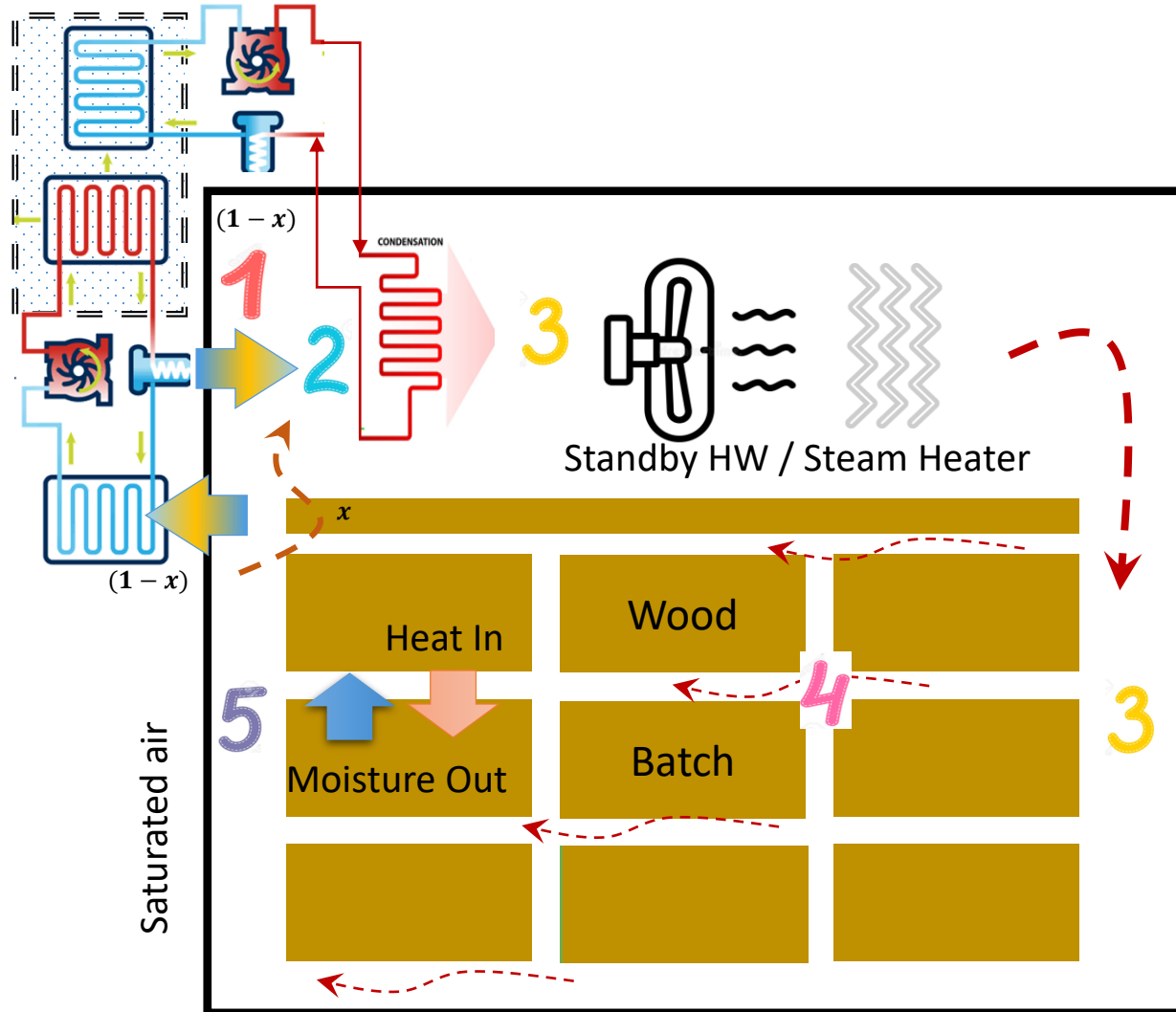
The Annex aims to structure and describe the numerous possibilities and advantages of heat pump integration in dryers.

Austria Operating Agent

Industrial HP in Sawmill Drying



Industrial HP in Sawmill Drying





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