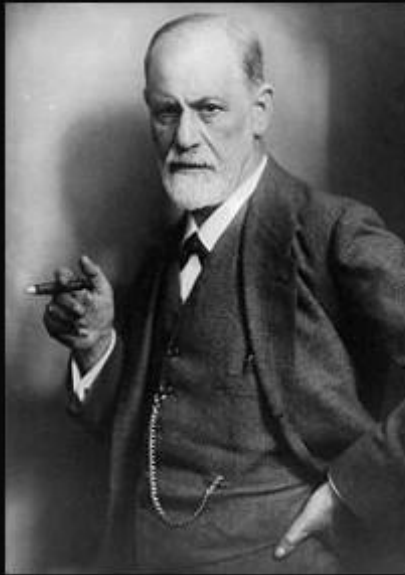


Sustainable Research Centres
or
The Origin of Dreams

Colin Carlile
Science Village Scandinavia & Uppsala university

...& a zero carbon footprint
science facility
seems crazy enough.



Dreams are often most profound when they seem
the most crazy.

(Sigmund Freud)

izquotes.com

Large Scale Facilities in Skåne

Then and now



The island of Ven

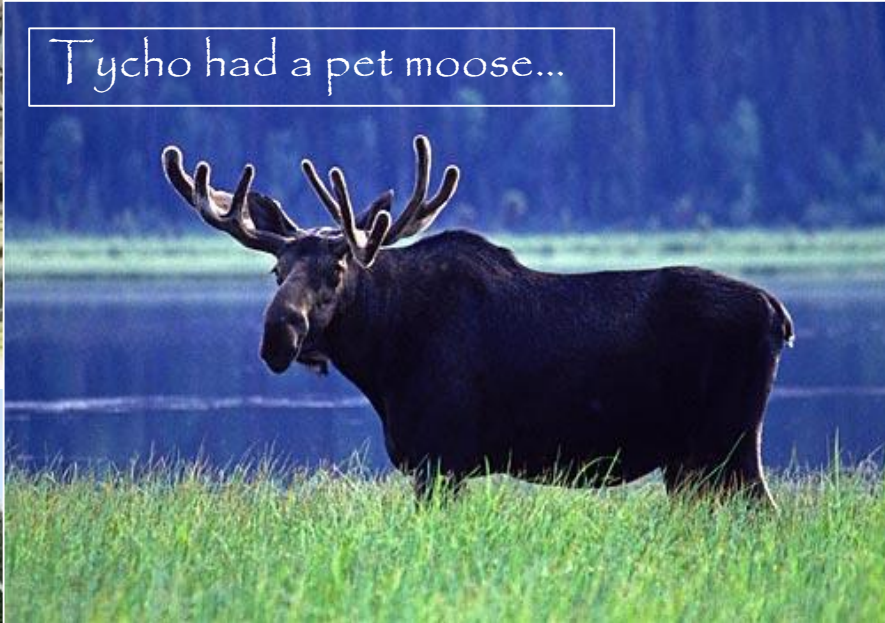
- Denmark & Sweden 1658



“The greatest observational astronomer who ever lived”

Tycho Brahe had his own large
research infrastructures on Ven

Tycho Brahe





What will there be in Lund?

Side-by-side, there will be :

- The world's brightest synchrotron light source
MAX IV - 0.68 B€
- The world's most intense neutron source
ESS - 1.8 B€
- Science Village Scandinavia
- Peak Electrical Demand ~40MW

MAX IV will be the brightest
light source in the world



ESS - the most intense neutron source in the world



Question everything...

The Big Question

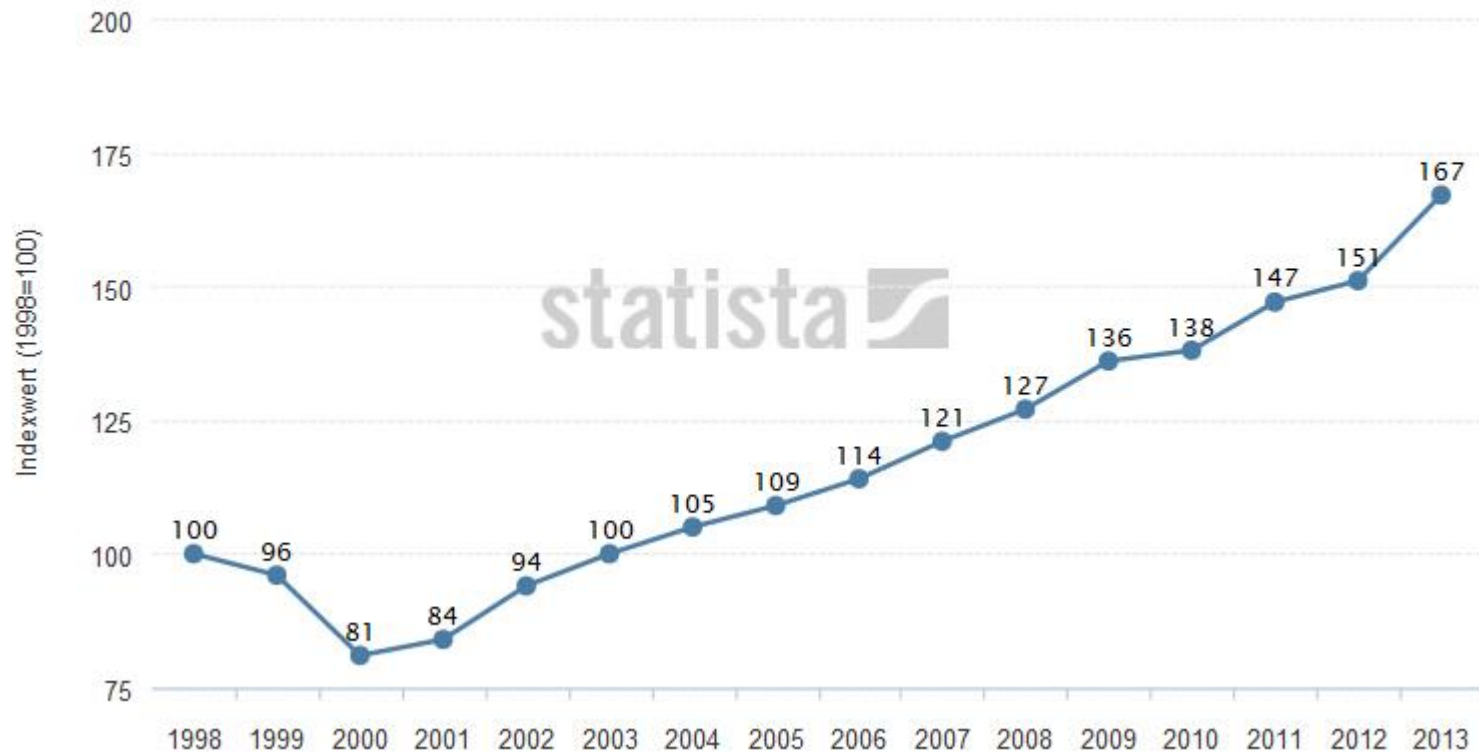
How do we deal
with peak
electricity demand
?

~ 40 MW

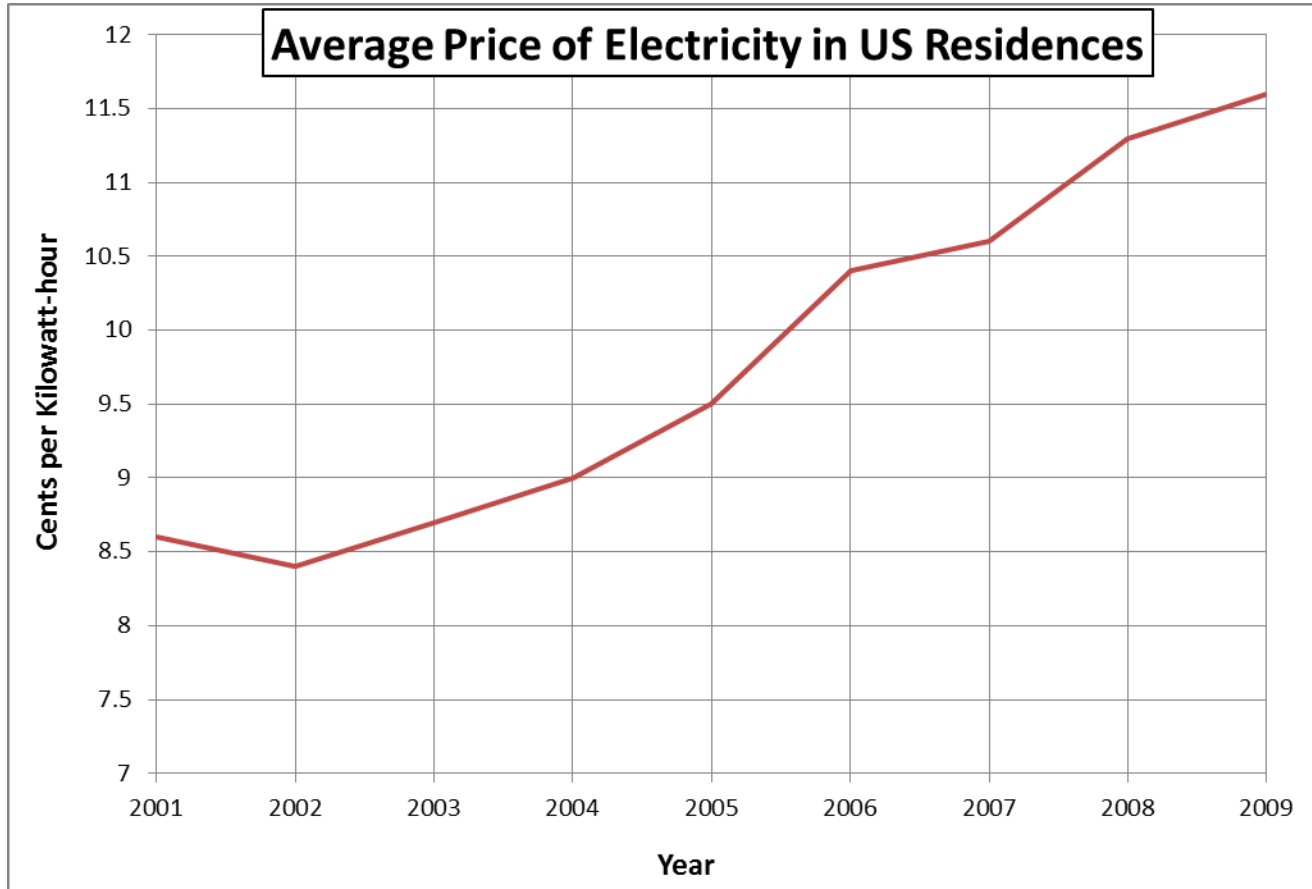


ANARCHY
IN THE UK.

Index zur Entwicklung des Strompreises* für Haushalte in Deutschland in den Jahren 1998 bis 2013 (1998 = Index 100)

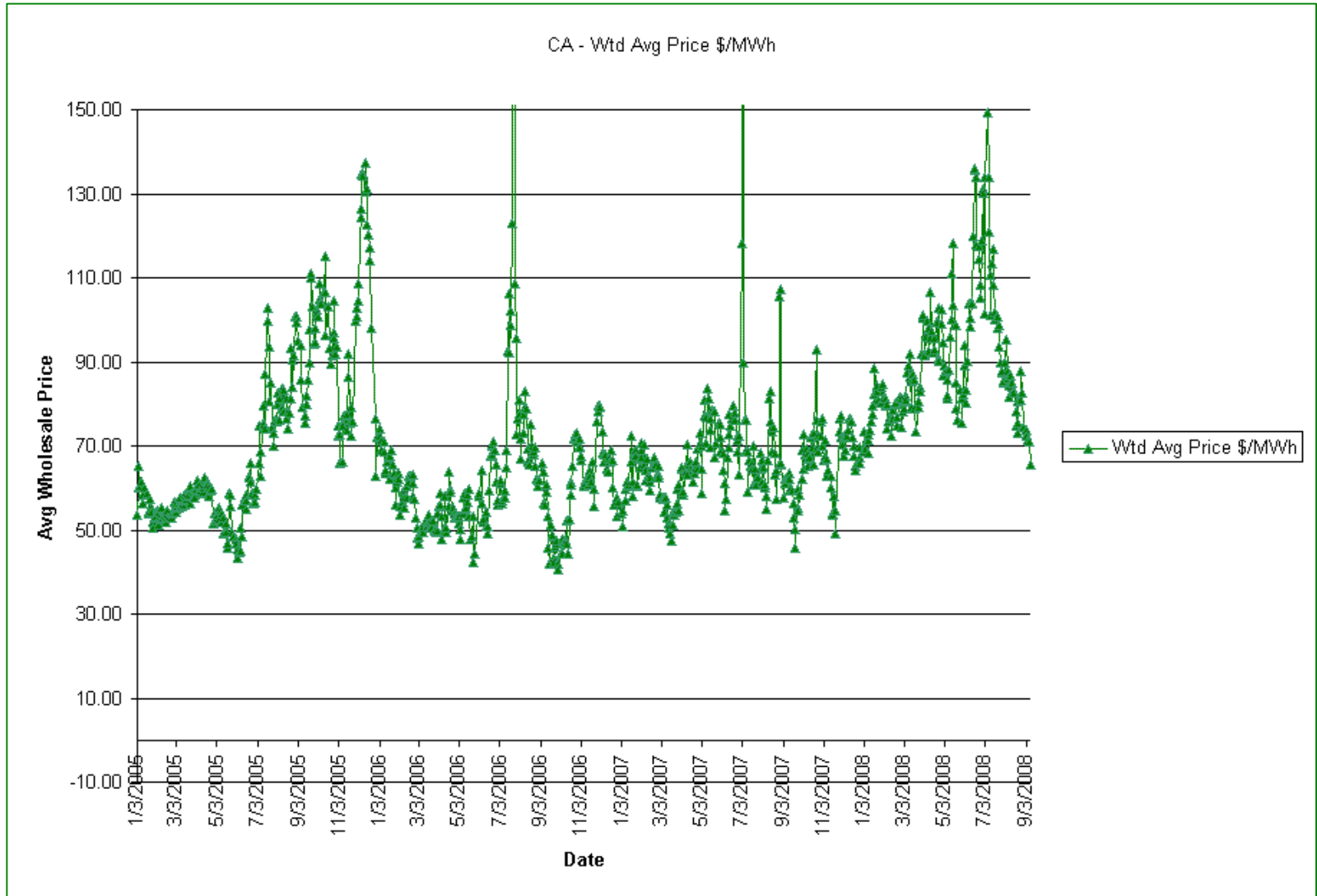


The same story in the USA



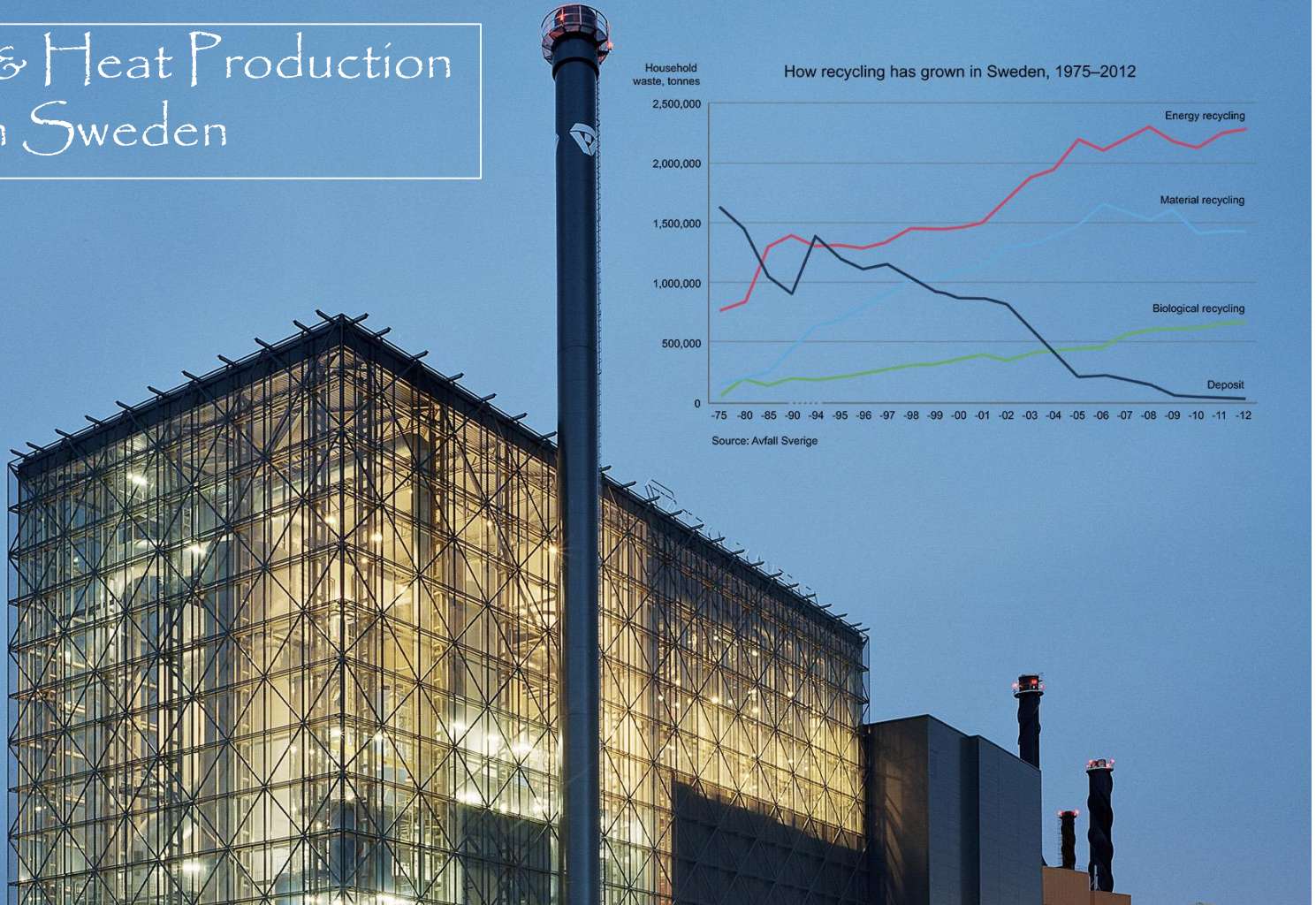
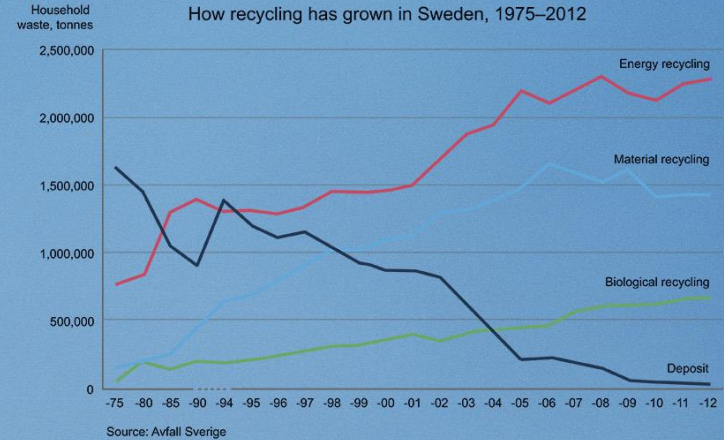
Price Rises of ~ 50 to 100%

Spot Price over 44 months



The facilities in Sweden have to be environmentally friendly

Recycling & Heat Production In Sweden



Green field site - Green field thinking



ESS neutrons

Science Village researcher support

MAX IV x-rays

Cost of solar heater RMB 5,000
Cost of electric heater RMB 2,000
Extra cost for solar heater
RMB 3,000 yuan

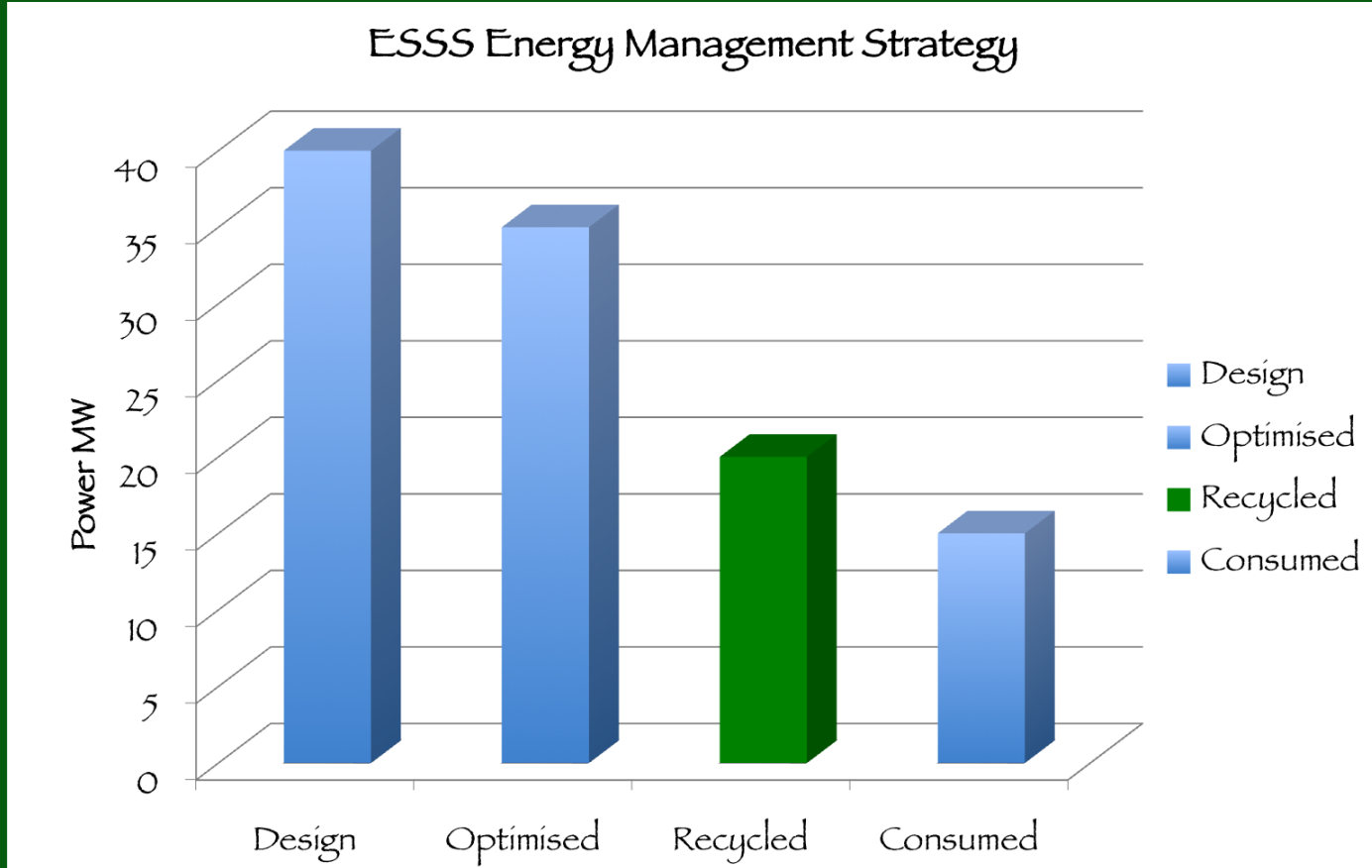
For a house with three people showering and using full 180 litre tank in one day costs about RMB 1.5

One year $365 \times 1.5 = \text{RMB } 547.5$

So it takes about 5.5 years to get back extra cost and then heating costs you nothing! ☺

625 9854

ESS Energy Management Strategy



CO₂ neutral!

How many windmills to run the ESS?

Power rating 5MW

Efficiency ~35%

Effective power output ~1.7MW

No. of windmills = $40 / 1.7 = 24$

$1.5 \text{ M€} / \text{MW} = 7.5 \text{ M€}$ per windmill

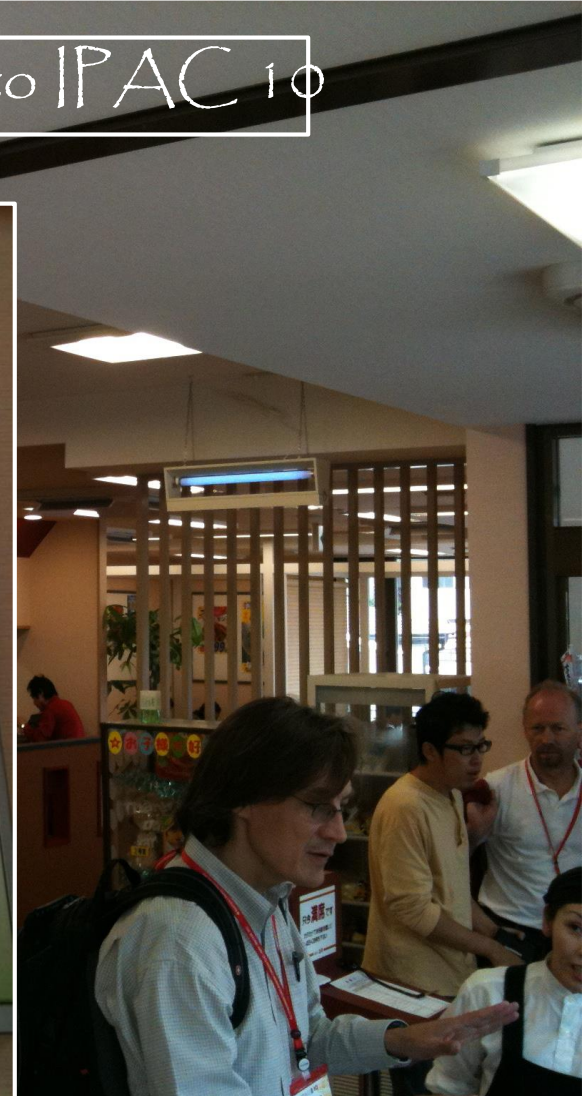
Total cost = 180M€ installed



This allows you to:

- Control your strategic resources
Niobium, helium-3, electricity, money
- Decide your own operating schedule
- Reduce your costs &/or Repay your loans

Japanese Restaurant in Kyoto IPAC 10



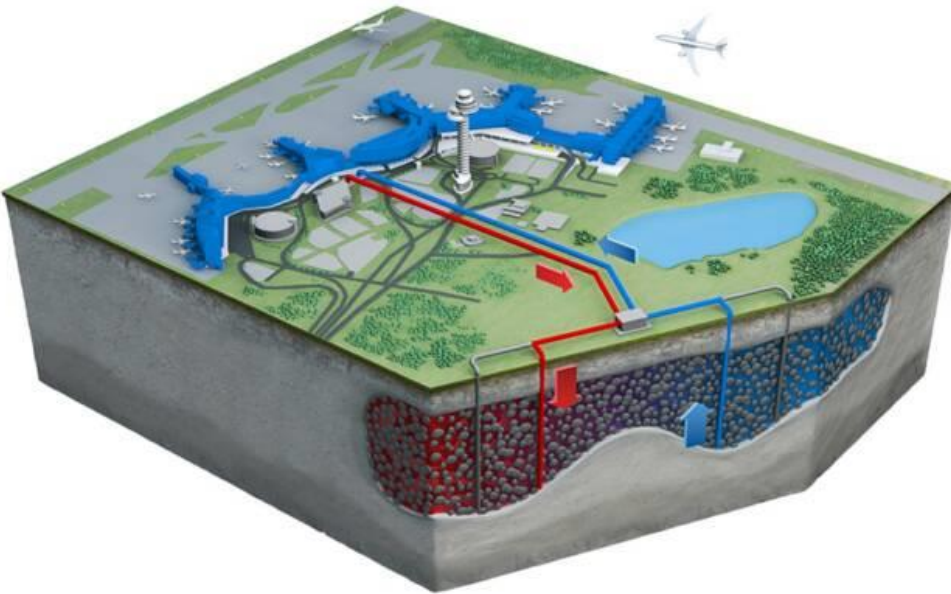
Where does ice come from?



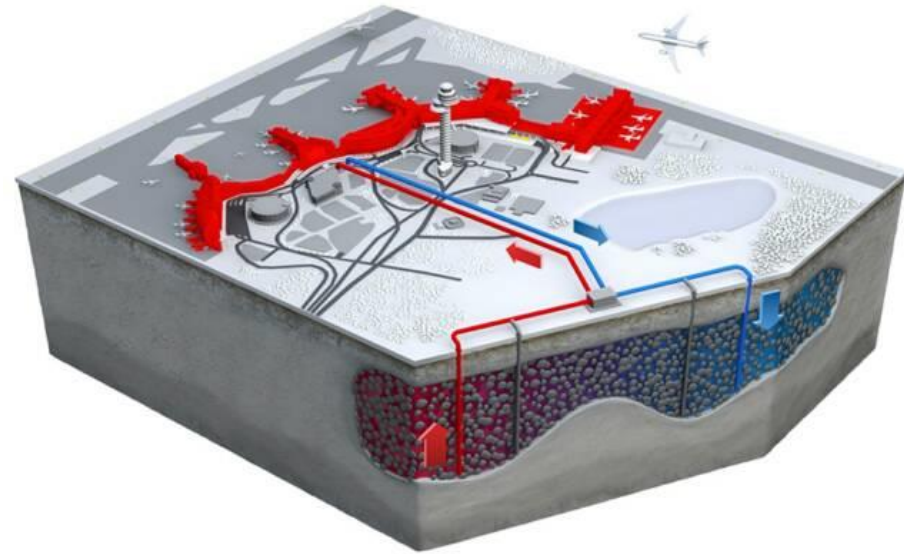
S

The Use of Aquifers for cooling/heating an airport

Lund sits on aquifers

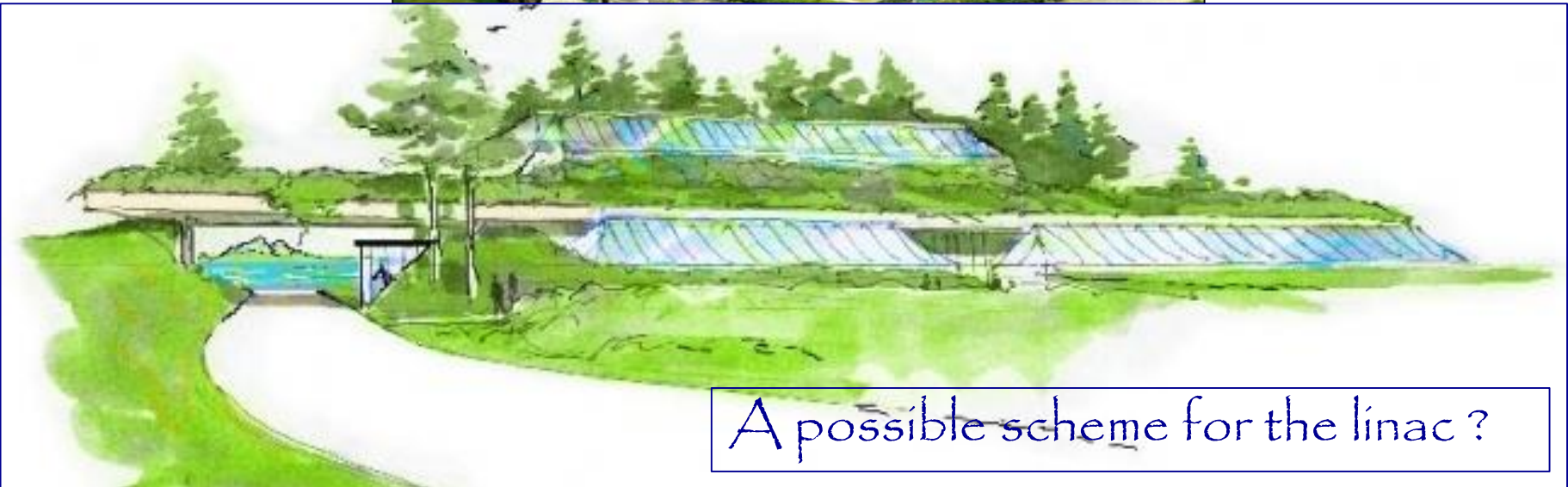


Summer



Winter

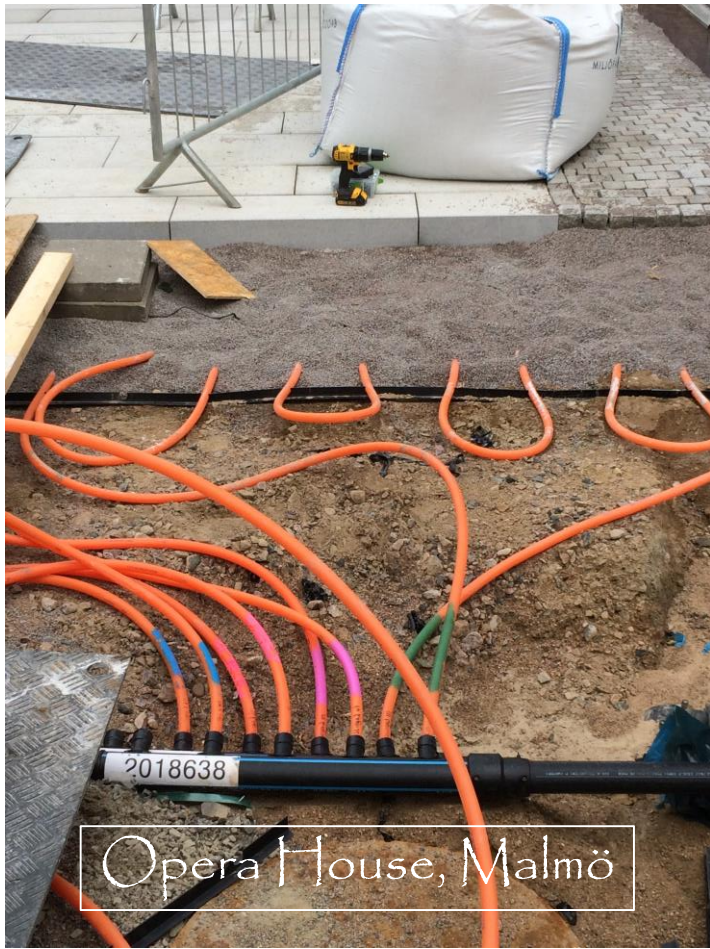
Green Roofing



A possible scheme for the linac ?

Heat the Pavements

Fewer broken legs; lower cleaning costs; less environmental impact



But
why
bother?

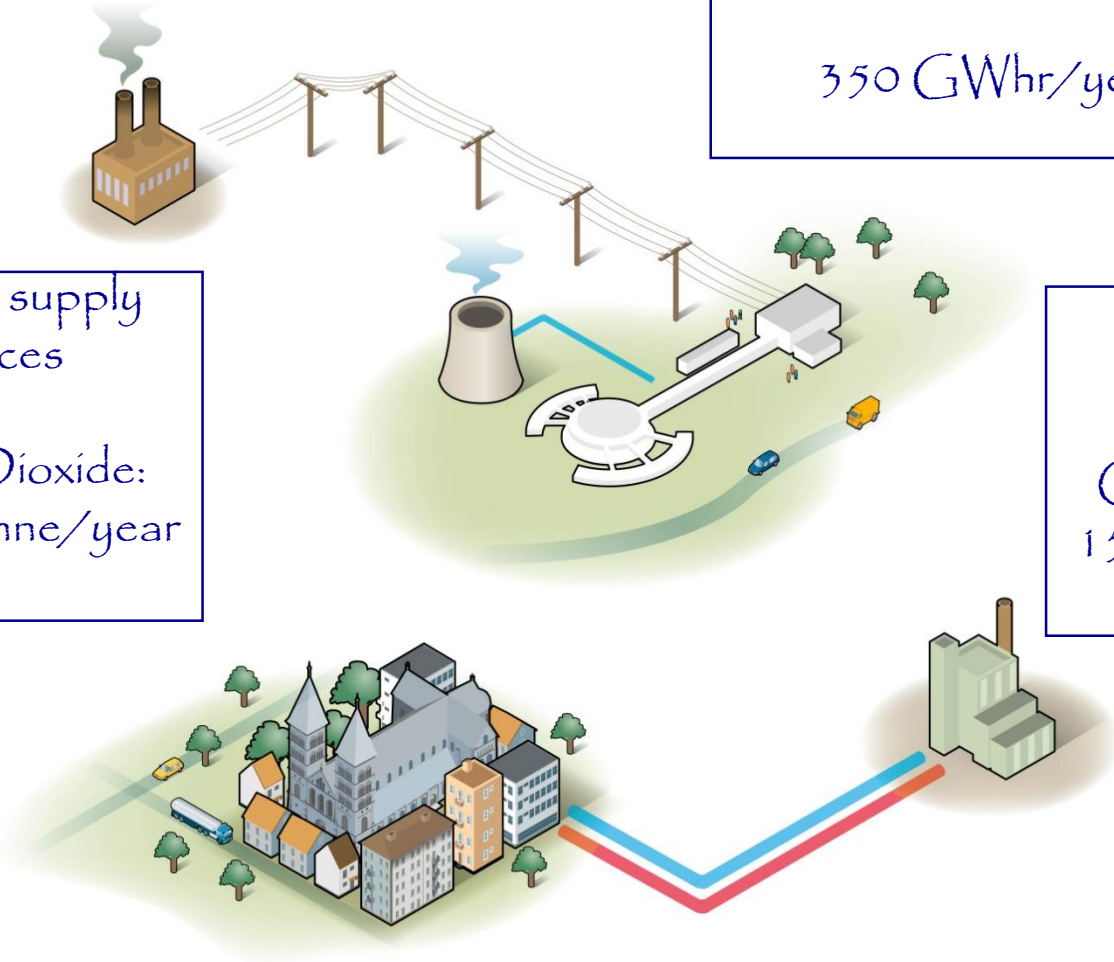


How it is usually done

Electricity consumption:
350 GWhr/year

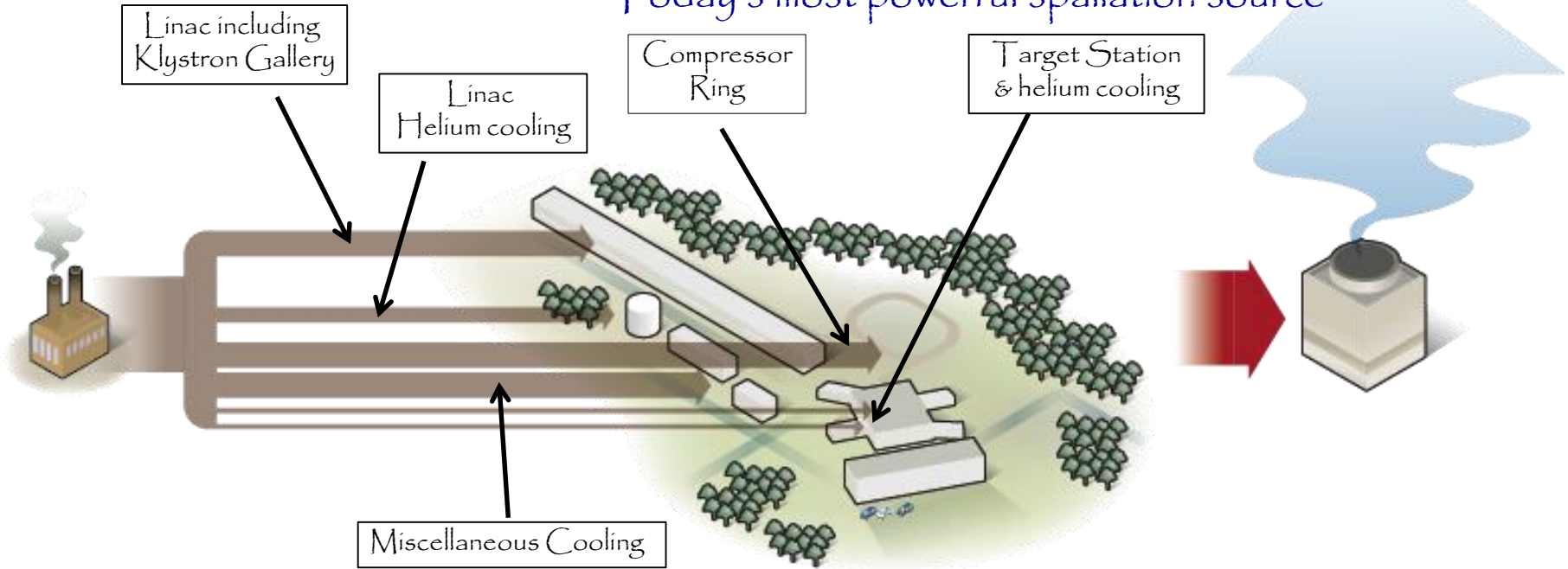
Electrical supply produces
Carbon Dioxide:
150,000 tonne/year

Heating supply produces
Carbon Dioxide:
15,000 tonne/year



So we modelled SNS Energy flow

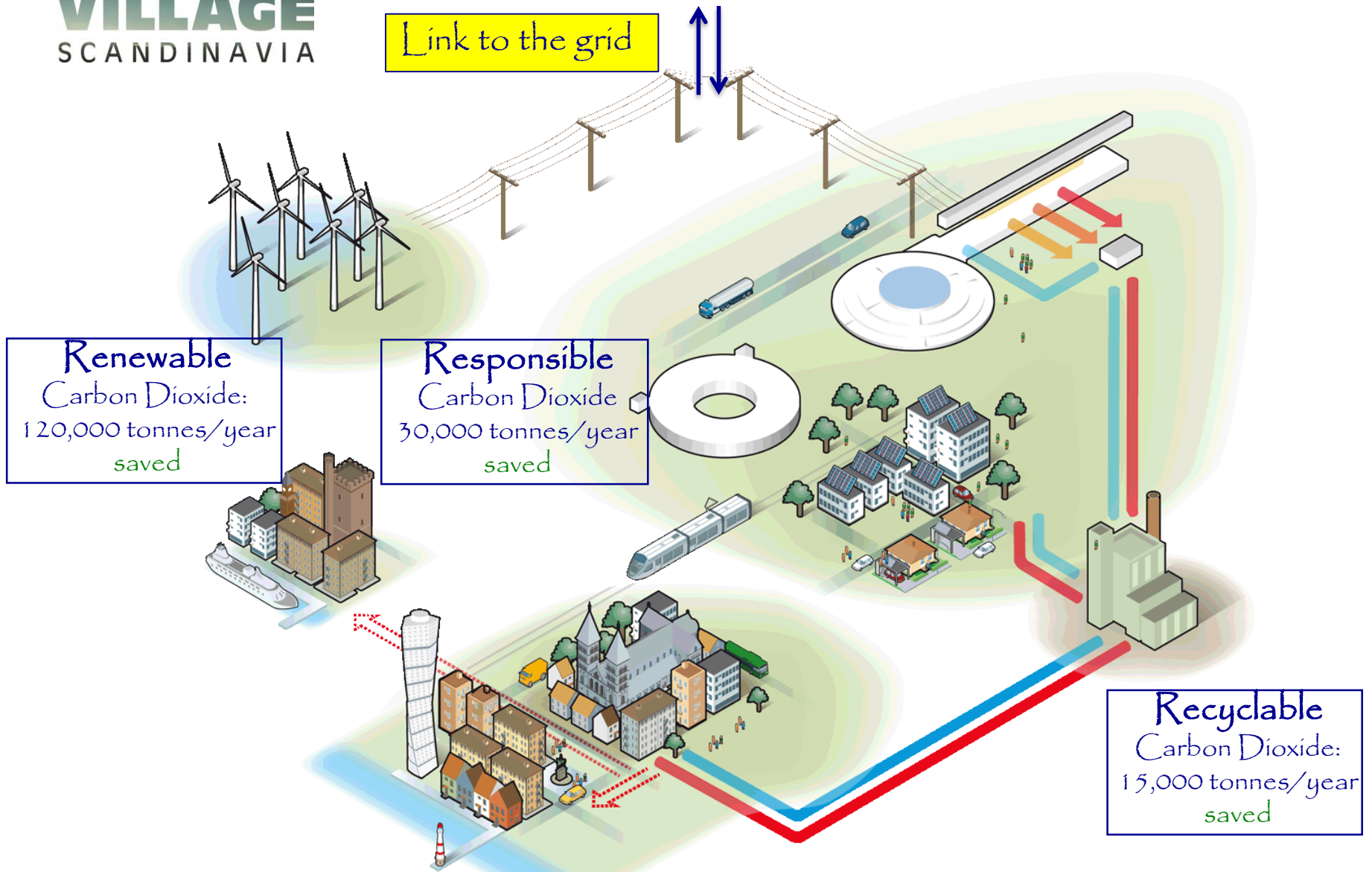
Today's most powerful spallation source



IN
150 GWhr
electricity

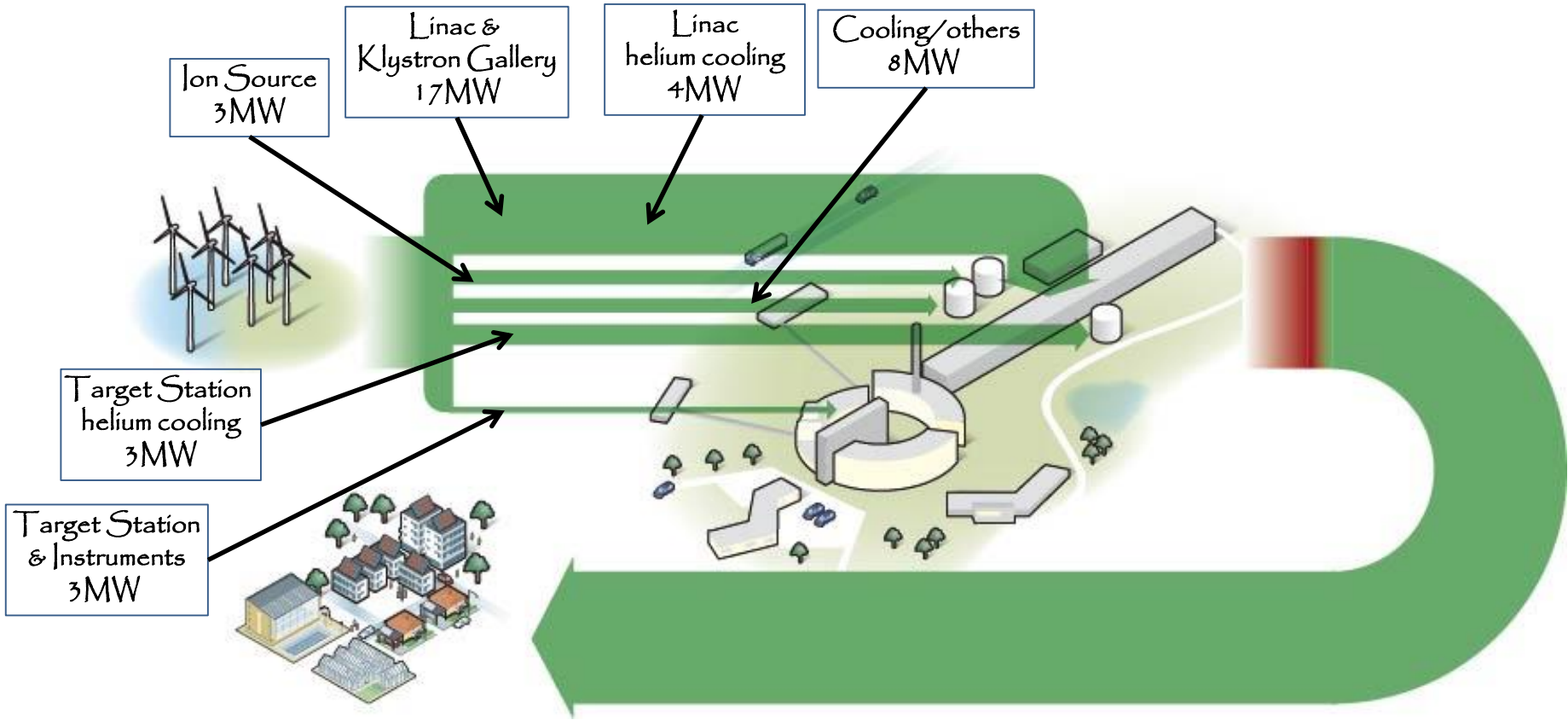
OUT
140 GWhr waste heat
Cooling Towers

How ESS & MAX IV could do it



ESS Energy concept 2011

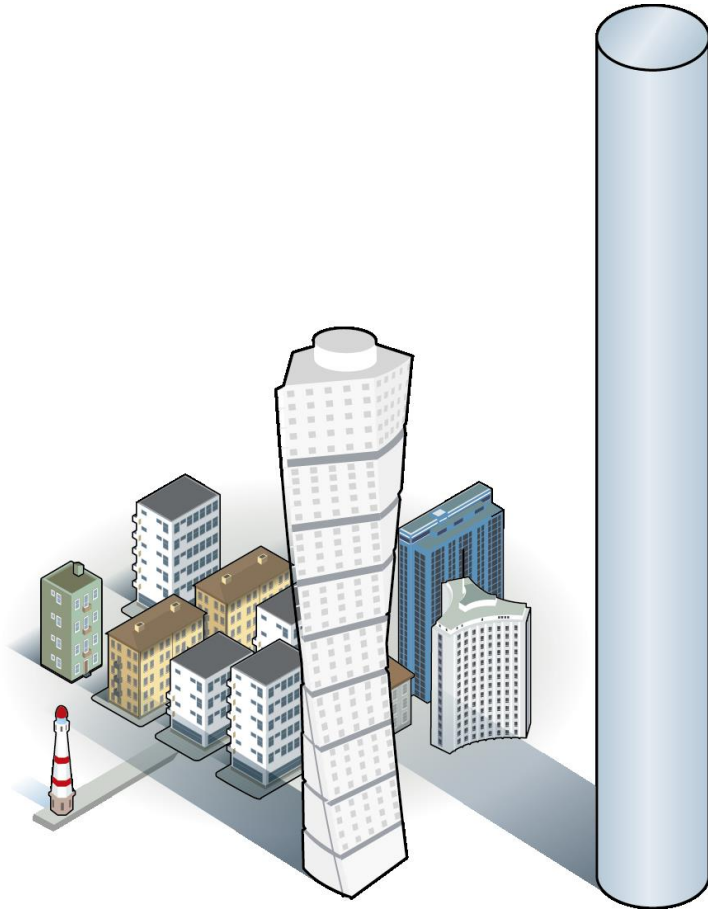
The world's first sustainable large-scale research facility?



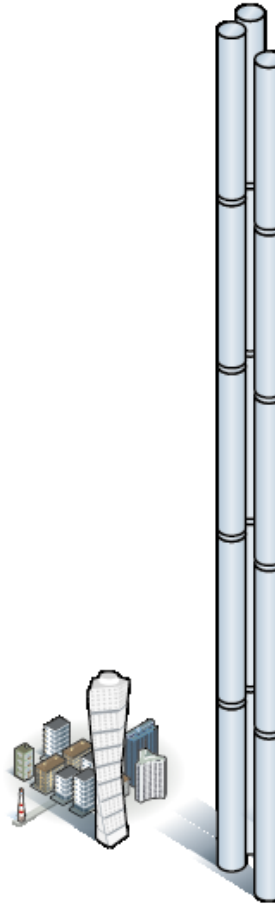
IN
250 GWhr electricity
Renewables & Green Certificates

OUT
174 GWhr
heat
Recycle & Sell

Savings of 6.6 million
= 64 Turning Torso b



After one year...

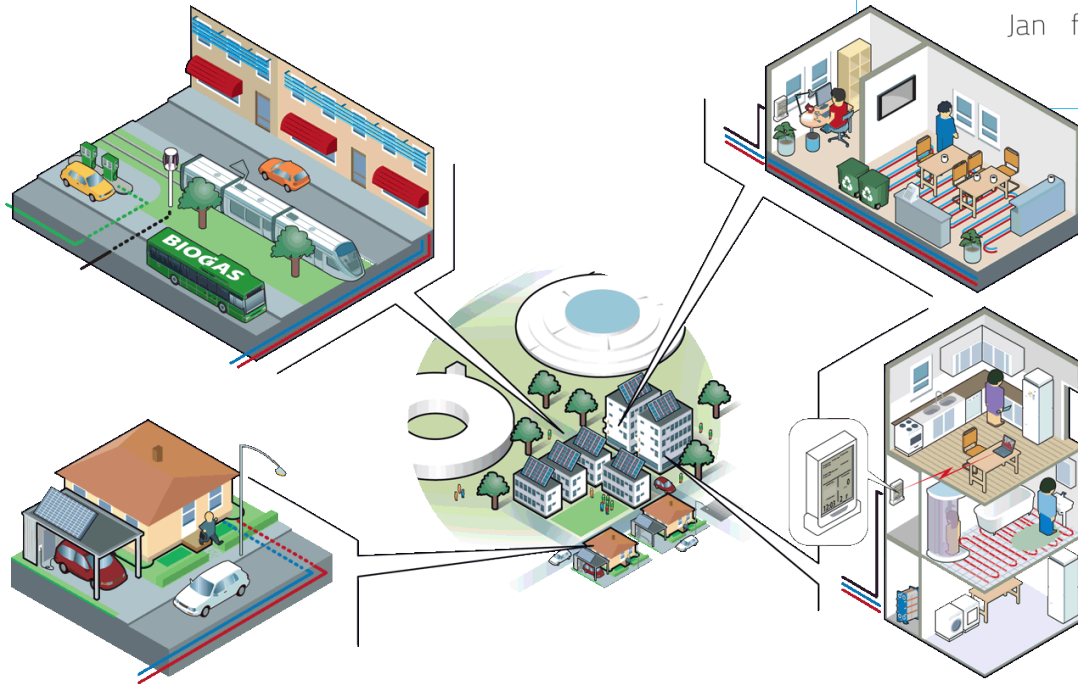
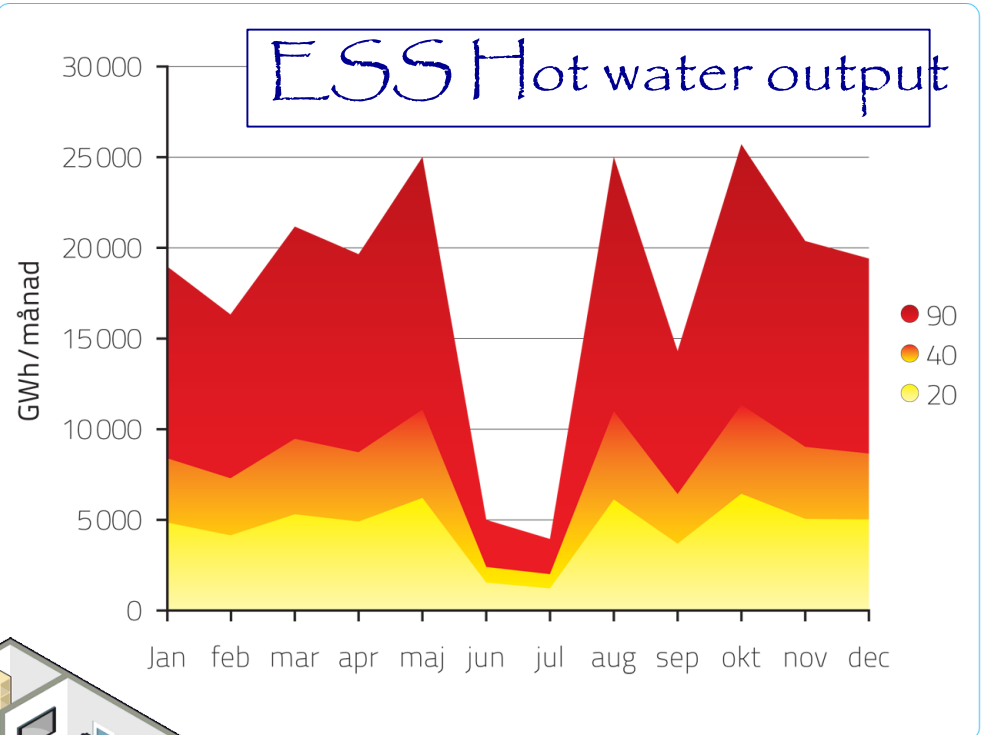


...after 40 y



Turning Torso,
Malmö

ESS Cooling water becomes someone else's Heating water



ESS could provide 20% of Lund's Heating needs

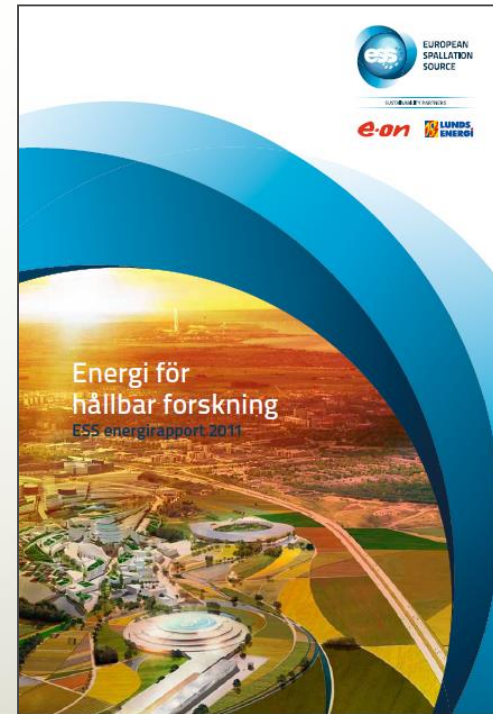
Conclusions: ESS energy solution



Thomas Parker, Richard Bengtsson,
ESS

Mats Didriksson
eON

Lunds Energi



What stops dreams becoming reality?

- Project managers are overburdened delivering on time, to budget & within specification, not on visionary ideas.
- International governing bodies want the science output for their own researchers & have little interest in visions that reflect on the host country
- Research Ministries do not wish to foot the bill for initiatives that deliver the goals of other Ministries
- No one is willing to take the risk that innovations engender

So it will be small steps & more of the same
and opportunities to inspire are lost unless...

Thank you for listening
& remember...

**A FREUDIAN
SLIP IS WHEN
YOU SAY ONE
THING BUT
MEAN YOUR
MOTHER**

PictureQuotes.com

PICTUREQUOTES