

Introducing

Jonas Lindhe

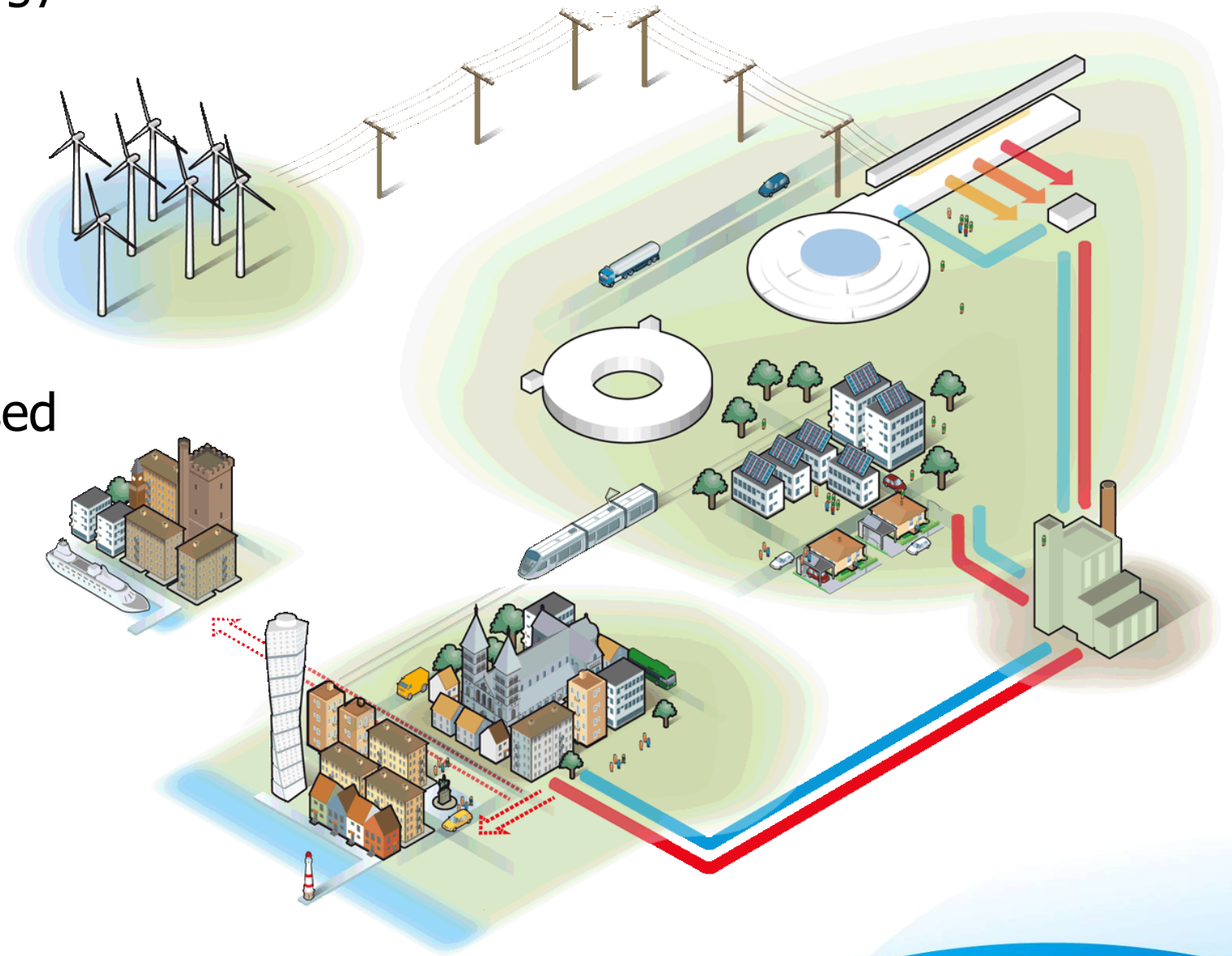


Martin Gierow



The energy concept- a part of the winning offer

- Responsible – 20 % reduced energy consumption
- Renewable – 100 % renewable energy usage
- Recyclable – 60 % recycling of used energy
- Reliable

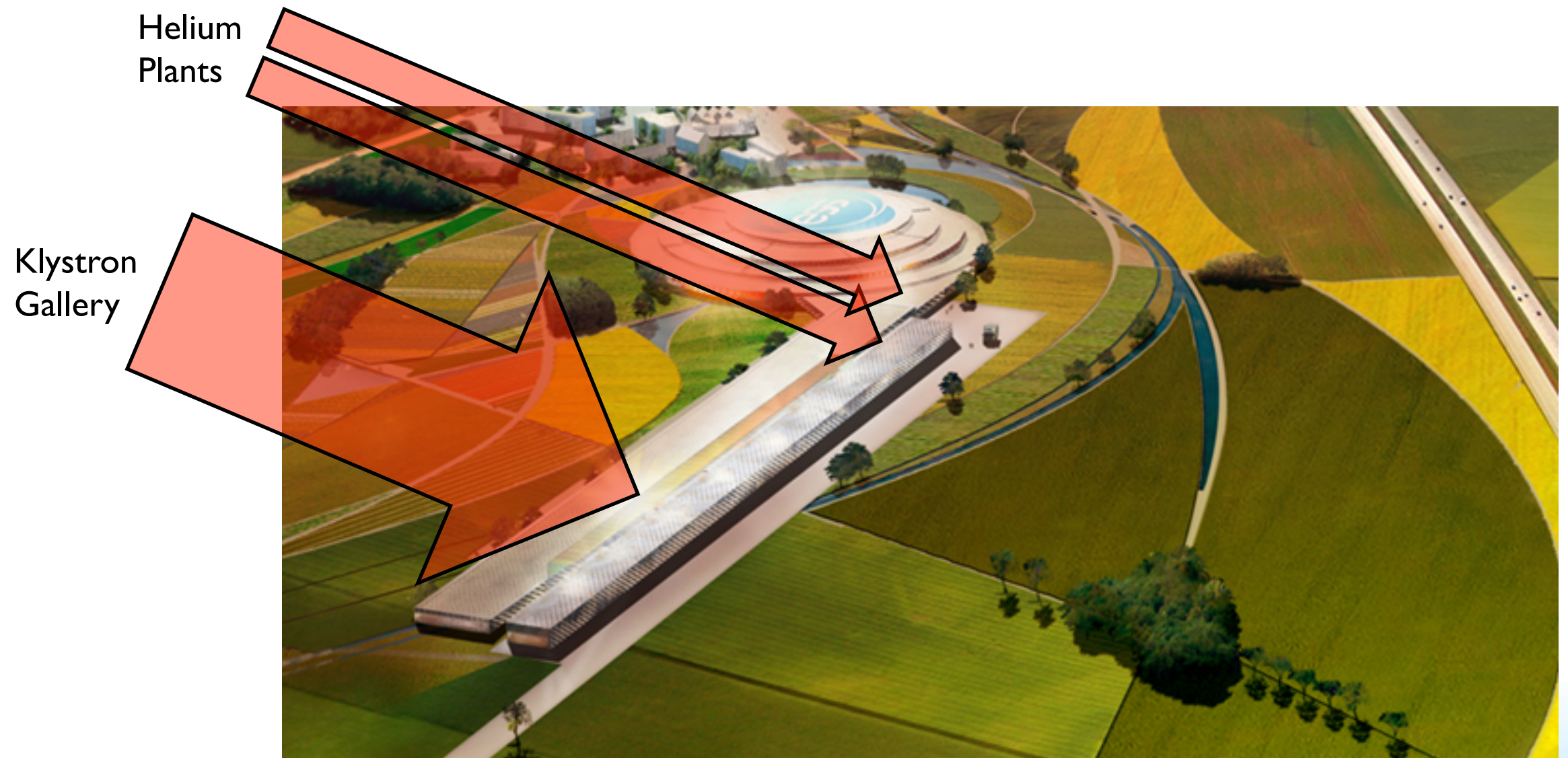


Energy Inventory



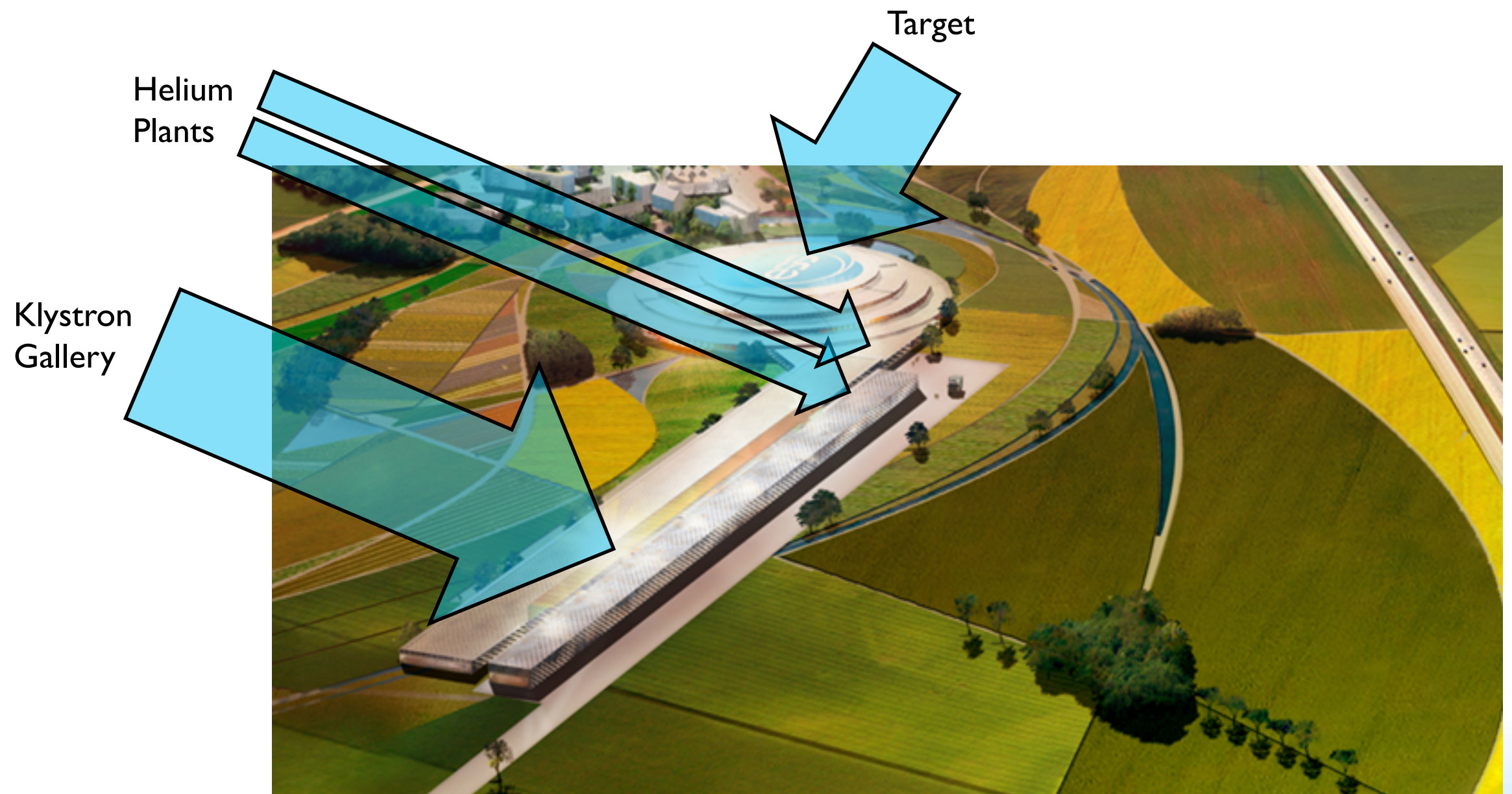
Energy Inventory

Power demand



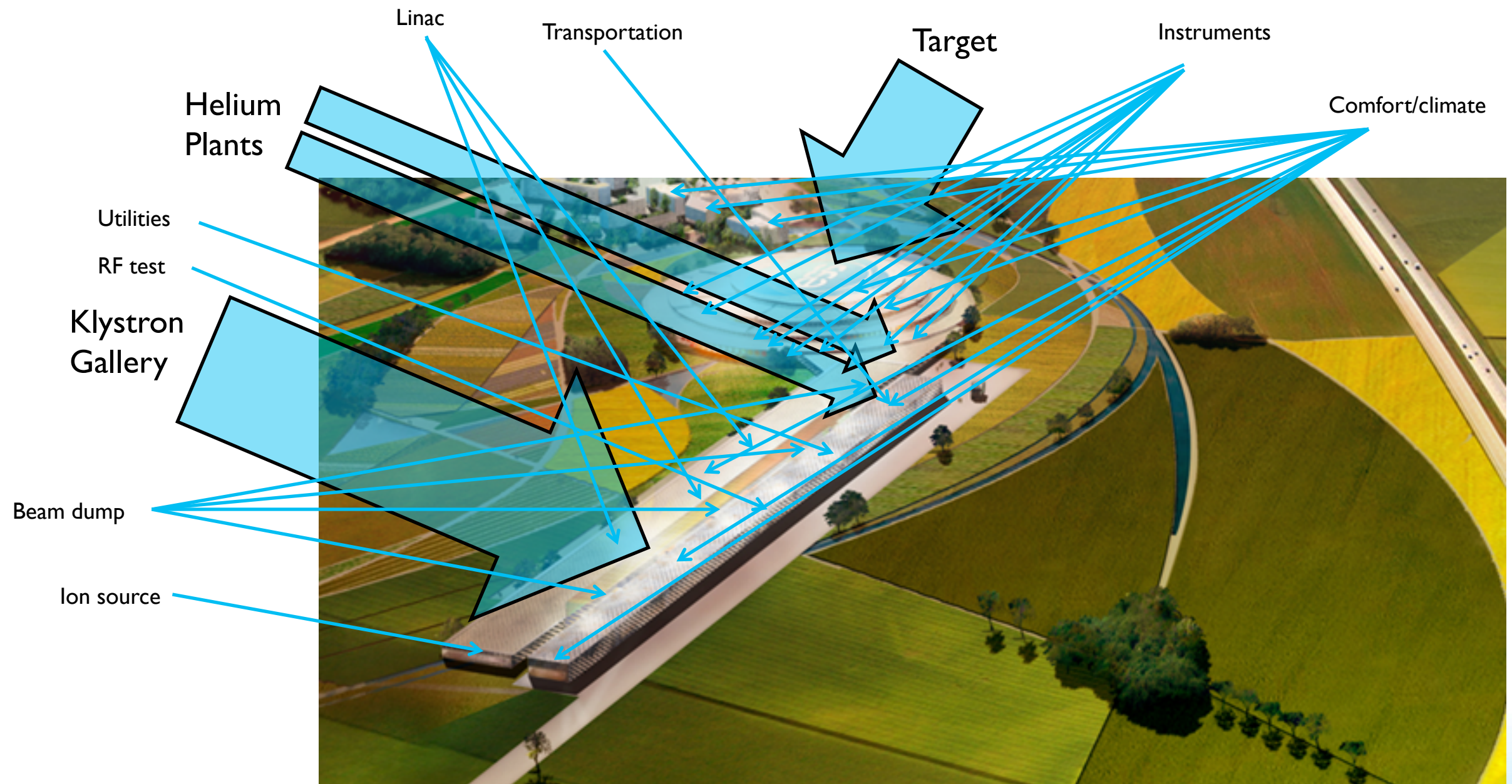
Energy Inventory

Cooling demand

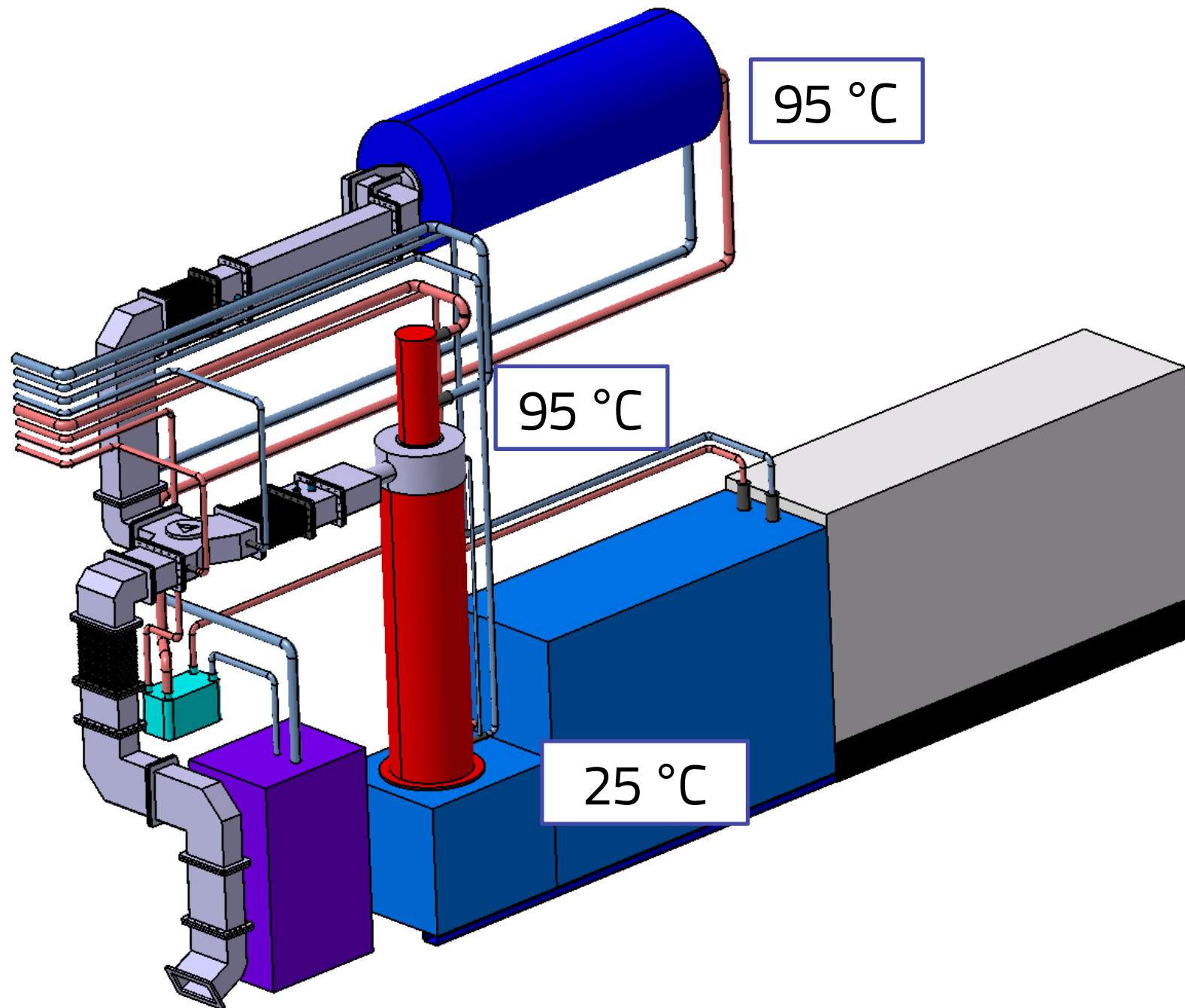


Energy Inventory

Cooling demand

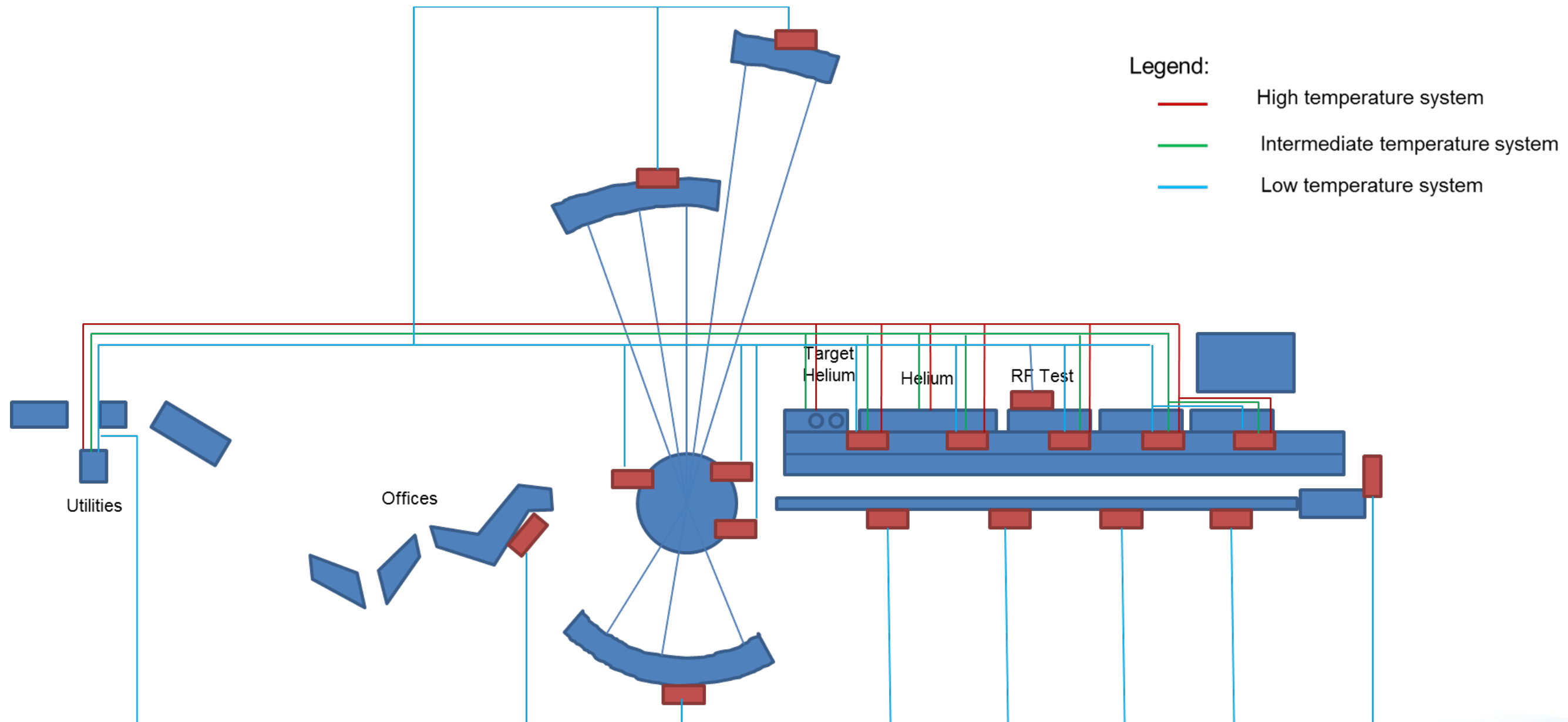


Example ESS: Klystron/modulator

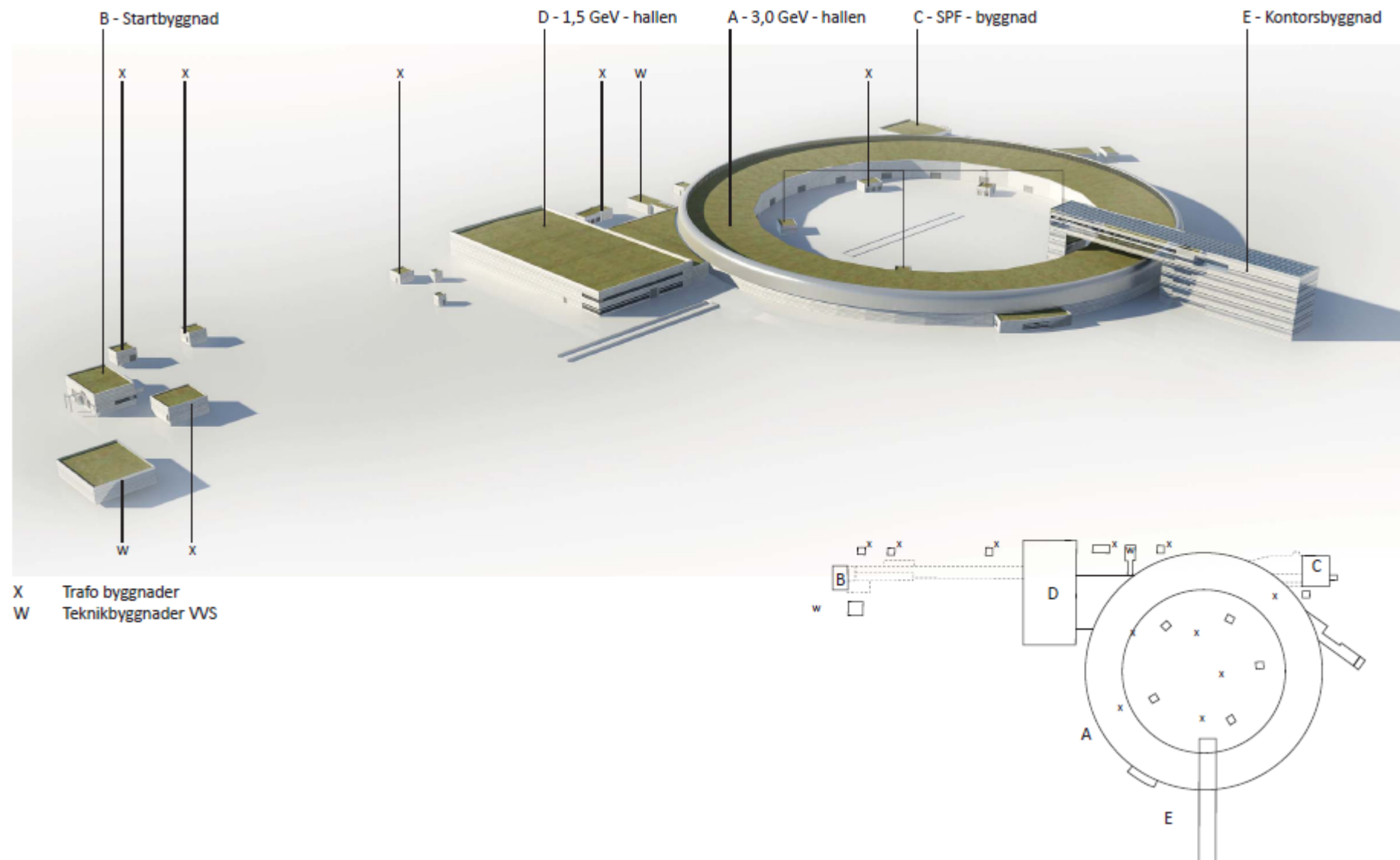


0.0448

Conceptual design



Energy mapping MAX IV, energy flow model



Input

Description of energy properties both in and out:

- Building
- Process
- Cooling

Air / Water

Temperature quality

- Lasting

Process

Building properties

HVAC & comfort

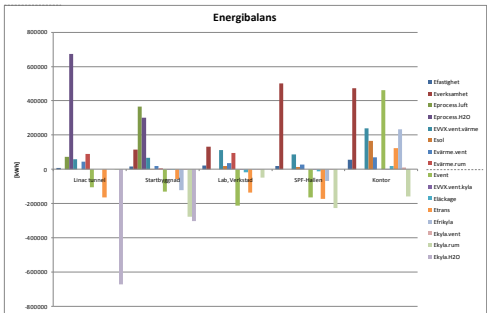
Cooling demand

Operating time

Byggnad		nr: 2		A2 Klystrongalleri									
Storhet	Enhet												
Byggnadsklass		Process											
Byggnadsform		Rektangulär											
Längd	m												
bredd	m												
höjd	m												
Antal våningar	st	1		Ref: Caj Lundquist									
A _{temp}	m ²	1861		Ref: Caj Lundquist									
A _{om,luft}	m ²	0		Ref: Caj Lundquist									
A _{om,mark}	m ²	4106		Ref: Caj Lundquist									
A _{fönster}	m ²	0		Ref: Caj Lundquist									
G _{m,fönster}	-	0,40											
U _{m,luft}	W/m ² °C	0,30											
U _{m,mark}	W/m ² °C	0,10											
G _{1,fr kyl}	°C	-99											
Q _{läckluft}	l/s m ² A _{om,ute}	0,05											
Q _{läckluft}	l/s	0											
T _{inblås(TU)sommar}	°C	25		Ref: LG Jannesson									
T _{ute,sommar}		21,0											
T _{inblås(TU)vinter}		25,0											
T _{ute,vinter}		25,0											
Q _{vent}	l/s m ² A _{temp}	0,35		Ref: LG Jannesson									
Q _{vent}	l/s	651,35											
VVX _{vent}	%	0,55		Ref: LG Jannesson									
SFP	kW/ m ³ /s	2,0		Ref: LG Jannesson									
Verksamhetsel	W/m ²	0											
Processer													
- Modulator 100Hz	kW	270	270										
- Modulator 10Hz	kW	54	54										
- Klystron + klyst.win 100Hz	kW	558	558										
- Klystron + klyst.win 10Hz	kW	55,8	55,8										
Verksamhetsel	kW	0	0										
Fastighetsel (fläktar)	kW	1	1										
Effektbehov	kW	1	0	5,58	55,8	55,8	558	5,4	54	27	270		
T _{in}	°C	25	25	25	25	25	25	25	25	25	25		
T _{ut}	°C	25	25	25	25	25	25	25	25	25	25		
Energier													
		Q _{vent}	E _{fläkt}	E _{verksamhet}	E _{process,luft}	E _{process,H2O}	E _{process,luft}	E _{process,H2O}	E _{process,luft}	E _{process,H2O}	E _{process,luft}		
		Ventilation	E->Luft	E->Luft	E->Luft	E->Luft	E->Luft	E->Luft	E->Luft	E->Luft	E->Luft		
		l/s	kW	kW	kW	kW	kW	kW	kW	kW	kW		
		651	1	0	6	56	56	558	5	54	27		

Output

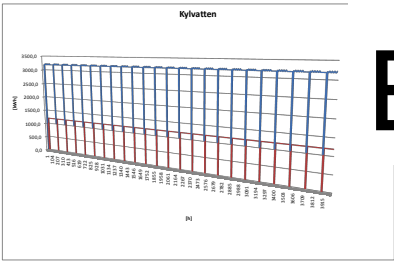
Based upon output:



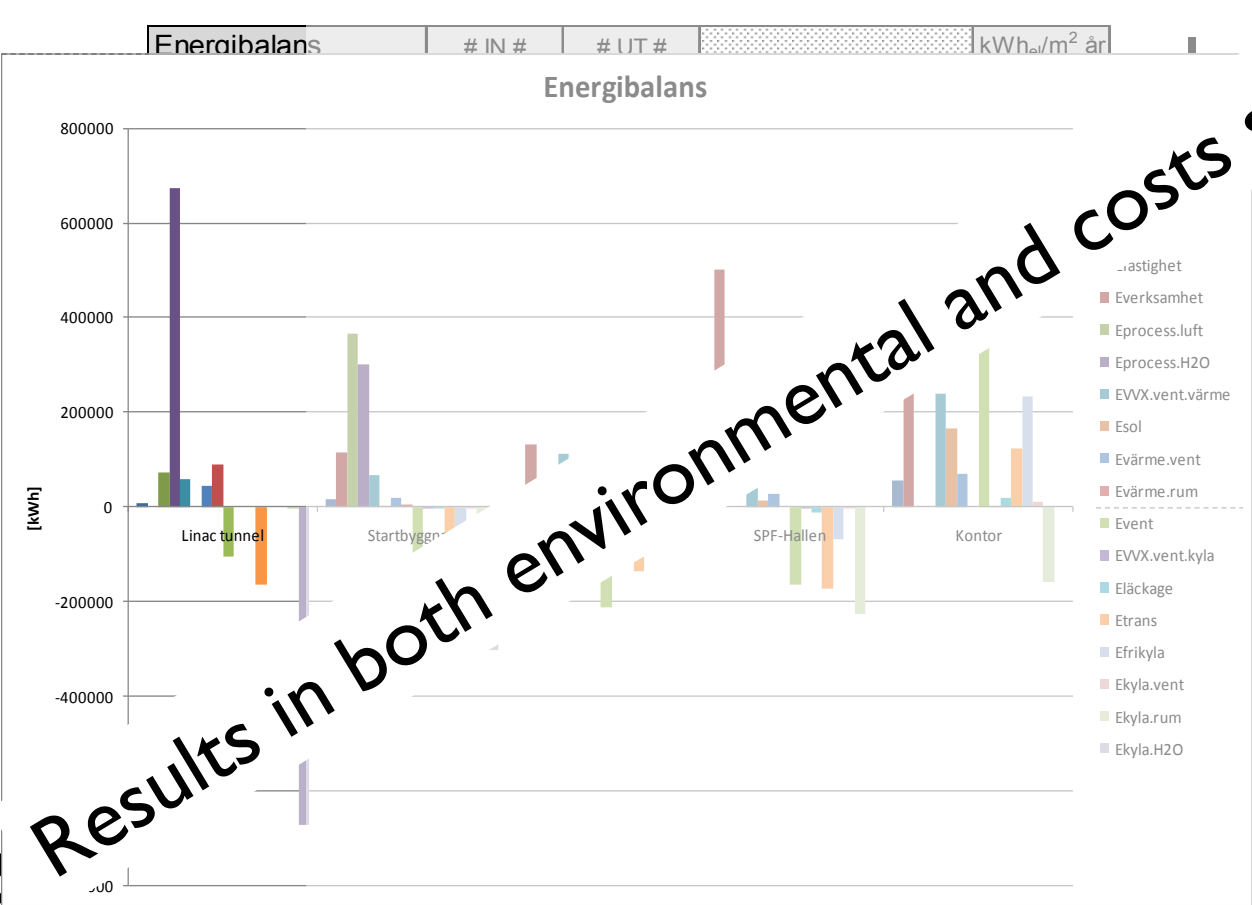
Energy balance, building level

Energi balans	# IN #	# UT #	kWh/m ² år
Evarmsamhet	596 408	1%	18
Eprocess.luft	5 654 726	12%	155
Eprocess.H2O	4 005 750	8%	110
EVVX.vent.värme	33 298 659	70%	913
Esol	2 798 361	6%	77
Evärme.vent	289 947	1%	8
Evärme.rum	954 928	2%	26
Event	219 449	0%	6
EVVX.vent.kyla	5 299 003	11%	145
Eläckage	1 096	0%	0
Etrans	255 186	1%	7
Efrikyla	2 797 082	6%	77
Ekyla.vent	1 625 290	3%	45
Ekyla.rum	45 934	0%	1
Ekyla.H2O	4 466 007	9%	122
Summa	47 788 236	47 788 236	1310

Total energy balance



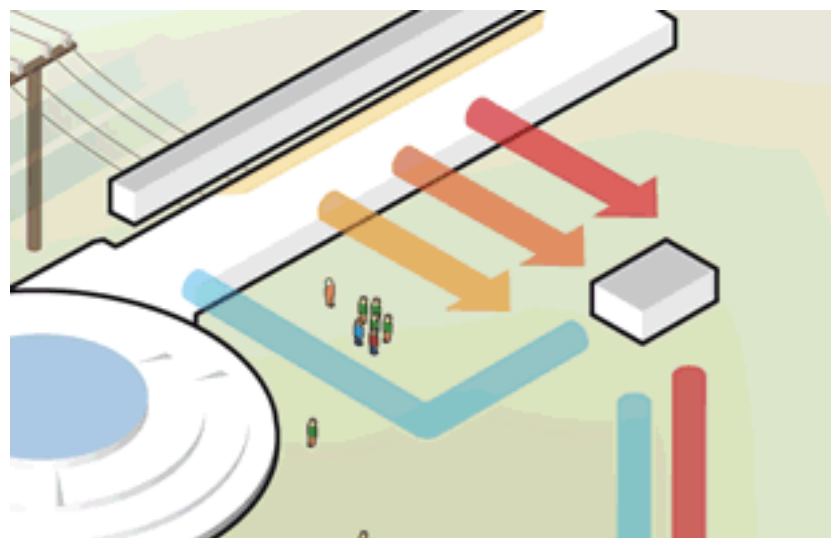
Excess energy in cooling water



Energy balance, building level

And the winner is....the wallet (ESS)

Investments	Electricity cost	Heat recovered
Heat pumps Piping	Heat pumps 20 GWh/yr	240 GWh/yr
3,5 M€	1 M€/yr	4,1 M€/yr



Carbon dioxide savings

Renewable
Carbon Dioxide:
- 120 000 ton/yr

Max IV
Carbon dioxide:
- 5 000 ton/yr

Responsible
Carbon Dioxide
- 30 000 ton/yr

Recyclable
Carbon Dioxide:
- 15 000 ton/yr

No district heating system? Seasonal demand limitations?

Other recovery ideas:

Internal system:

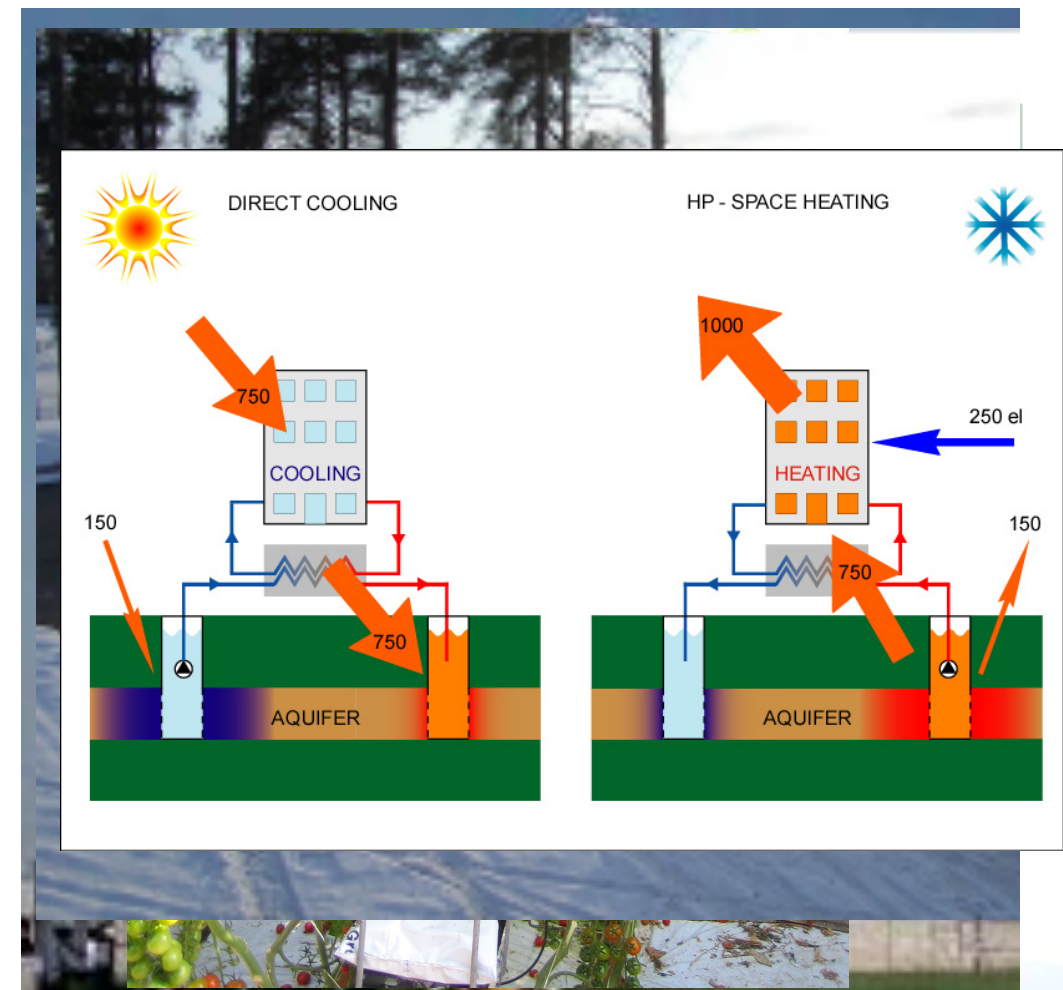
- Recover for internal heating and hot water production
- Sorptive cooling
- Absorption heat pump
- Steam cycle connected to high temp waste heat
- ORC
- Heat driven stirling engine
- Pre-heating of waste heat with solar heating
- Hot water accumulators

External users of low temp waste heat:

- Green house
- De-icing of pavements etc
- Low temp heating of buildings
- Biogas plant

Seasonal storage systems:

- Local storage
- Storage in geothermal system
- Salt storage system



Thank You!!

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