



IYCE'22
International Youth
Conference on Energy

8th International Youth Conference on Energy

Certificate of presentation

On behalf of the Local Organizing Committee of the 8th International Youth Conference on Energy 2022, we hereby certify that

Kende Kocsis

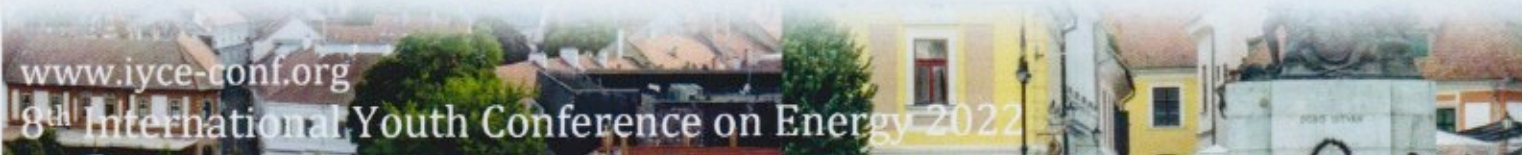
presented the paper entitled

A heat pump strategy to meet the simultaneous heating and cooling needs of a multifunctional office and residential building

at the 8th International Youth Conference on Energy 2022 in
Eger, Hungary, 6th-9th July 2022.

Eger, 8th July 2022.

László Székely
IYCE'22 General Chair





ÉPÜLETGÉPÉSZETI ÉS
GÉPÉSZETI ELJÁRÁSTECHNIKA
TANSZÉK

A Heat Pump Strategy to Meet the Simultaneous Heating and Cooling Needs of a Multifunctional Office and Residential Building



IYCE conference presentation

Kocsis Kende MSc energy engineering student

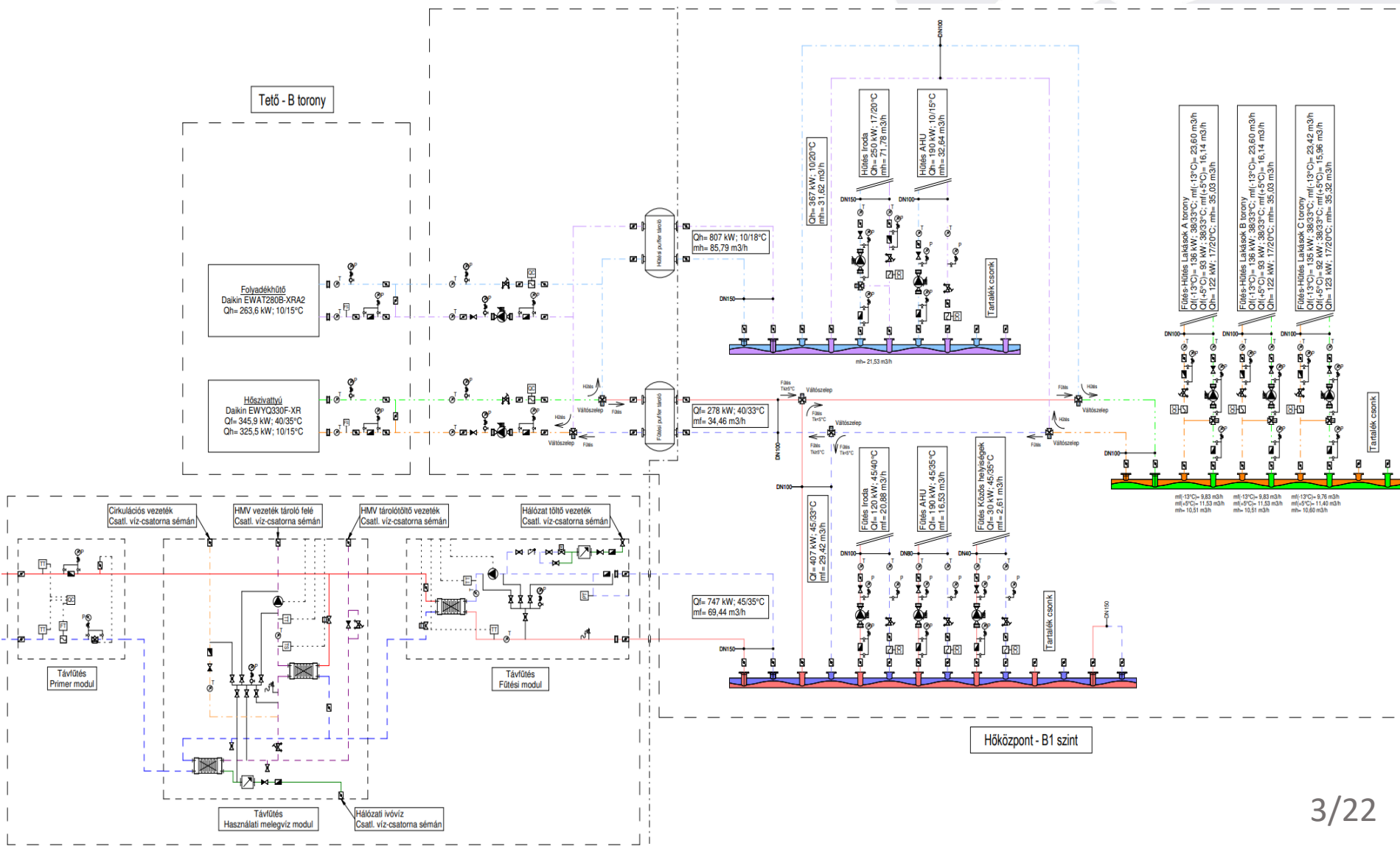
Building description

- Central Budapest
- 9 floors
- Office area: 5126 m²
- Residential area: 4692 m²
- Date of handover in the 4th quarter of 2021



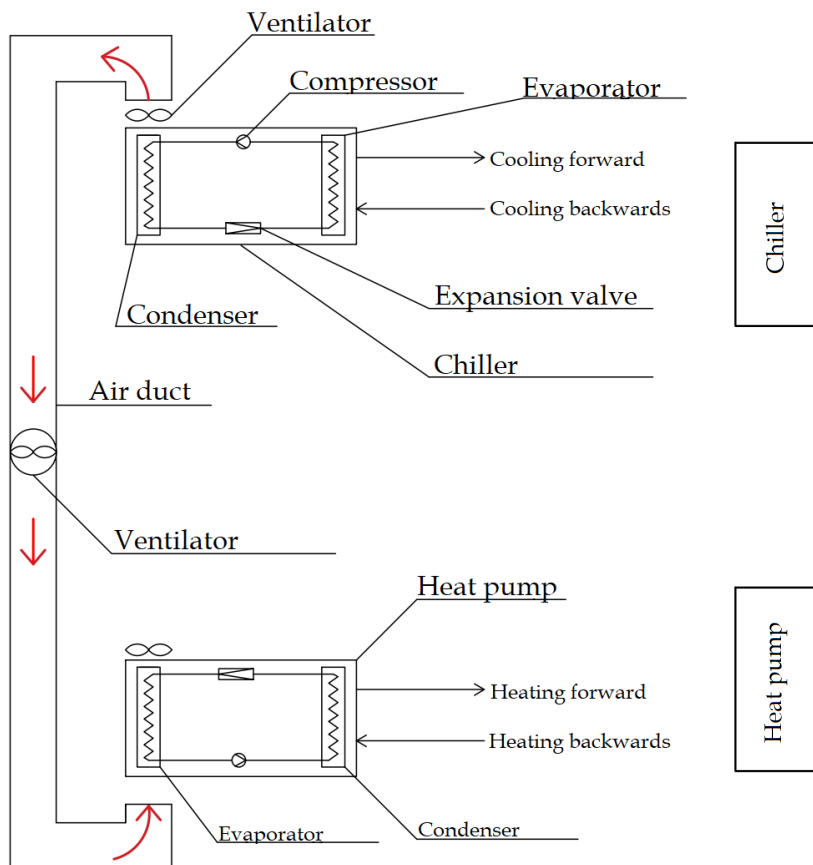
Purpose of energy consumption	Required energy type	The building's yearly heating and cooling energy consumption
Heating (Residential)	District-heating and electricity	34,87 kWh/m2/year
DHW (Residential)	District-heating and electricity	30,00 kWh/m2/year
Cooling (Residential)	Cooling energy	19,75 kWh/m2/year
Heating (Offices)	District-heating and electricity	40,52 kWh/m2/year
Cooling (Offices)	Cooling energy	65,00 kWh/m2/year
Free cooling winter cooling	Cooling energy	15,00 kWh/m2/year

Heating-Cooling System Sceme

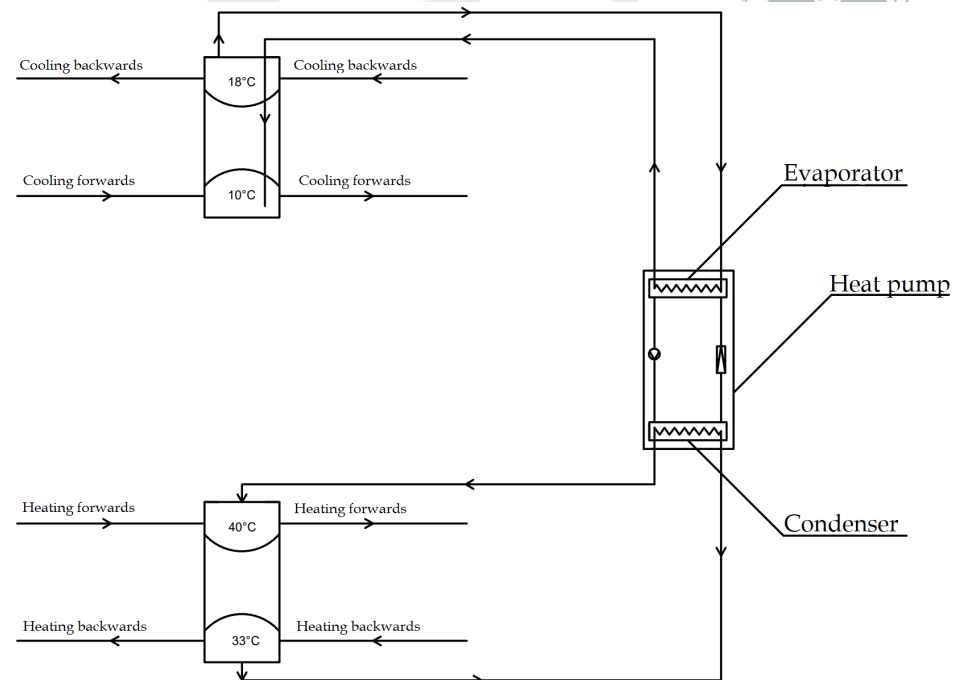


Alternatives for Heat Recovery

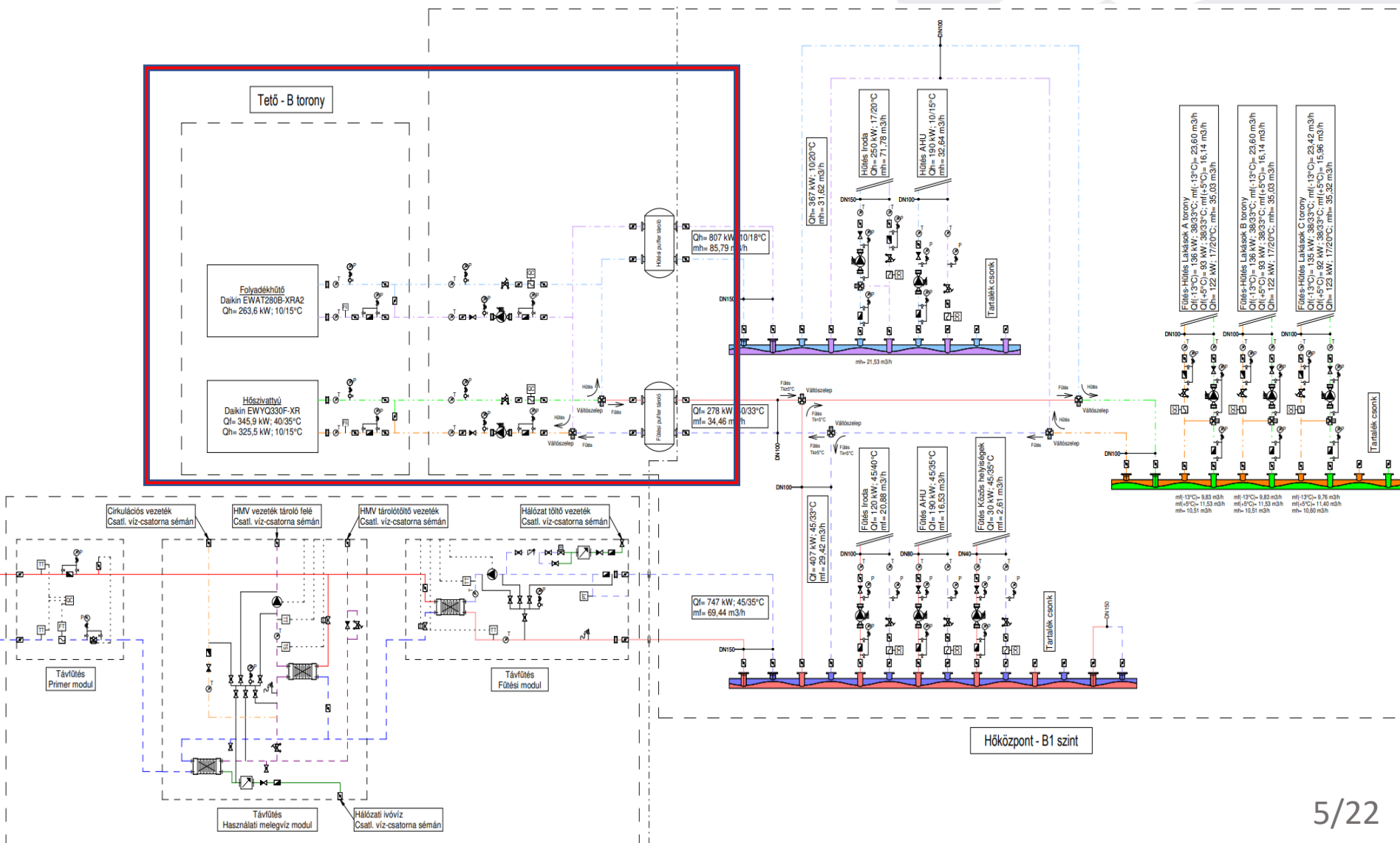
Air-side source linking



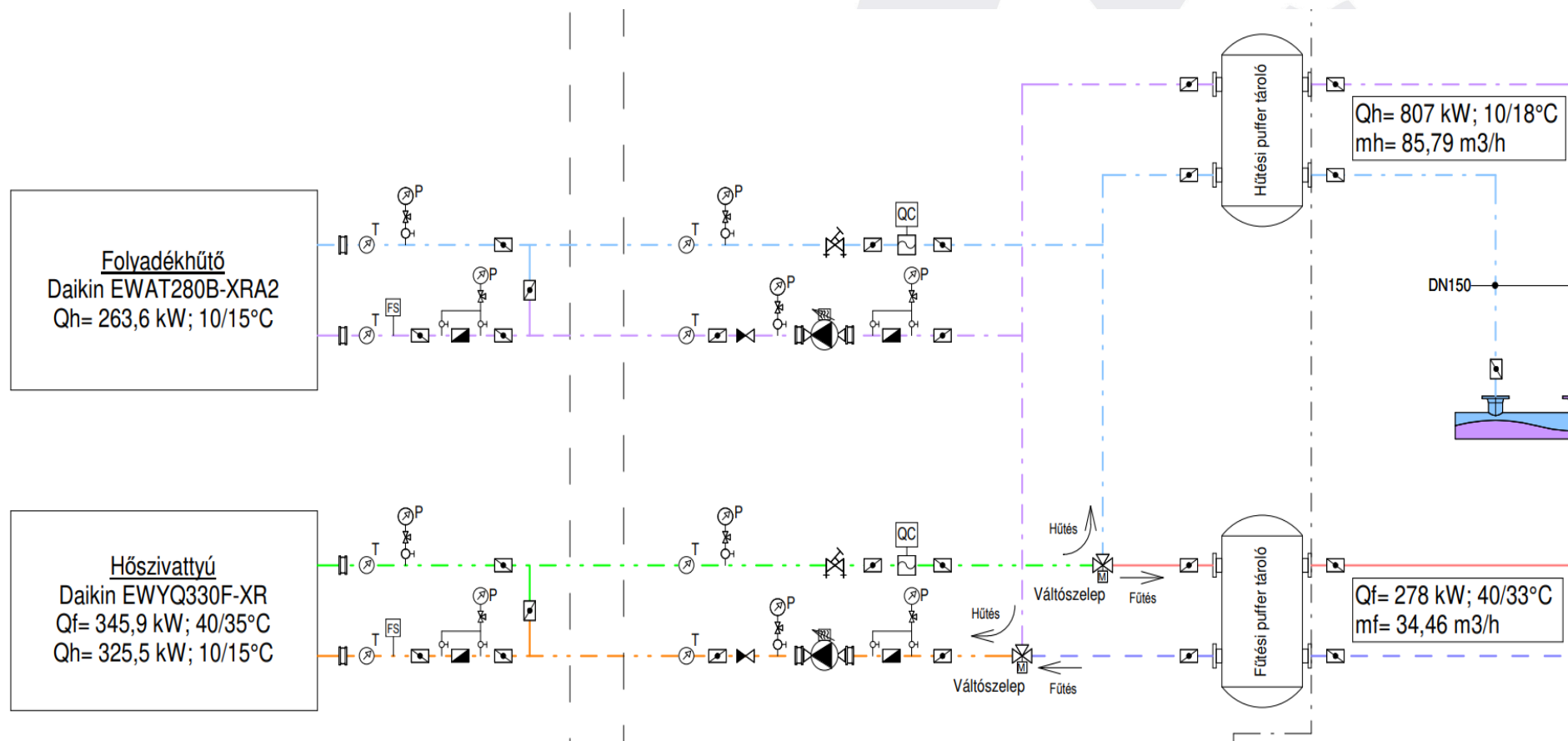
Heat pump between two tanks



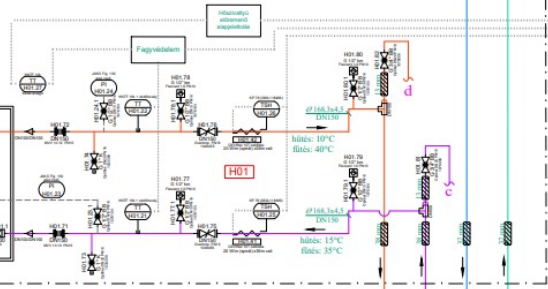
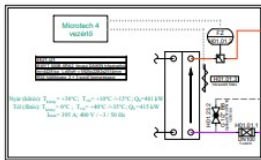
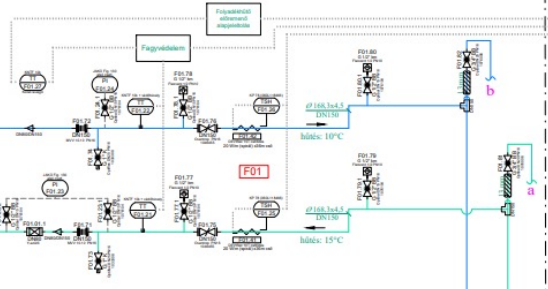
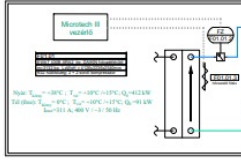
Heating-Cooling System Sceme



Heat Pump and Chiller



"B" torony lapostető (kültéri szakasz)



JELMAGYARÁZAT:

- Hőszivattyú kör előremenő
- Hőszivattyú kör visszatérő
- Folyadékűhítő kör előremenő
- Folyadékűhítő kör visszatérő

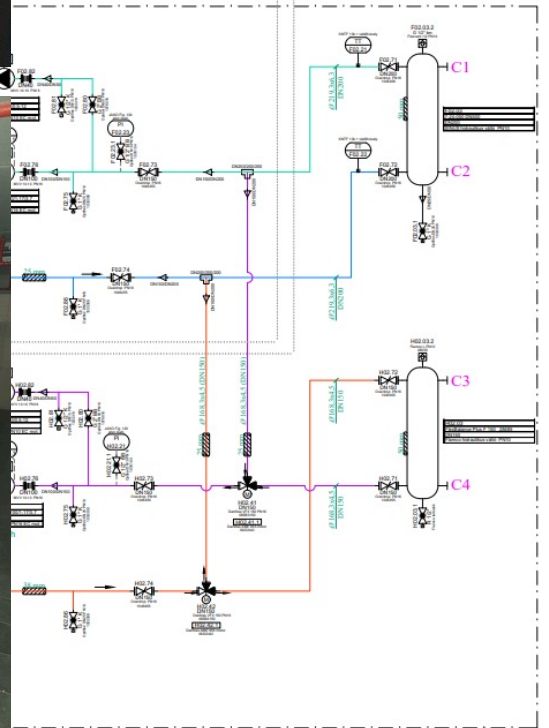
- Golyós elzárószelep
- Pillangószelep
- Visszacsapószelep
- Statikus beszabályzó szelep
- Szűrő
- Háromjratú motoros szelep
- Biztonsági szelep
- Légtelenítő
- Úritószelep
- Áramlásőr
- Gumikompensátor
- Térfogatárammérő
- Nyomásmérő
- Hőmérsékletváltó
- Armaflex hőszigetelés

Akna



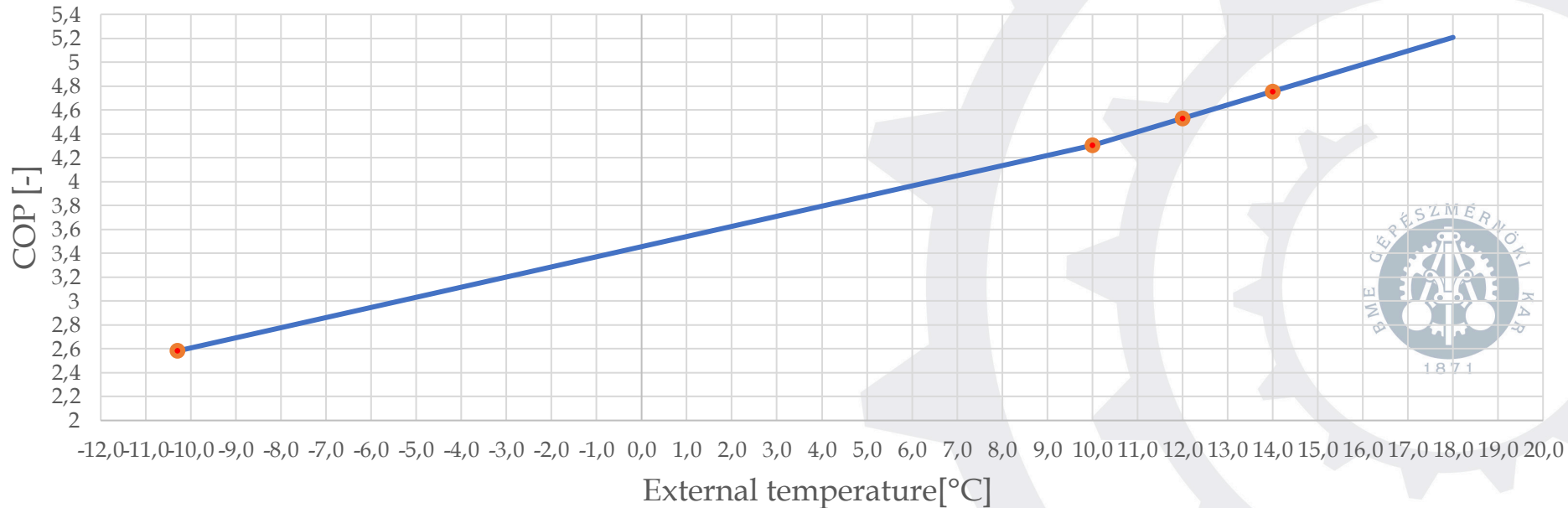
ZÉS:

...a lágyított víz hűdözőző közeggel kell felülni.
...a tartalmat (fűtés hűd, váltóval együtt) kb. 5,1 m3, a folyadékűhűtő (hűtés hűd, váltóval együtt) kb. 5 m3.
...elepek előtt min. 5D, után min. 2D hosszúságú egyenes csőszakaszokat ajánlott alkalmazni.
...építéséhez alkalmazható SL37 hosszvarratú acélcső, ahol másképpen nincs jelölve.
...a vezetékeket beltérben és kültérben egyaránt 38 mm összecsapású (2 réteg) AC/Armaflex csőhőszigeteléssel kell ellátni.
...a közeleket beltérben 25 mm, kültérben 32 mm vastagságú AC/Armaflex csőhőszigeteléssel kell ellátni.
...a hőszigetelést 0,75 mm vastag borsnyózott acéllemez burkolattal kell ellátni.
...a gumikompensátorokat a napugárzás ellen védő acéllemez burkolattal kell ellátni.
...a rendszerem nyomáscsozota PN10, vagy magasabb.



Heat Production Strategies

COP values as a function of external temperature



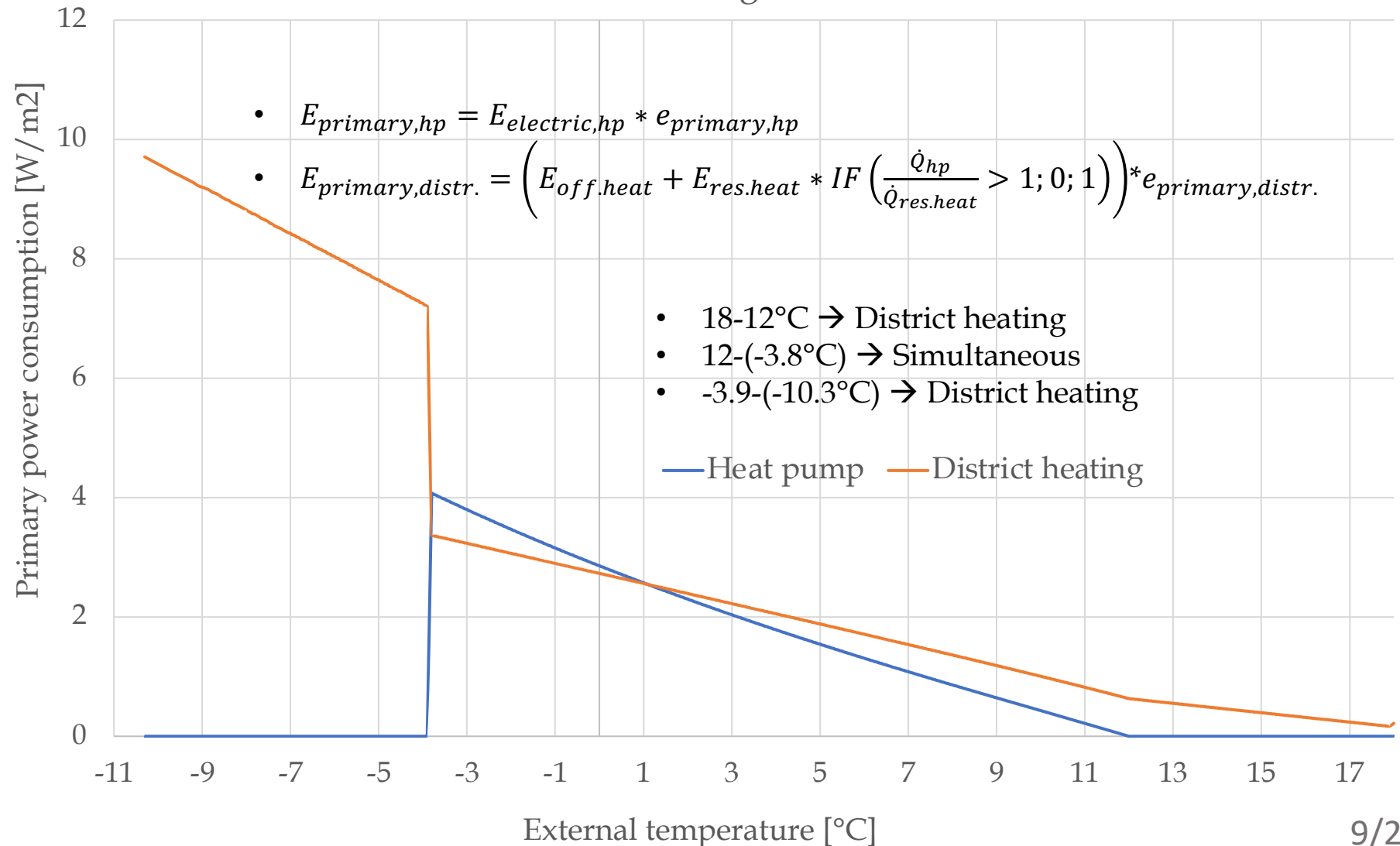
- $$COP_i = IF \left(t_{k,i-1} - t_{k,i} = 0; COP_{i-1}; COP_{i-1} + \frac{COP_{10} - COP_{-10}}{(t_{k1} - t_{k2}) * 10} * (t_{k,i-1} - t_{k,i}) \right)$$
- A Daikin EWYT 500B-XRA2 heat pump



Heat Production Strategies

Primary energy optimum

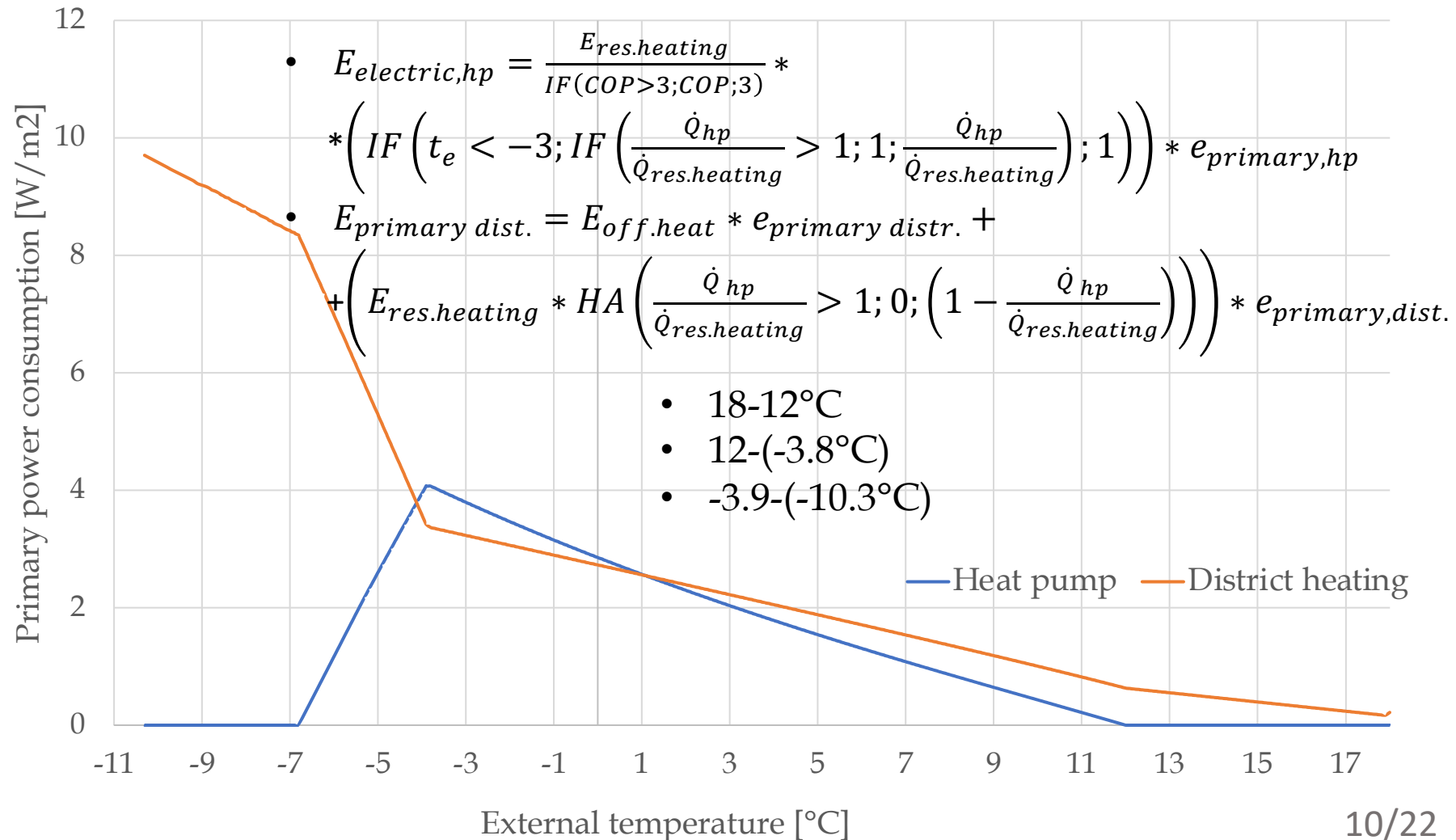
Alternating mode



Heat Production Strategies

Primary energy optimum

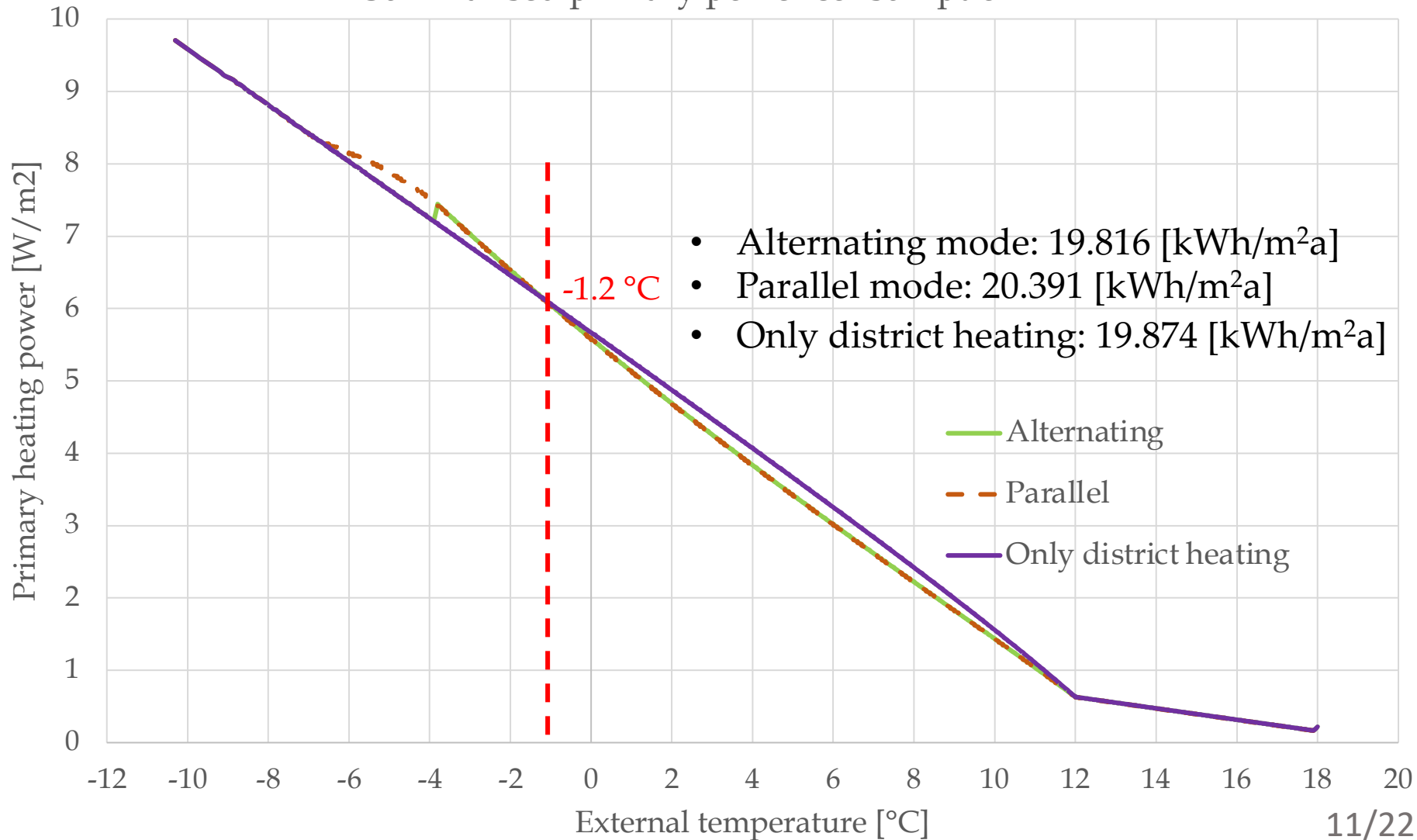
Parallel mode



Heat Production Strategies

Primary energy optimum

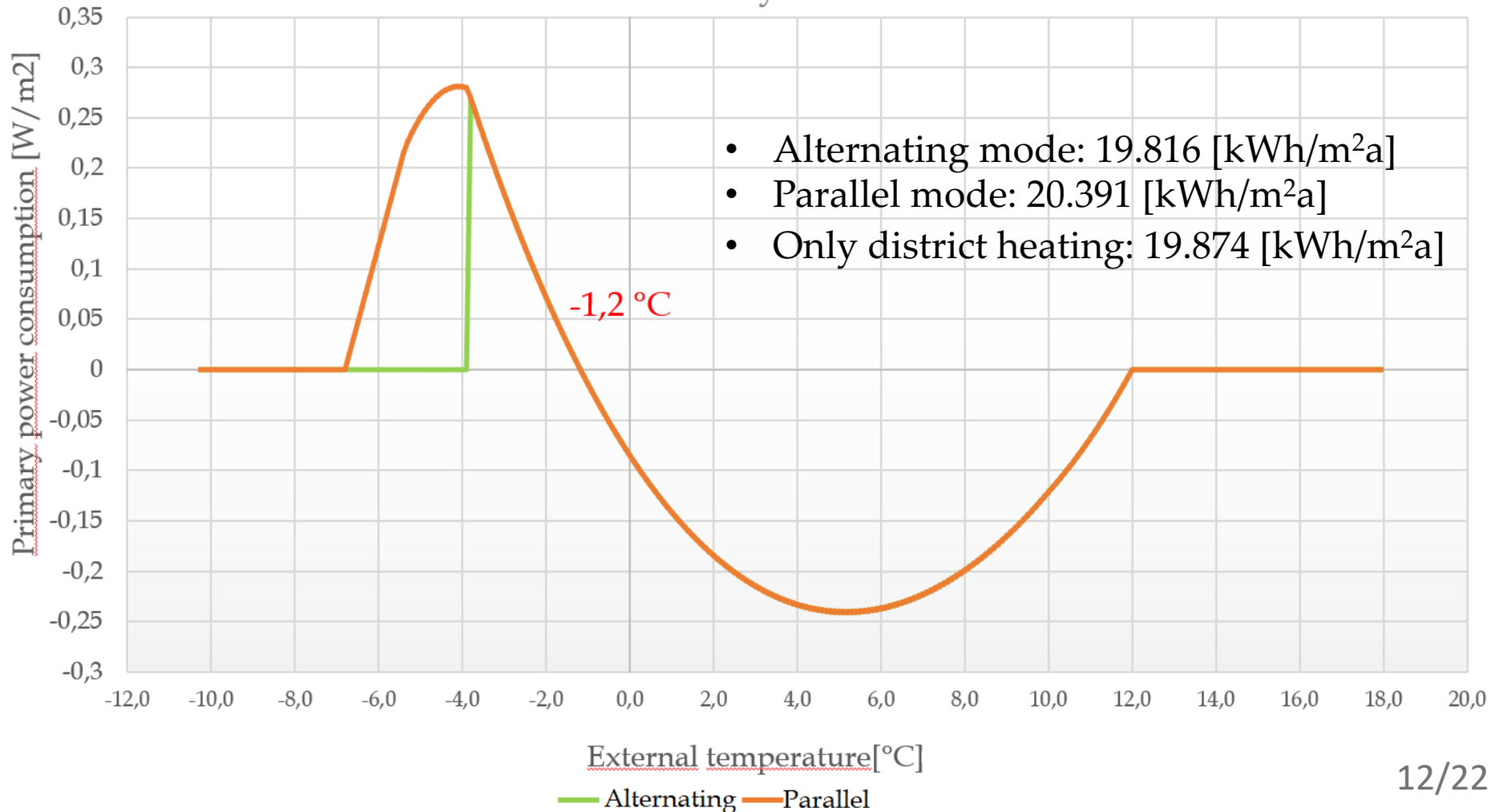
Summarised primary power consumption



Heat Production Strategies

Primary energy optimum

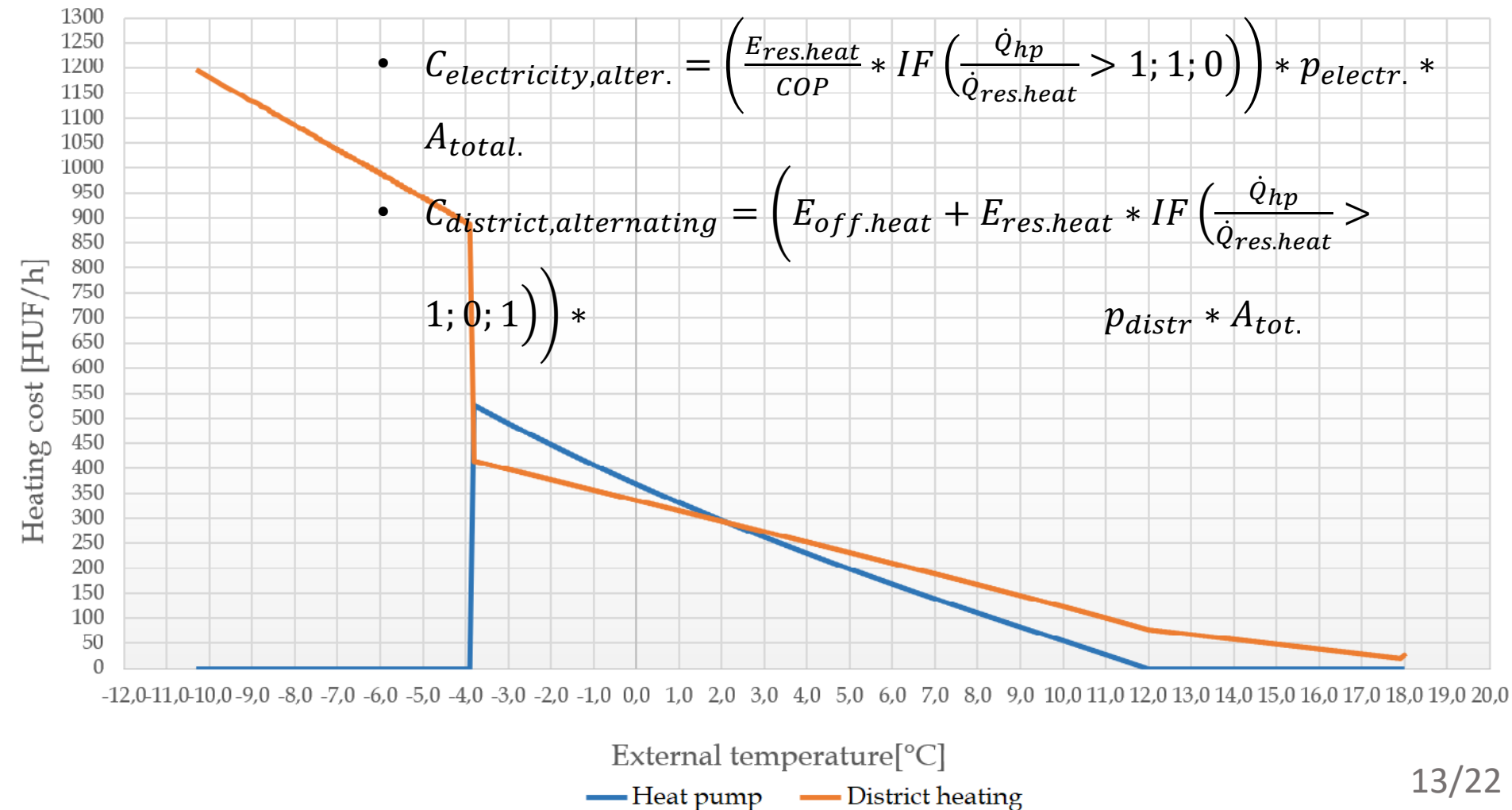
Differences in primary energy use compared to district heating only



Heat Production Strategies

Operational cost optimisation

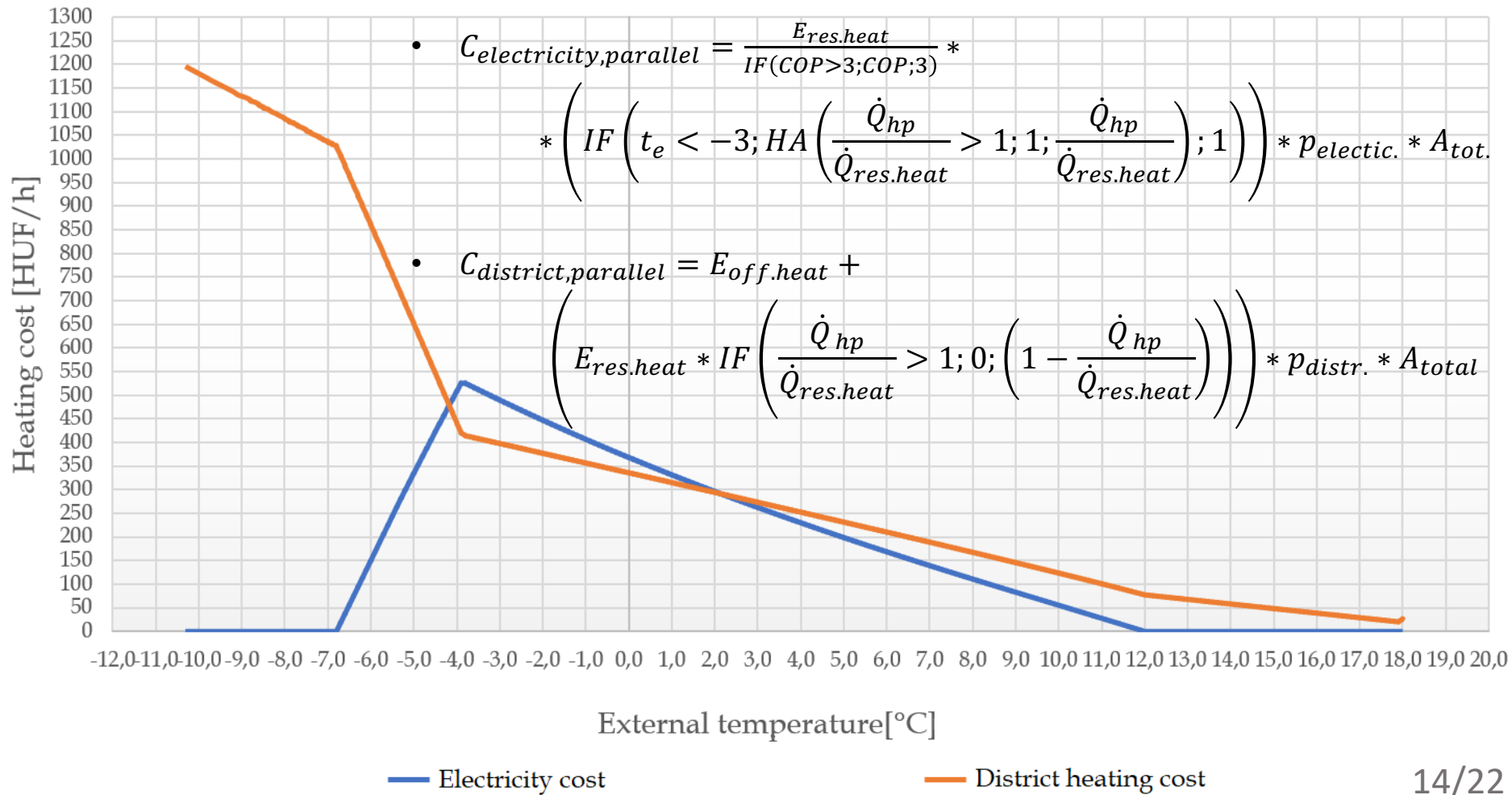
Costs in alternating mode



Heat Production Strategies

Operational cost optimisation

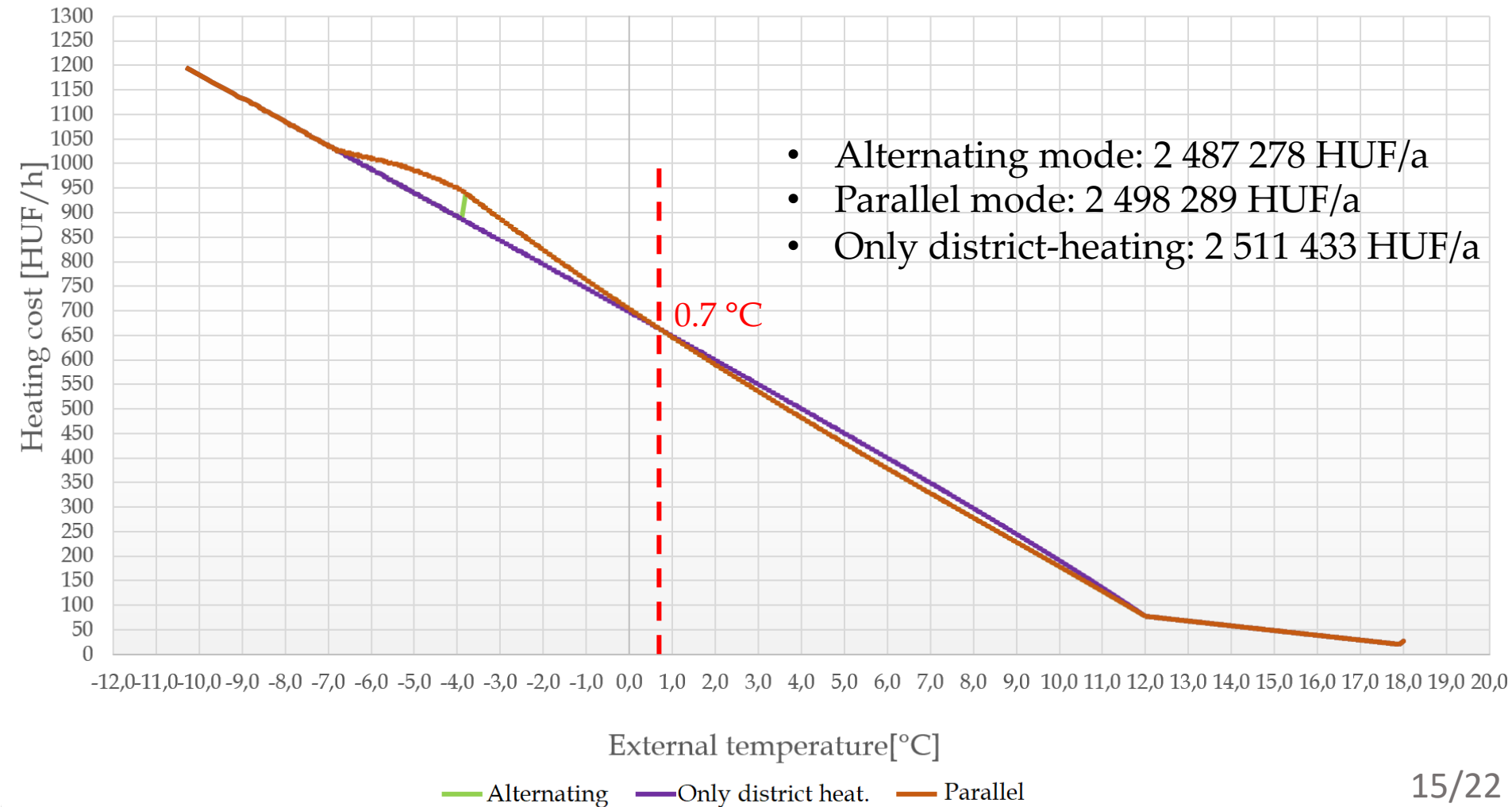
Cost overruns in parallel mode



Heat Production Strategies

Operational cost optimisation

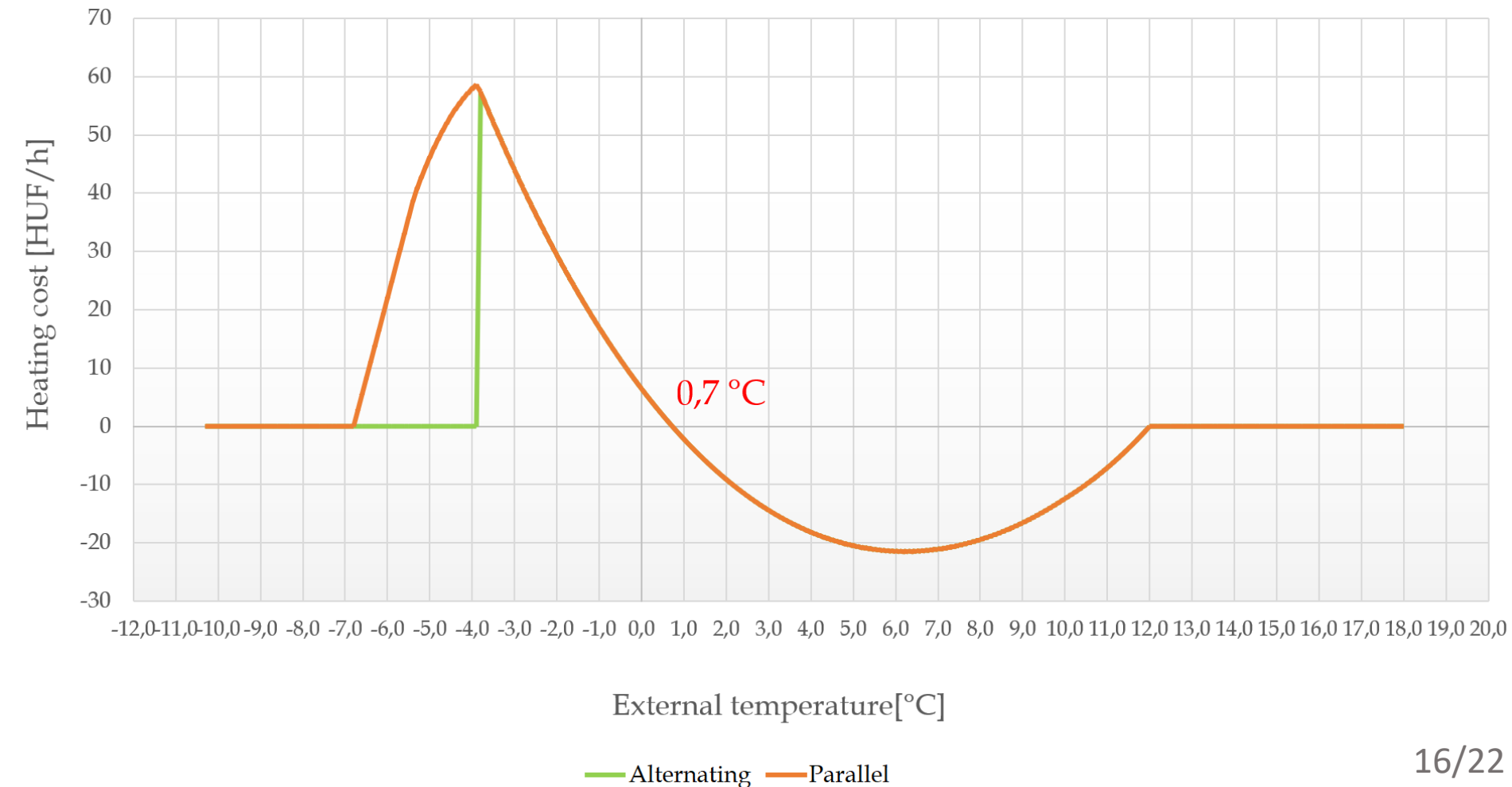
Summed operation mode costs



Heat Production Strategies

Operational cost optimisation

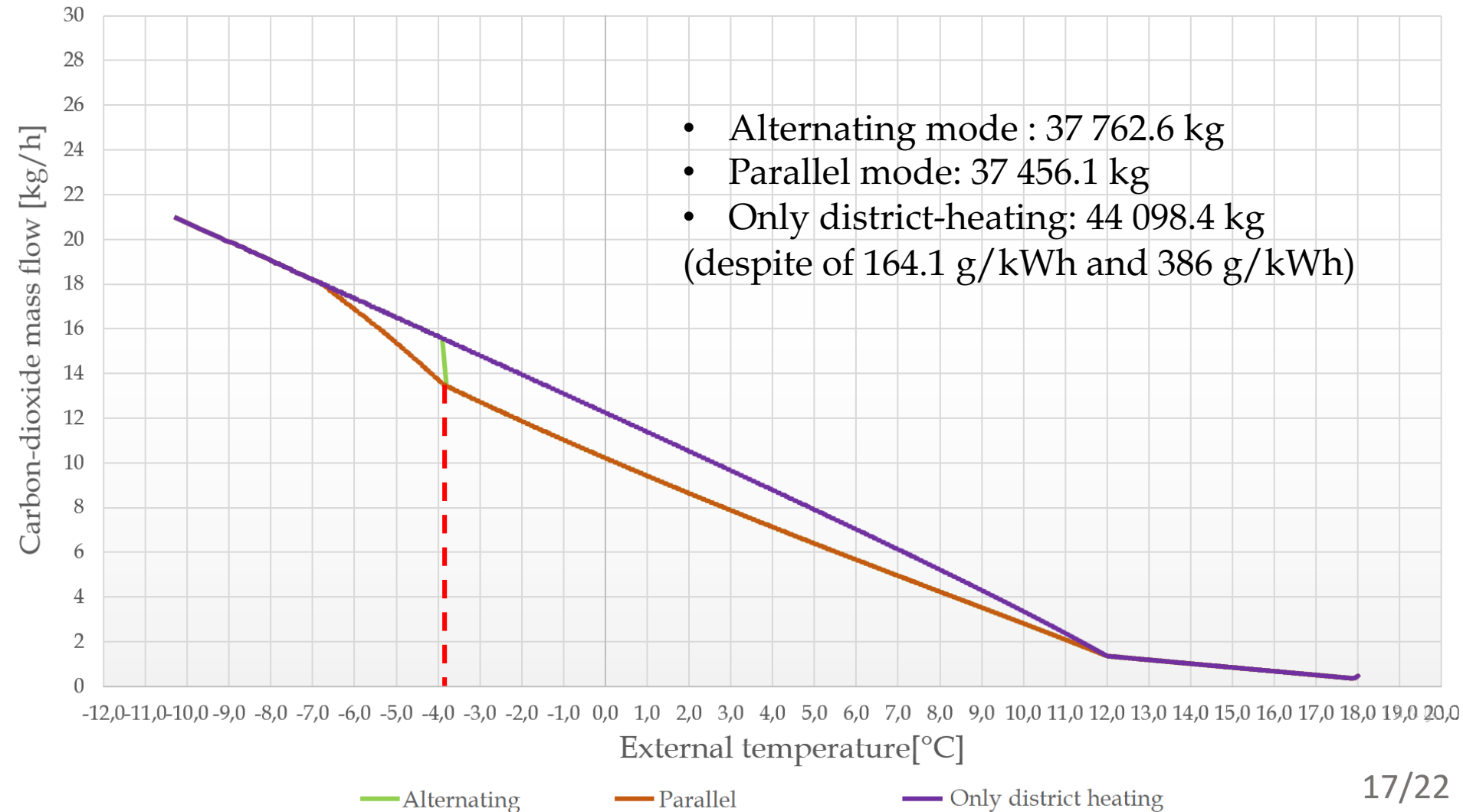
Differences in operational cost compared to only district heating



Heat Production Strategies

CO₂ emission optimisation

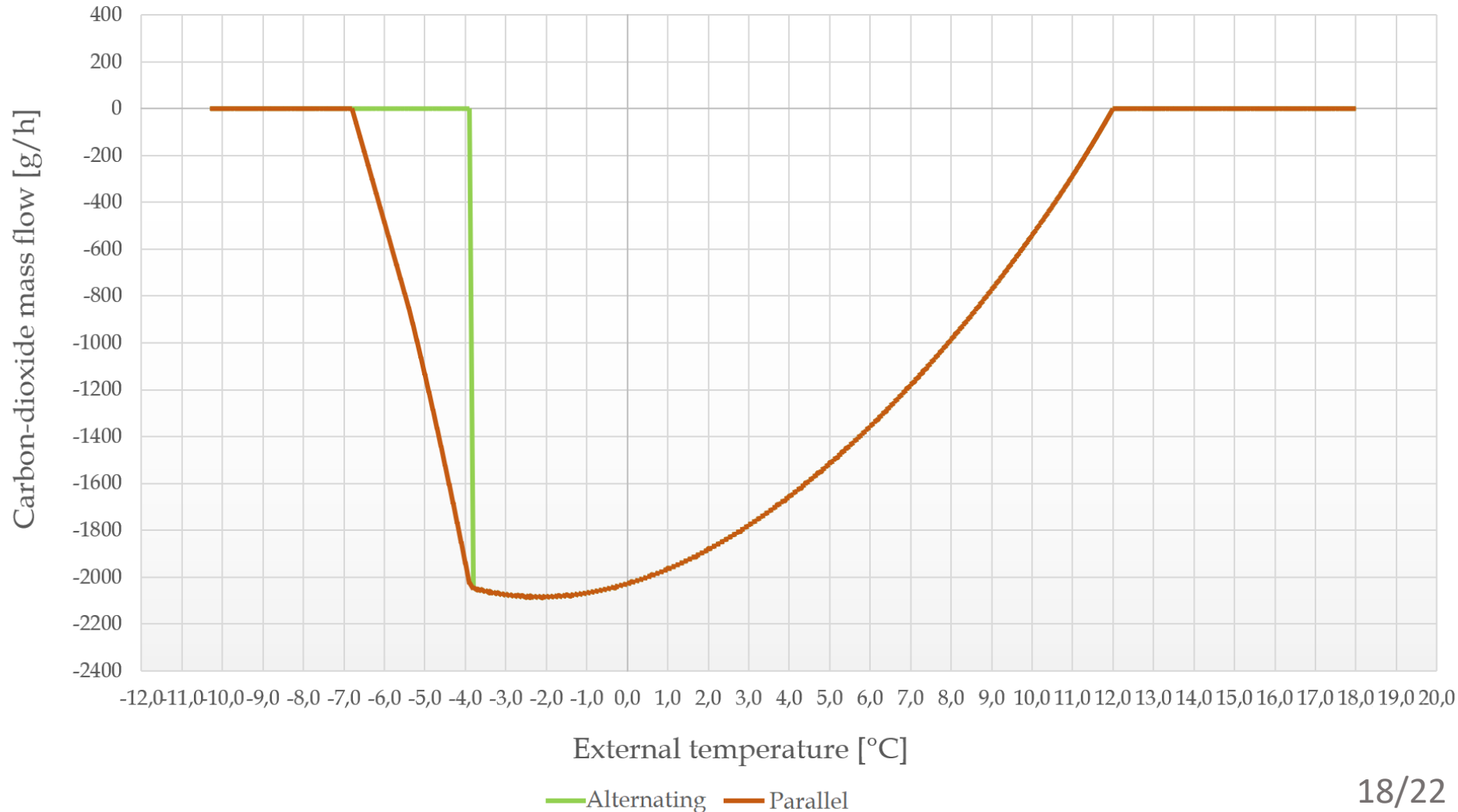
CO₂ emissions



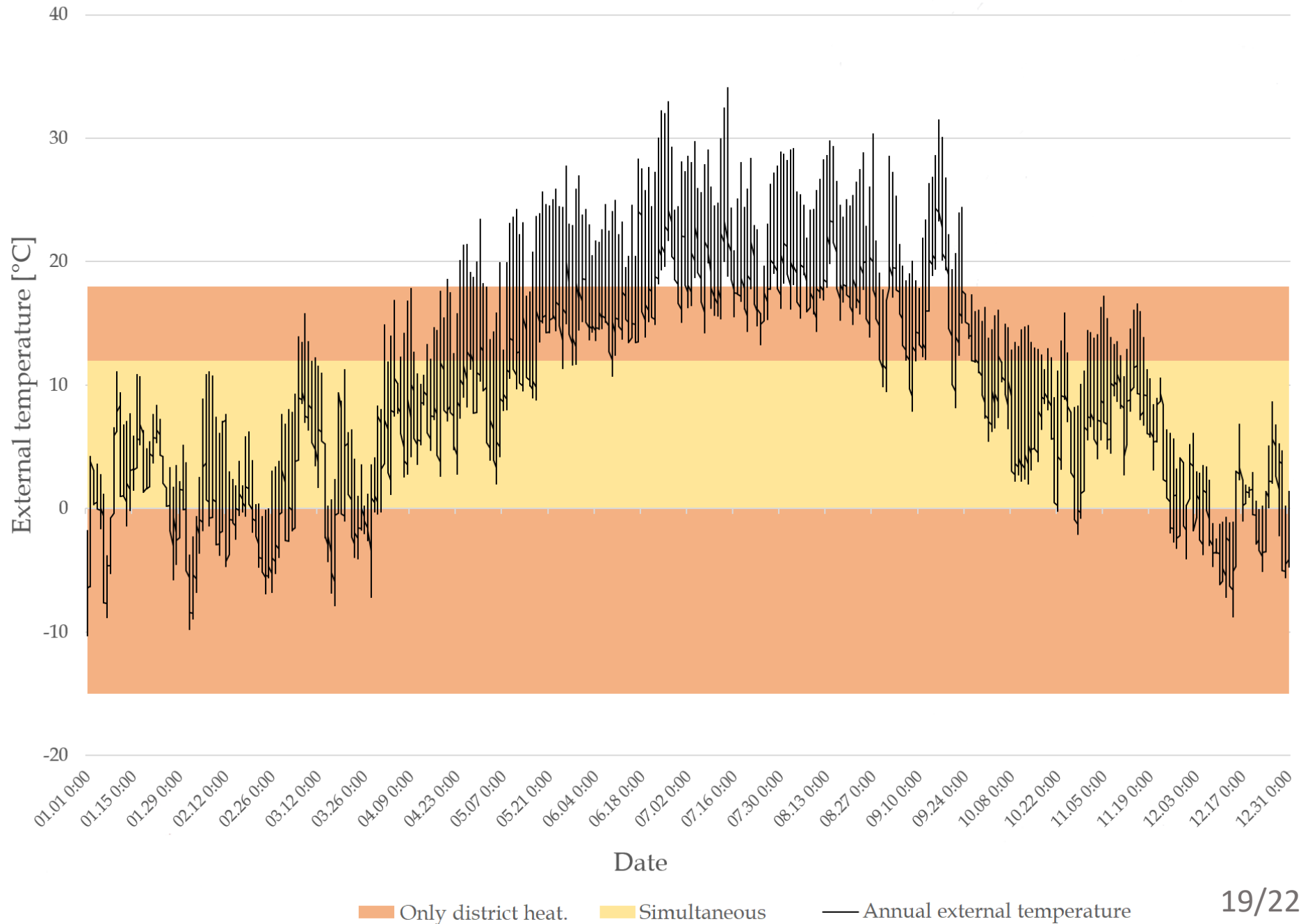
Heat Production Strategies

Operational cost optimisation

CO₂ emission differences compared to only district heating



Annual external temperature and heating modes

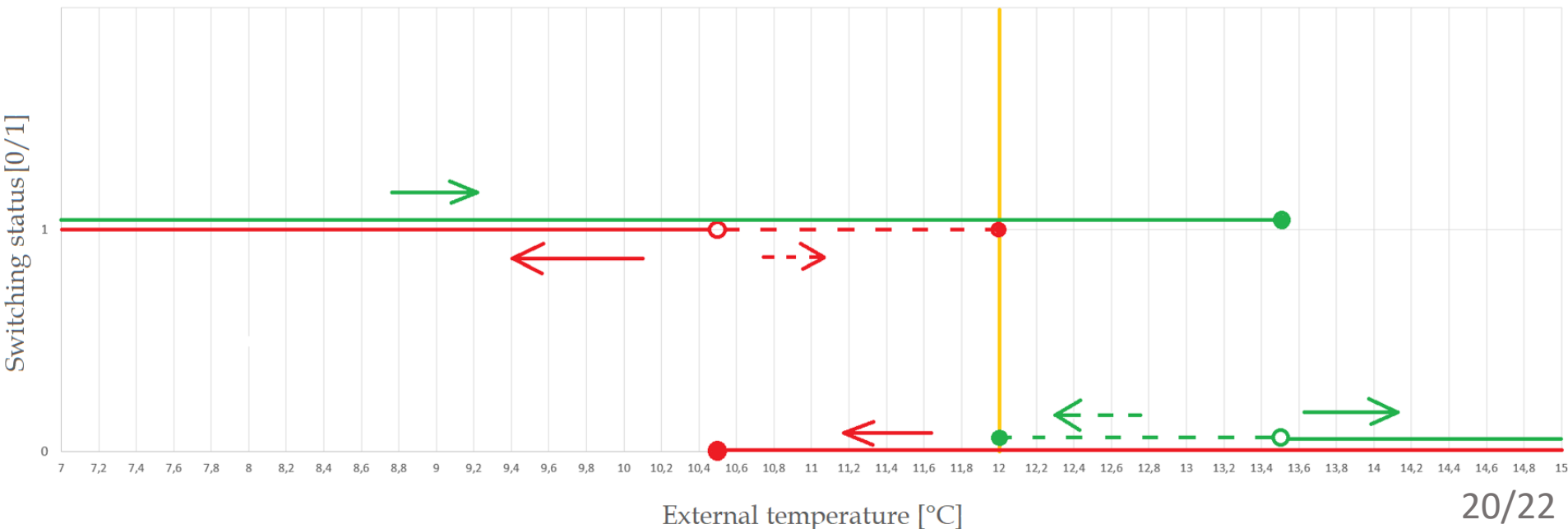


Heat pump control

- Time-dependent switching
 - 2 hours of information collection
 - 6 hours of deactivation time after mode change
- External temperature dependent switching
 - 1,5°C temperature margin



Heat pump switching



Summary

- System unable to utilise waste heat recovery
- The most suitable system operational mode is parallel
- Negligible gains without constructional system changes
- System upgrade options



Thank you for your attention



H-1111 Budapest, Bertalan Lajos u. 4–6., Hungary

+36 1 463 1106

tanszek@mail.bme.hu

epget.bme.hu

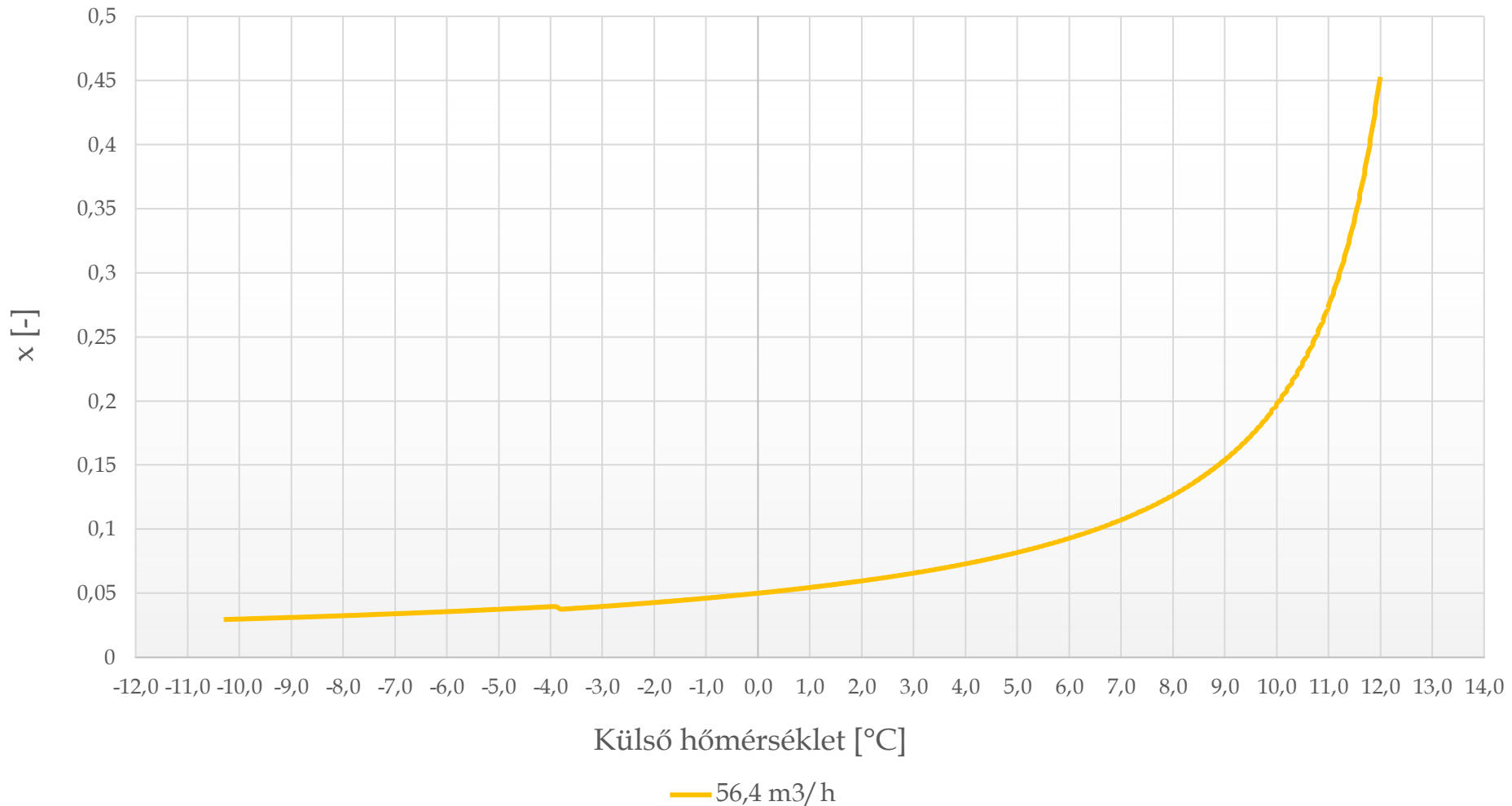
facebook.com/EPGET



ÉPÜLETGÉPÉSZETI ÉS
GÉPÉSZETI ELJÁRÁSTECHNIKA
TANSZÉK

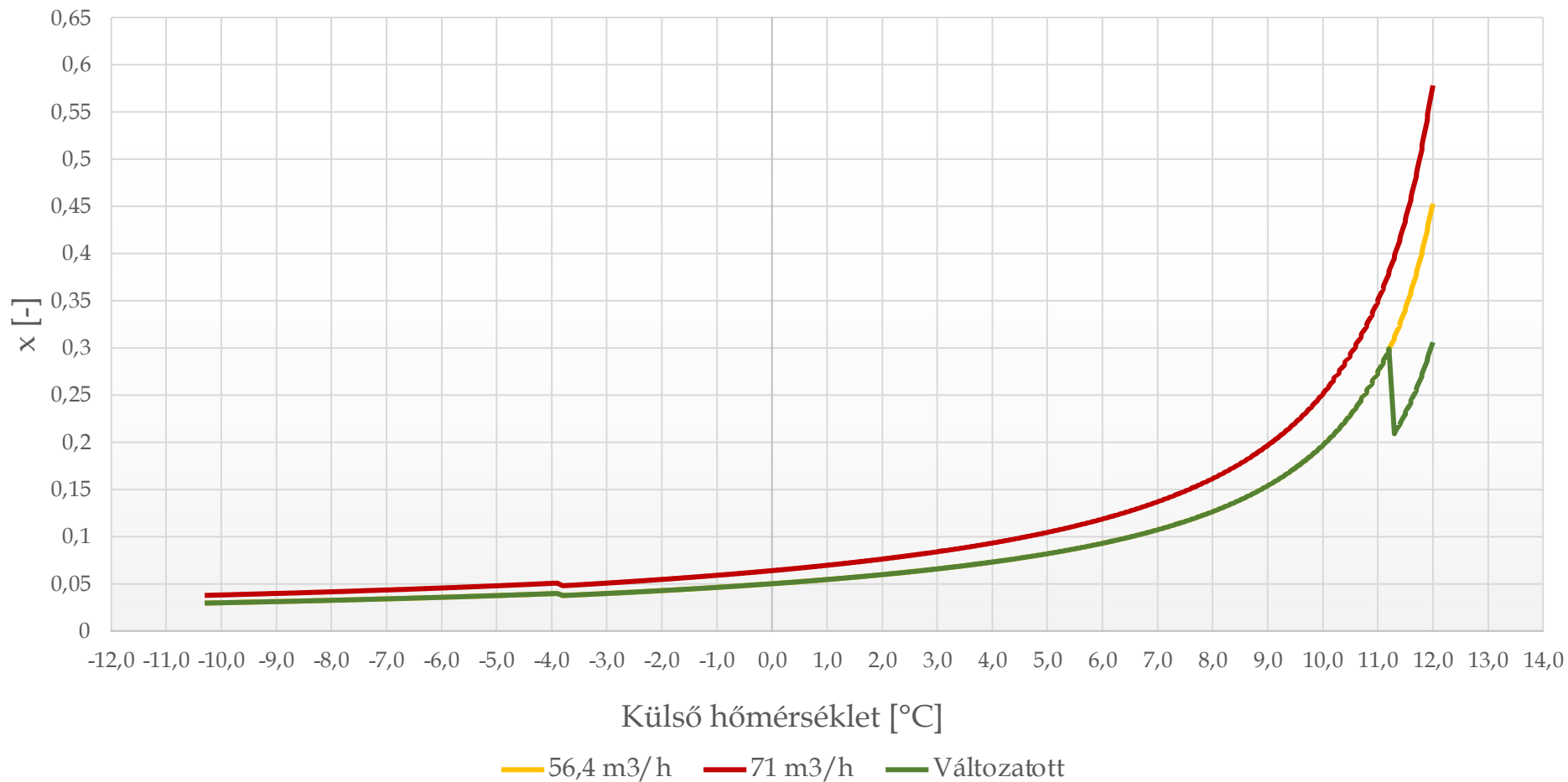
Szivattyú szabályzása

Szivattyúköltség a fűtés költség arányában



Szivattyú szabályzása

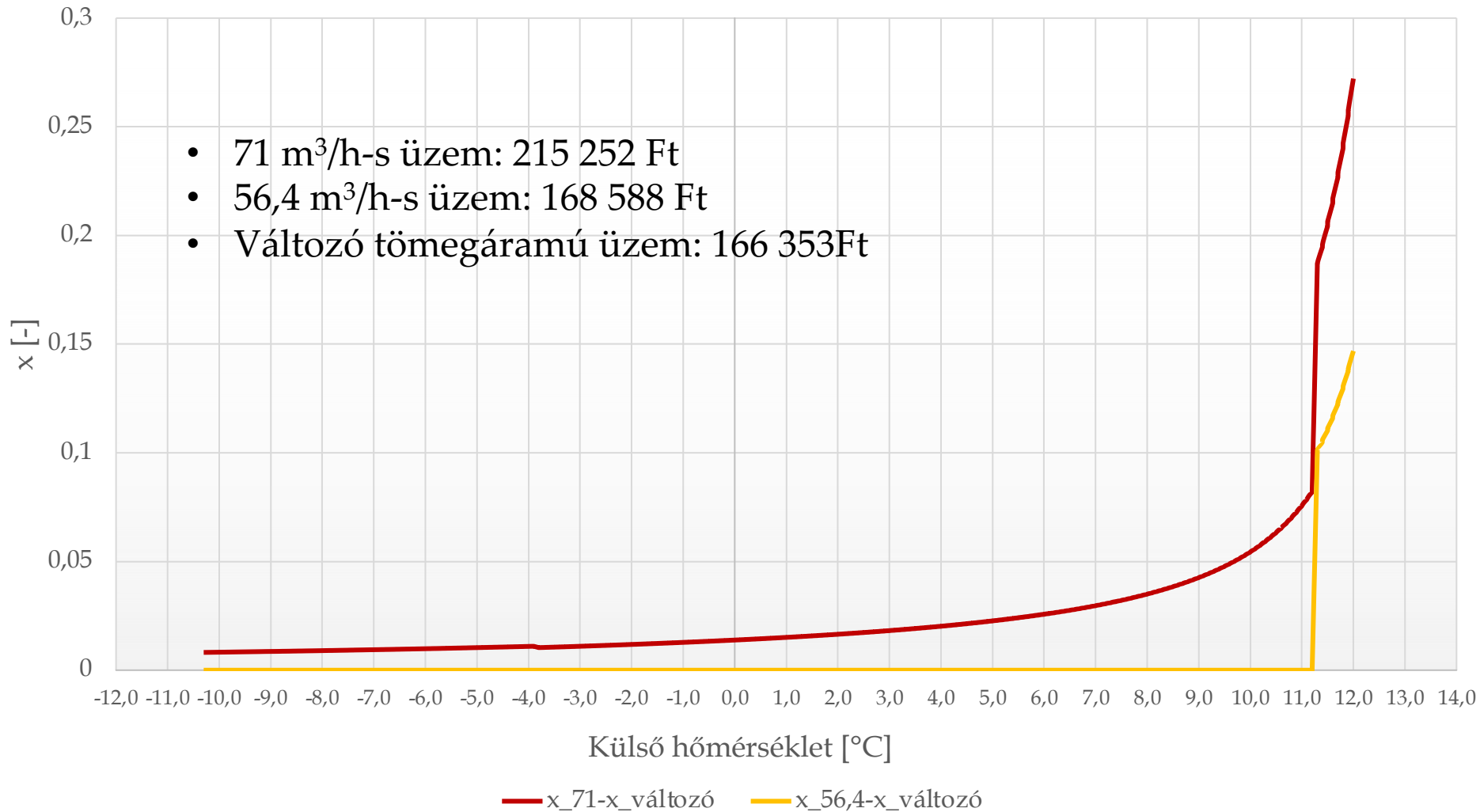
Szivattyúköltség a fűtés költség arányában



Szivattyú szabályzása

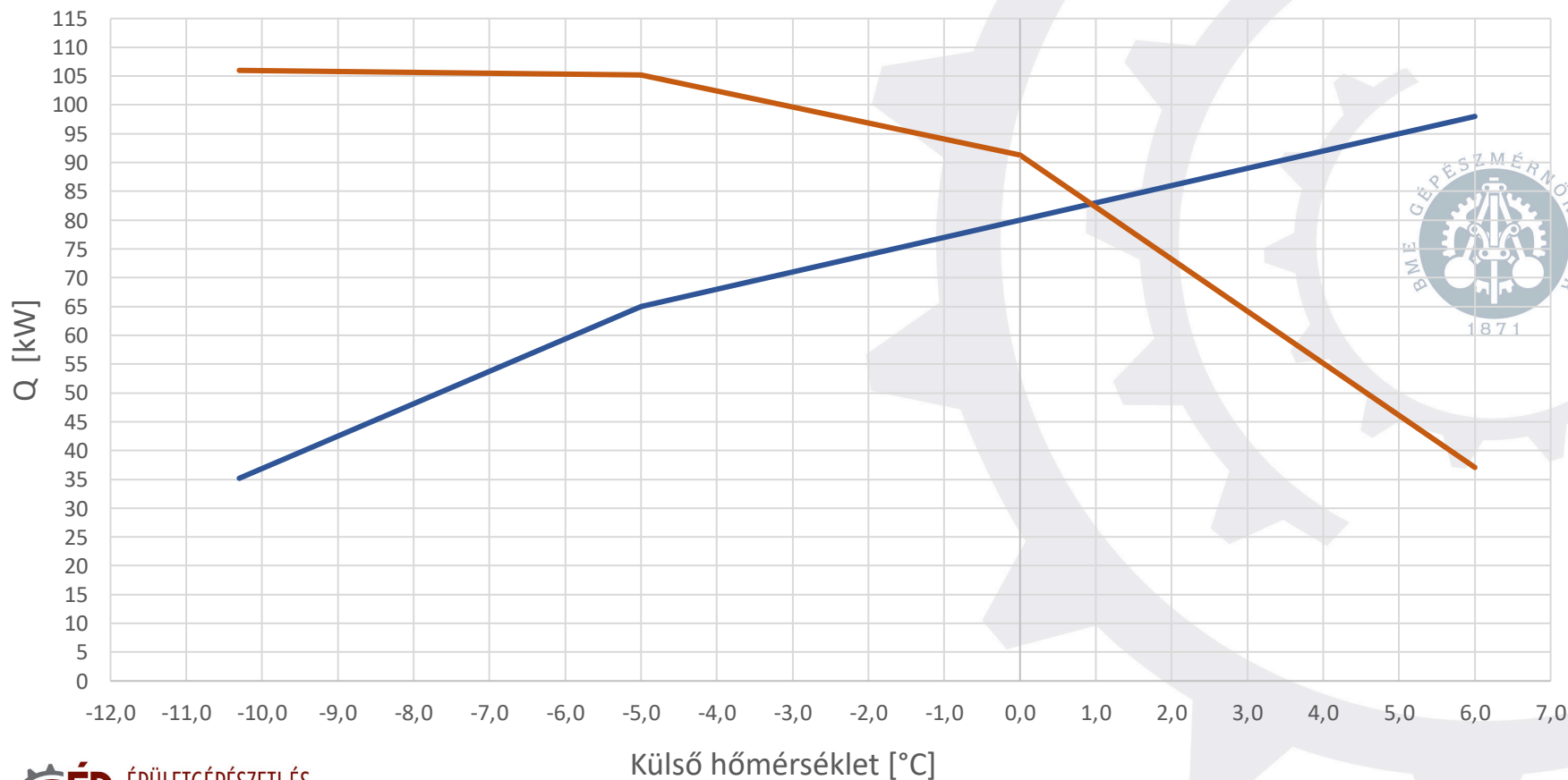
A változó üzemmód megtakarításai

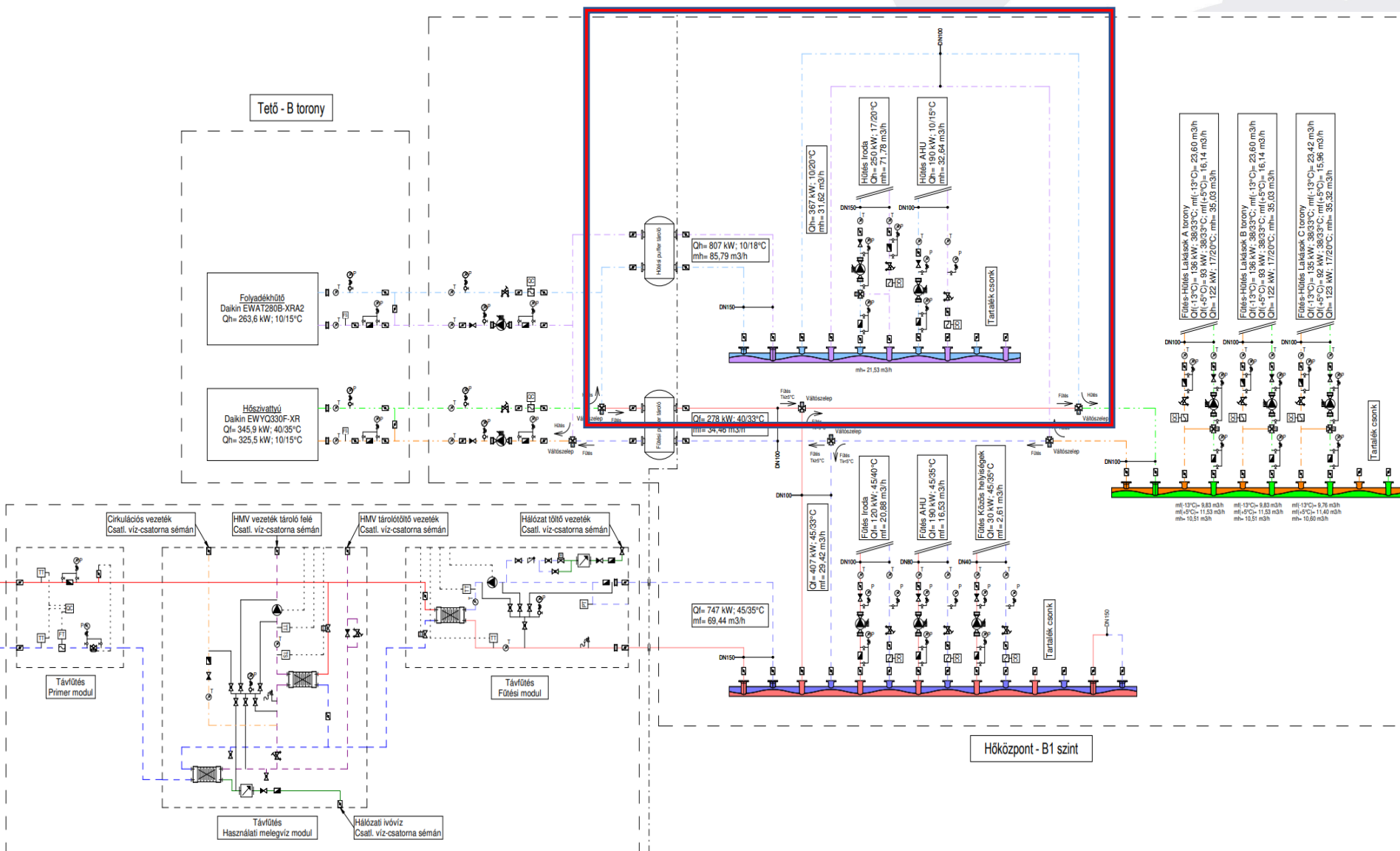
- 71 m³/h-s üzem: 215 252 Ft
- 56,4 m³/h-s üzem: 168 588 Ft
- Változó tömegáramú üzem: 166 353 Ft



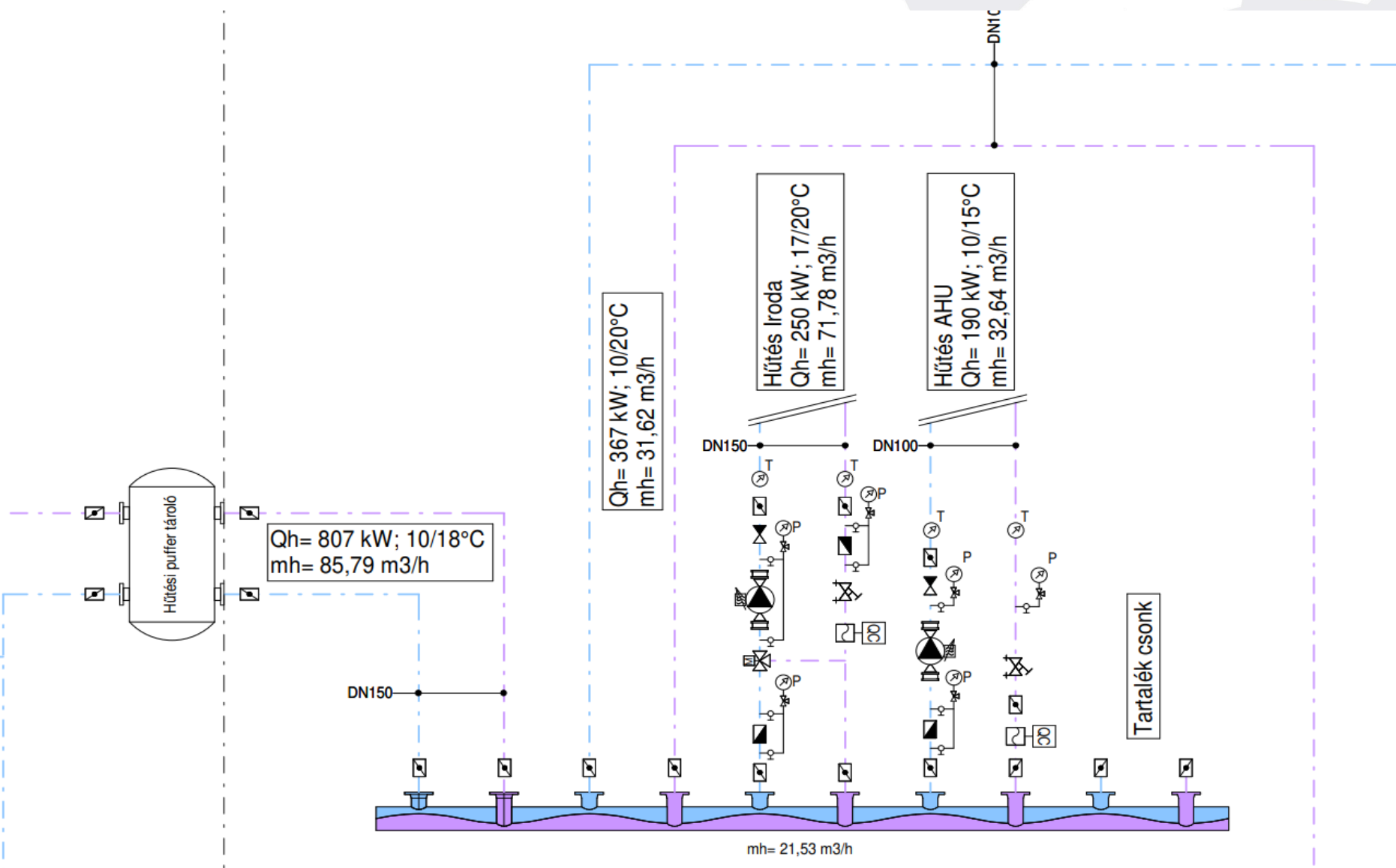
Free-cooling üzem

Hűtési igények kiszolgálása

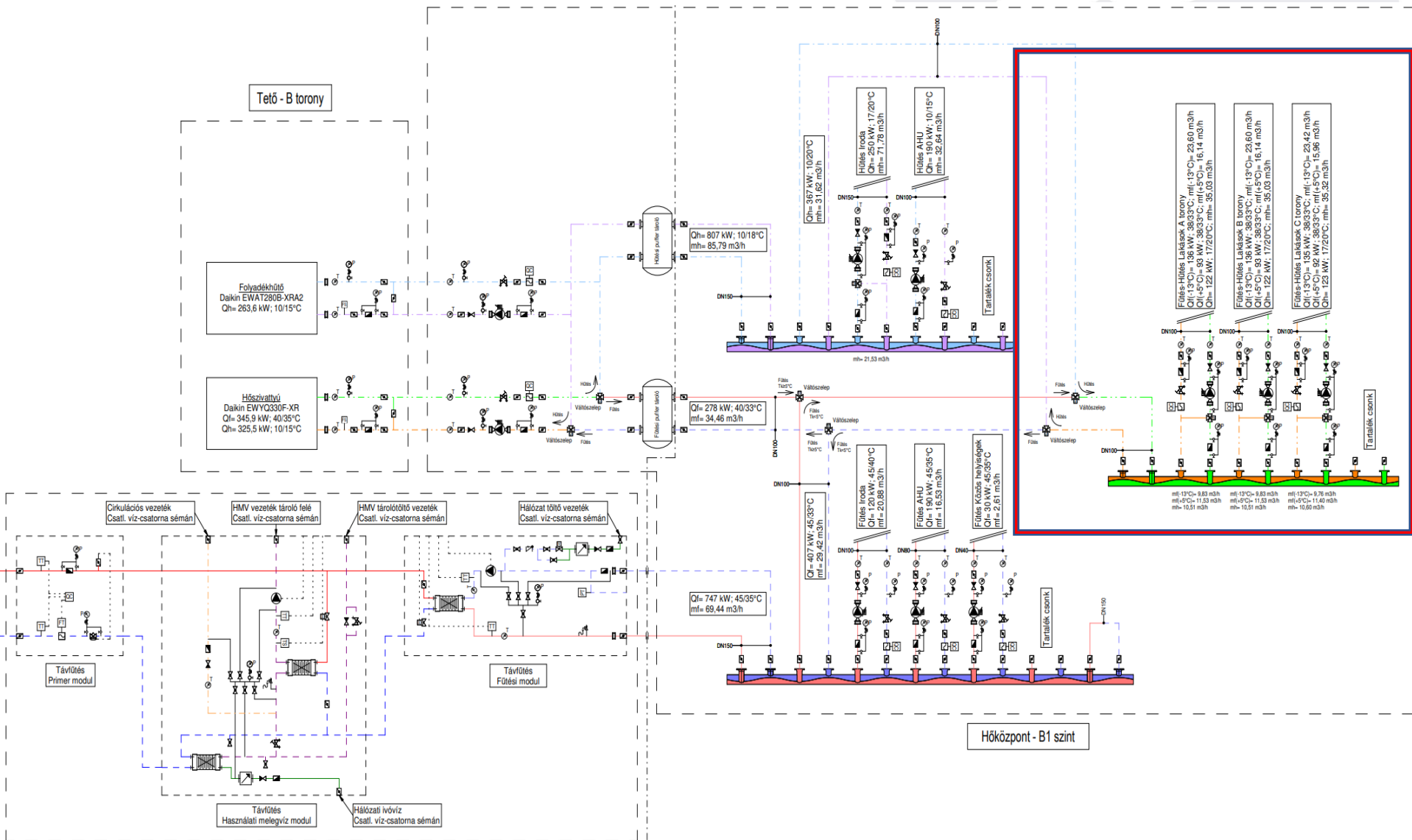




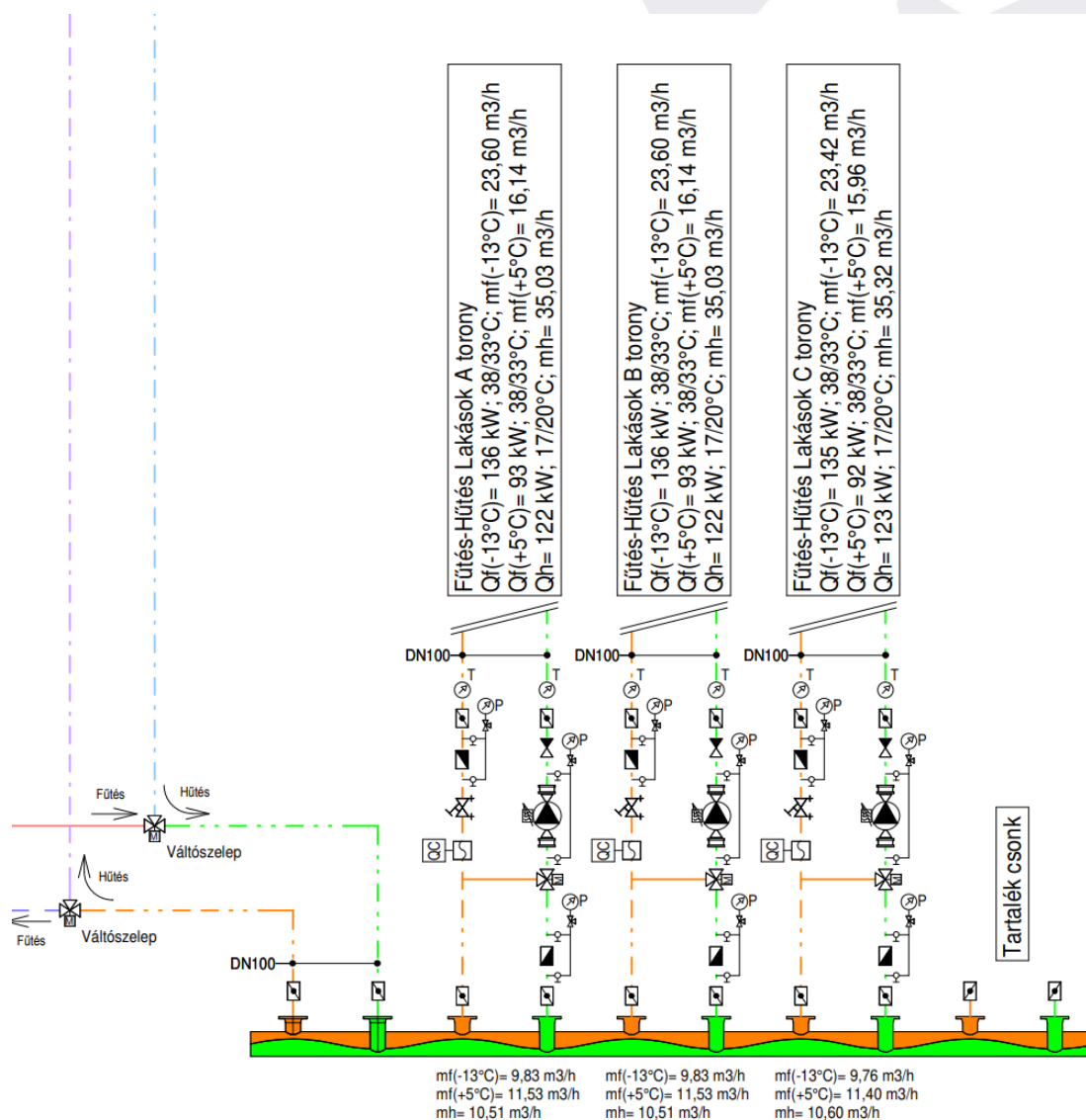
Hűtési osztó

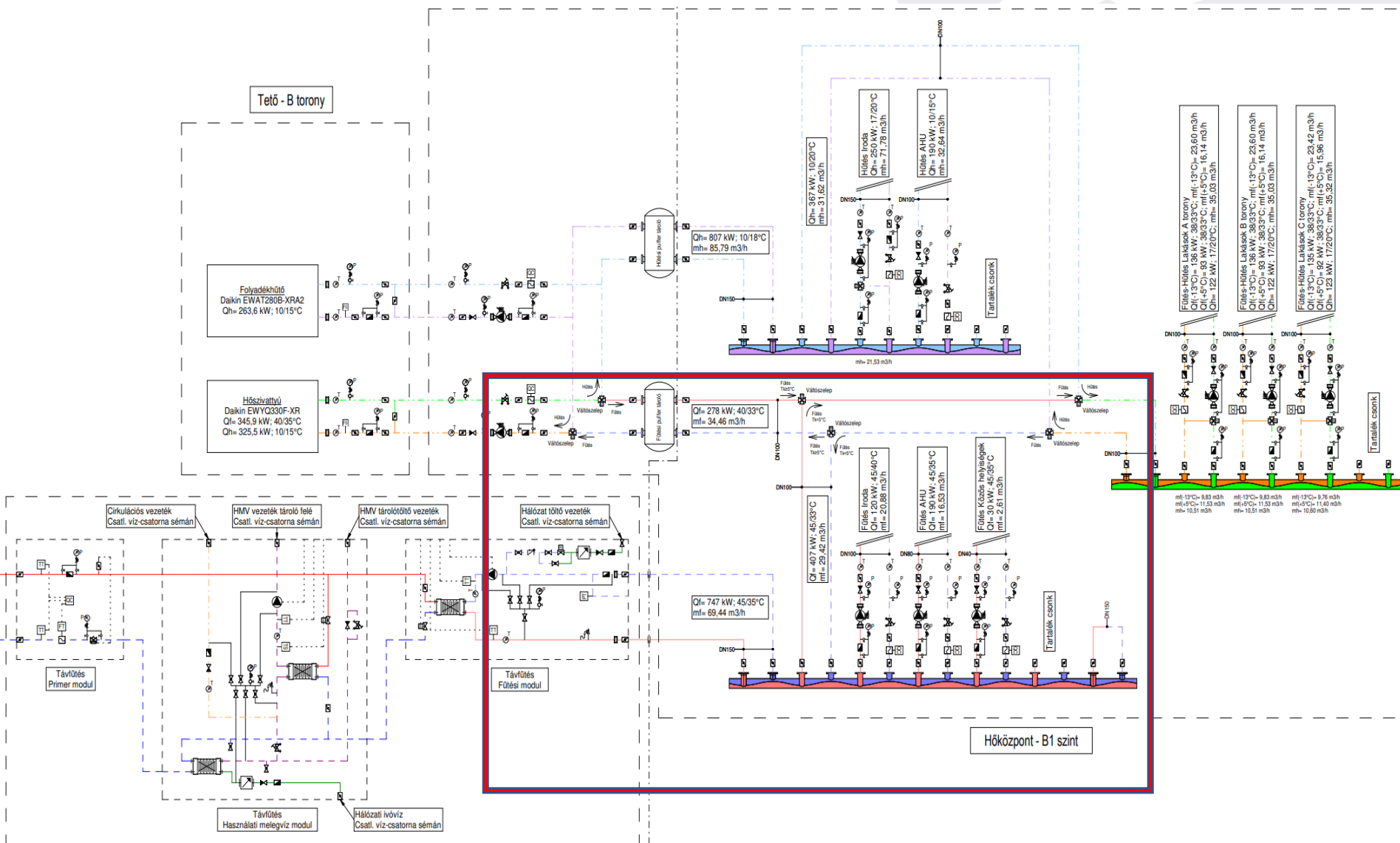


Fűtés-hűtési kapcsolási rajz



Lakások fűtés-hűtési osztója





Fűtési osztó

