Market potential for PVT

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The potential size of the market is obviously very big

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What determines the size of the market

- The decision maker
  - Private houseowner
  - Building owner
  - Project developers
  - Housing associations (in Denmark: Social housing sector, 20% of all housing units)
  - Industry decision makers

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How does the decision maker deside

- Depends on three things
  - The cost effectiveness of the PVT technology compared to the alternatives
    - Investment usually higher for PVT than for the alternative
    - LCOE – Levelized Cost of Energy (compare LCOE for PVT with the alternatives)
      - Cost of financing
      - Cost of maintenance
      - Cost of possible supplementary energy
      - Cost of reinvestments
      - Environmental costs (CO_2 tax, other tax benefits)
  - Legislative matters
    - Possible subsidies (for example x % refund of the investment). Included in the LCOE
    - Legal requirements (building regulations, phase-out of gas, compulsion)
  - Other motivations
    - Green, recommended by a trusted, special offer, interesting technology …

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Complication for the consultant or sales person who want to advise on an informed basis

- The decision makers in the various sectors have very different conditions
  - Different time perspective (short term, long term)
  - Different priorities in terms of climate change
  - Different expectations regarding payback time or internal rate of return
  - Different opportunities for financing
  - Different legislative conditions
  - Different architectural views
  - Possible different subsidies

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Conclusion (for the consultant or marketing people)

- Each costumer represent a combination of these
- Necessary to treat each case individually

- Not possible to analyze all aspects and compare all potential technologies (only in very big projects)
- In reality many decisions are made on a not fully informed basis

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How do we do that ?

- Overview of technologies
- Analysis and comparison of technologies

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PVT Technology

- PVT (not energy-absorbing, collector warmer than air)
  - Supply heat when collector temperature is higher than the demanded temperature
  - Can operate without heat pump
  - Only supplementary energy
- PVT-E (with energy-absorbing)
  - With a heat pump. Heating can be produced at any time.
  - Combined with cooling.
  - Formation of ice
- BIPVT-E
  - PVT-E building integrated
- PVT for cooling
  - Free cooling - when demanded cooling temperature is lower than collector temperature.
  - Radiative cooling – when the collector temperature is lower due to sky radiation

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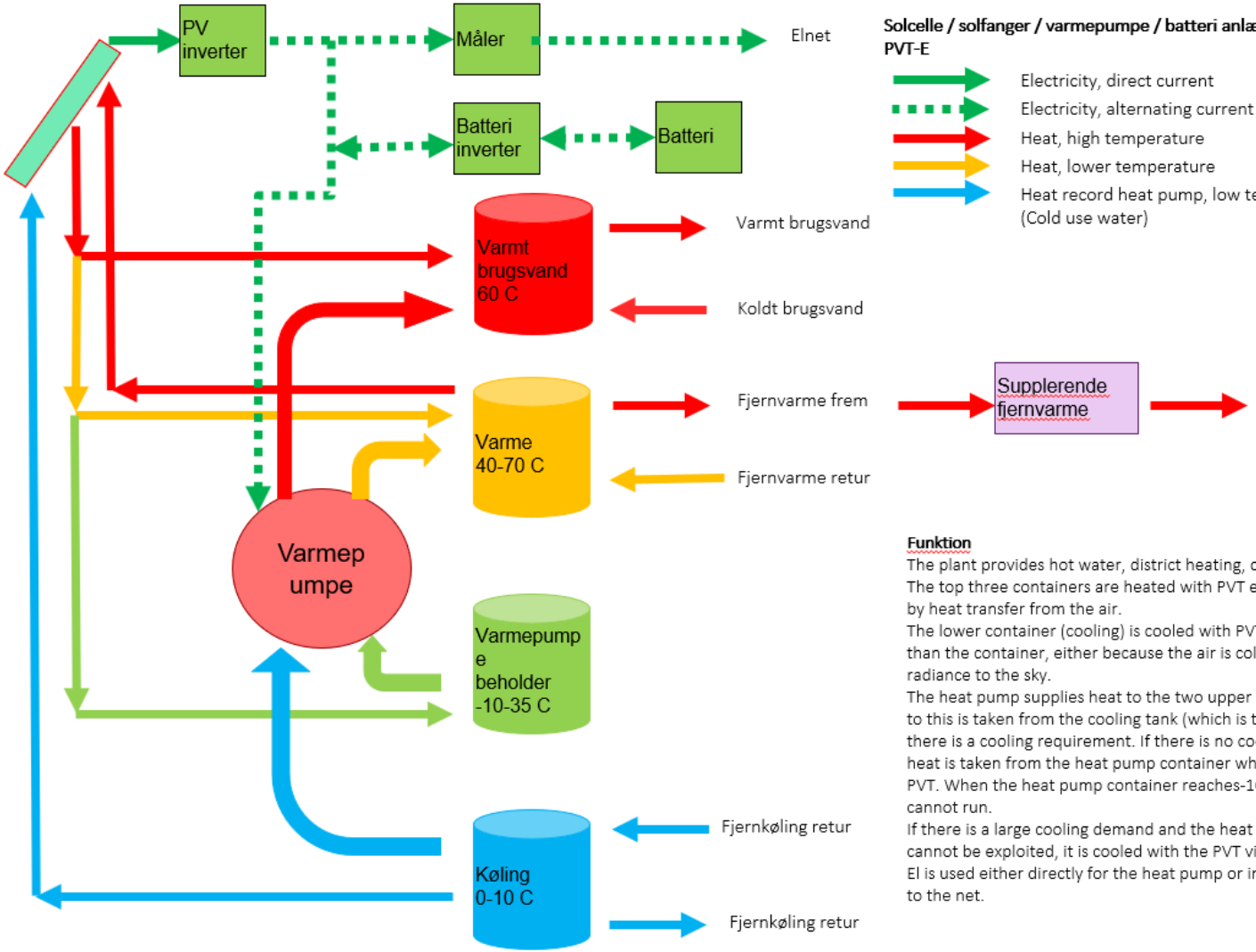

Solcelle / solfanger / varmepumpe / batteri anlæg til forsyning af varme, køling og el . PVT-E

- Electricity, direct current
- Electricity, alternating current
- Heat, high temperature
- Heat, lower temperature
- Heat record heat pump, low temperature (Cold use water)

Funktion

The plant provides hot water, district heating, cooling and electricity.
The top three containers are heated with PVT either by solar heat or by heat transfer from the air.
The lower container (cooling) is cooled with PVT when this is colder than the container, either because the air is colder or due to radiance to the sky.
The heat pump supplies heat to the two upper containers. The heat to this is taken from the cooling tank (which is thereby cooled) if there is a cooling requirement. If there is no cooling requirement, heat is taken from the heat pump container which is reheated with PVT. When the heat pump container reaches-10 C, the heat pump cannot run.
If there is a large cooling demand and the heat from the machine cannot be exploited, it is cooled with the PVT via the heat tank.
El is used either directly for the heat pump or in a battery. Profits go to the net.

Most relevant related to housing – market size

		Competition	Minus	Plus	Size of market
1	Domestic hot water with PVT-E in single family houses	Solar thermal	Other technology needed for heating demand. Not good if district heating. Complicated small plant.	Cover all demand for hot water. Possibility for CO_2 reduction for houseowner.	Small
2	Domestic hot water with PVT-E for multiapartment buildings	Air source heat pump and PV	Other technology needed for heating demand. Less good if district heating.	Cover all demand for hot water. Possibility for CO_2 reduction. Less noise than with air source.	Medium
3	Domestic hot water and heating for single family houses.	Air source heat pump and PV.	May not be competitive to air source heat pump combined with PV.	The only source of energy. CO_2 neutral if combined with PV and battery. Less noise than air source. Good for new buildings.	large
4	Domestic hot water and heating for multiapartment building.	Air source heat pump and PV	May not be competitive to air source heat pump combined with PV Not with district heating	Buildings using central heating with gas. Can supply 80% with gas as supplement. Extended when gas is disconnected.	large
5	No 3 with cooling in southern Europe	Air source heat pump. Split units. PV.	Problematic in existing buildings.	Mainly for new buildings. CO_2 neutral or plus energy.	large

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The challenge

Simple calculation

Somewhat known

System dependent
complicated analysis

Investment, system cost € per m²	€/w	w/m²	€/m²
Solar collector			300
PV	1,7	180	306
PVT	2,3	180	414
PVT-E	2,5	180	450

Output, kWh pr. m²	Solar col.	PV	PVT	PVT-E
Electricity		160	170	70
Heating	400		150	400
Cooling				150

Value of production € per kWh	
Electricity	0,20
Heating	0,09
Cooling	0,13

Value of production € pr. år pr. m²	Solar col.	PV	PVT	PVT-E
Electricity		32	34	14
Heating	37		14	37
Cooling				20
SUM	37	32	48	71

Simpel pay back time	Solar col.	PV	PVT	PVT-E
TBT	8	10	9	6

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Difficult case:
PV and PVT-E project in the social housing sector

- Very big market in Denmark (20%)
- Big potential for PV and PVT-E
- Multiapartment and linked buildings from 60ties and 70ties
- Need renovation (new roof (asbestos), new heating system, boilers etc).
- Many have district heating, others gas.
- Highly regulated and supported sector
- Need for thorough analysis
- Must be decided by the residence
- Need exact calculation of the consequences for the future rent and energy expenses

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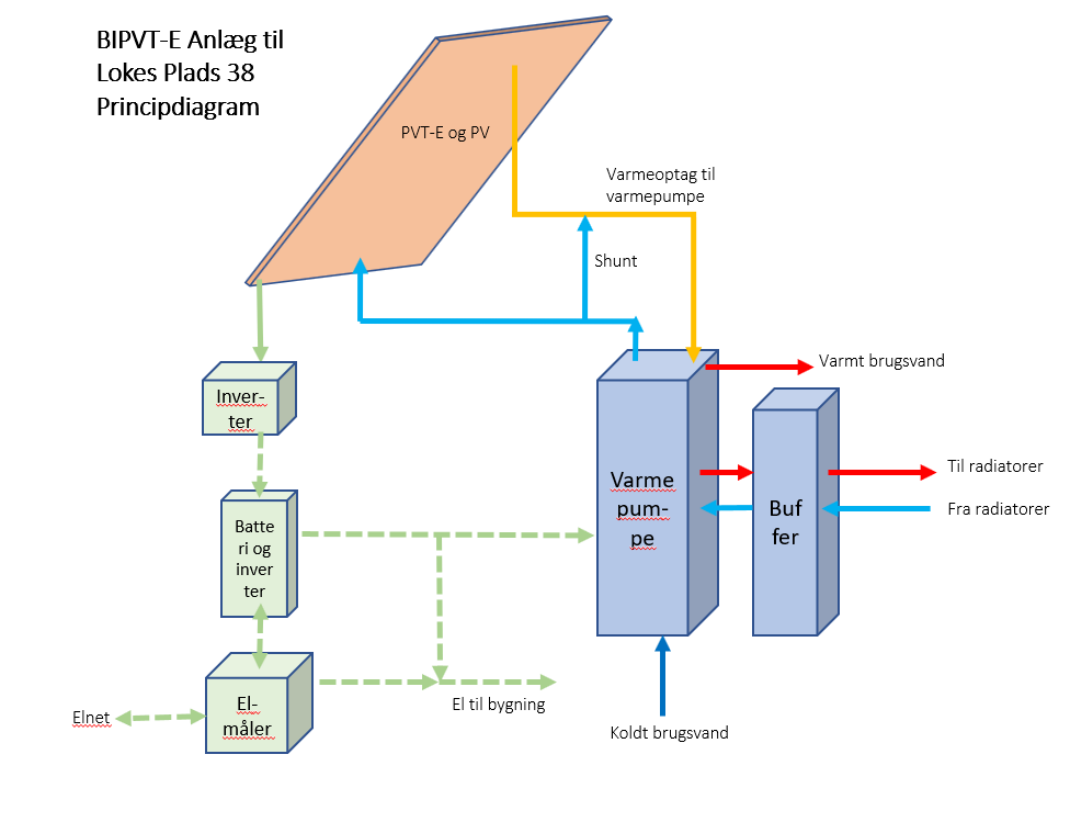
Pilot project with PVT-E, heat pump and battery

Case Stengården



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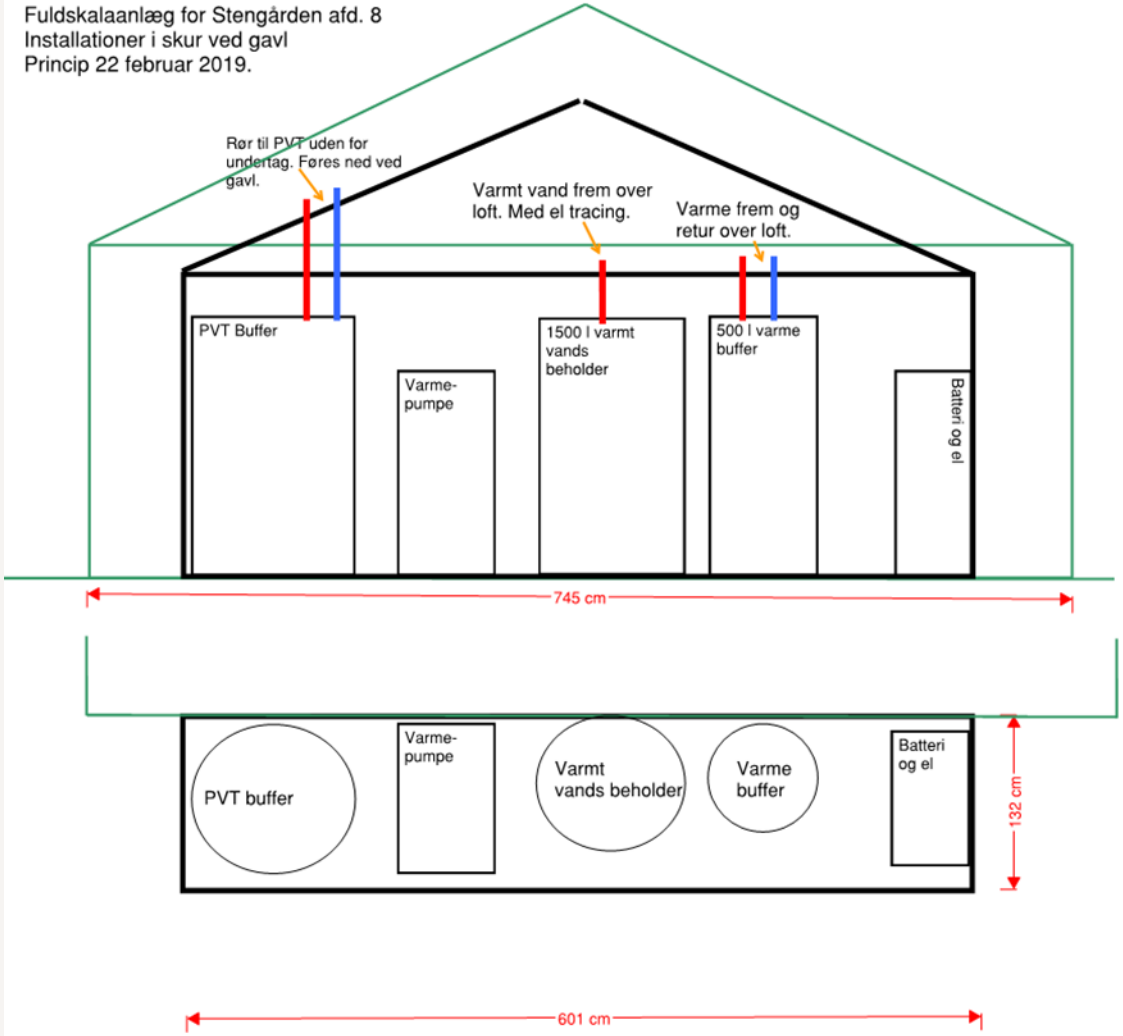
Fuldskalaanlæg for Stengården afd. 8
Installationer i skur ved gavl
Princip 22 februar 2019.
Rør til PVT uden for undertag. Føres ned ved gavl.
Varmt vand frem over loft. Med el tracing.
Varme frem og retur over loft.
PVT Buffer
Varme-pumpe
1500 l varmt vands beholder
500 l varme buffer
Batteri og el
745 cm
PVT buffer
Varme-pumpe
Varmt vands beholder
Varme buffer
Batteri og el
132 cm
601 cm

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Case Stengården

Project with Metro Therm

RACELL,
Denmark

Triple Solar,
Netherlands

Talum,
Slovenia

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Microbooster

https://www.metrotherm.dk/en/products/heat-pumps/domestic-hot-water-heat-pumps/metro-microbooster

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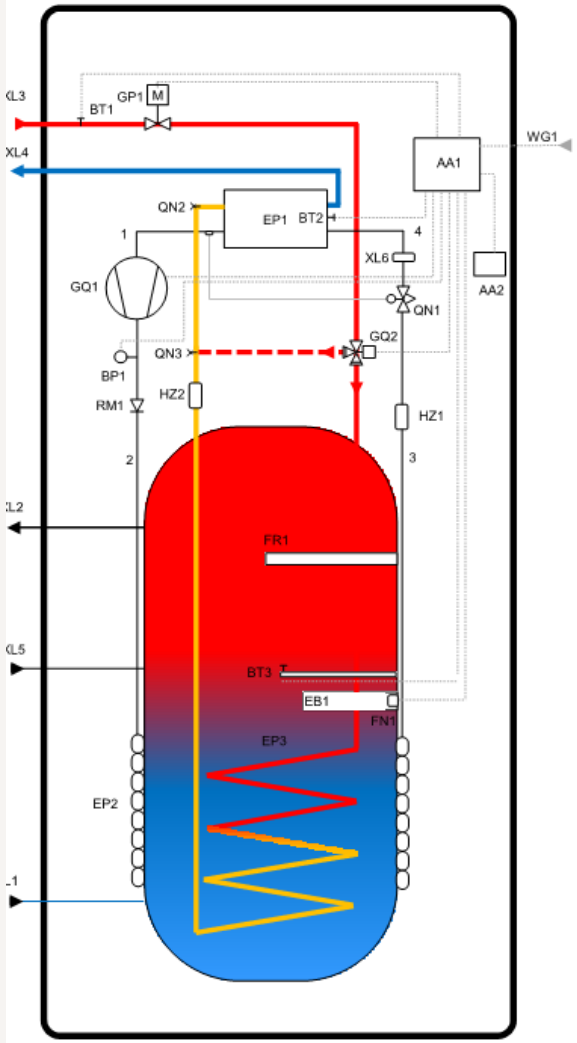
Microbooster



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