Sustainable Accelerators

EUROPEAN SPALLATION SOURCE

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The Permanent Energy Crisis

- Energy “crisis” 1973, officially ended when it became permanent
- Harrisburg, Sellafield, Chernobyl, Fukoshima, Energiwende
- Climate change
- => Energy = sustainability challenge

Science- technology - energy

- New levels of scientific knowledge have often been reached as a result of technological breakthrough.
- Telescopes and accelerators are examples of Research Infrastructure.
- For each level of scientific breakthrough, the requisite infrastructure tends to need more and more energy.

The Sustainability Balance of Science

Value of Science

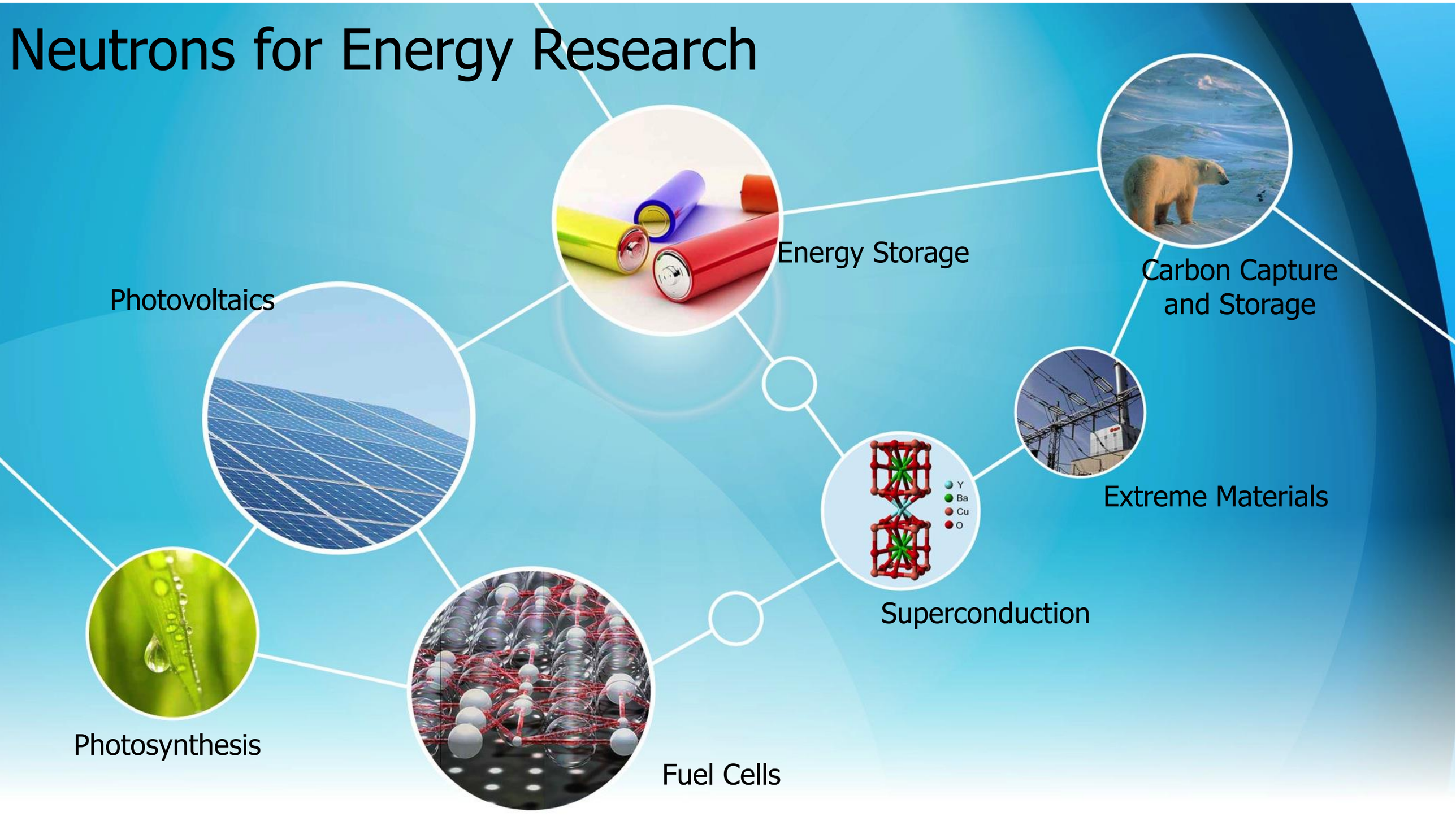
- Knowledge
- Applications
- Externalities, e.g. clusters

Cost of Science

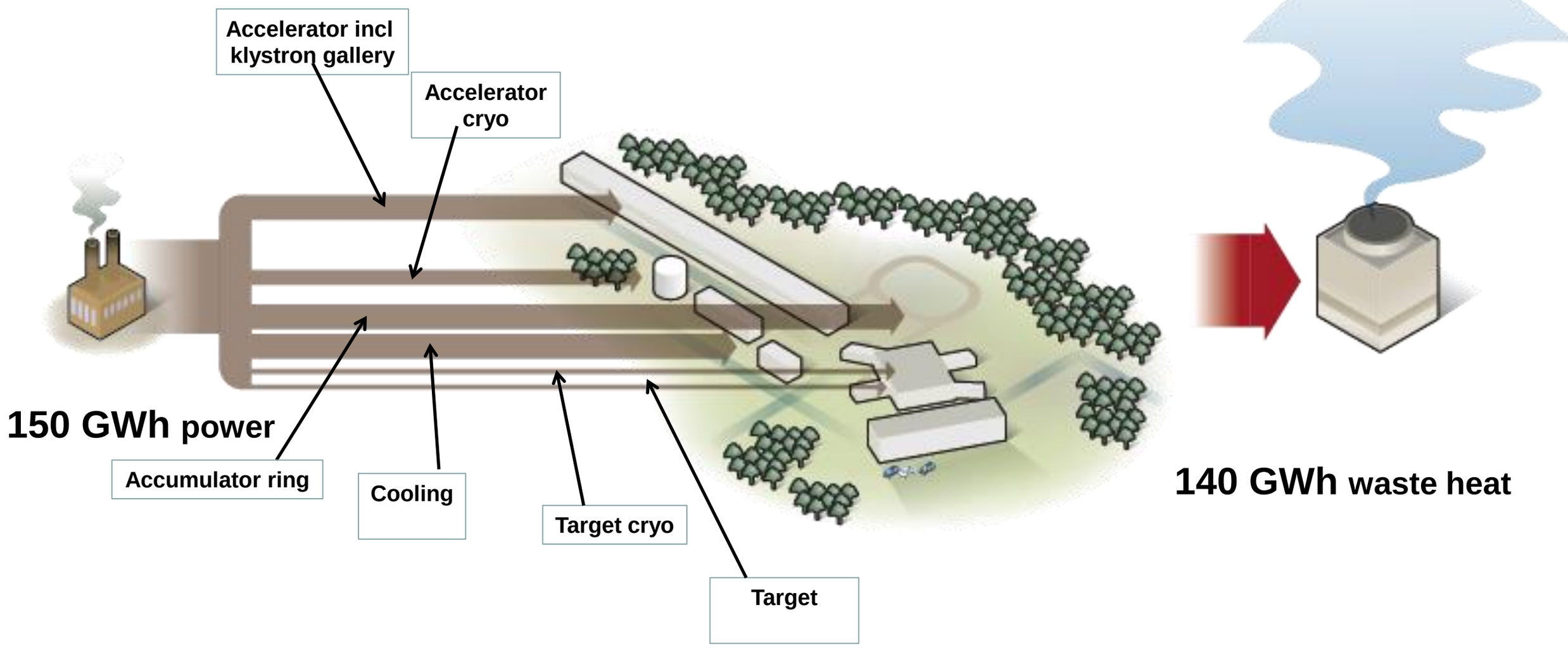
- Investment
- Operations
- Externalities, e.g. environmental impact

Each new accelerator project must show that it will contribute more good (sustainability) than it will cost.

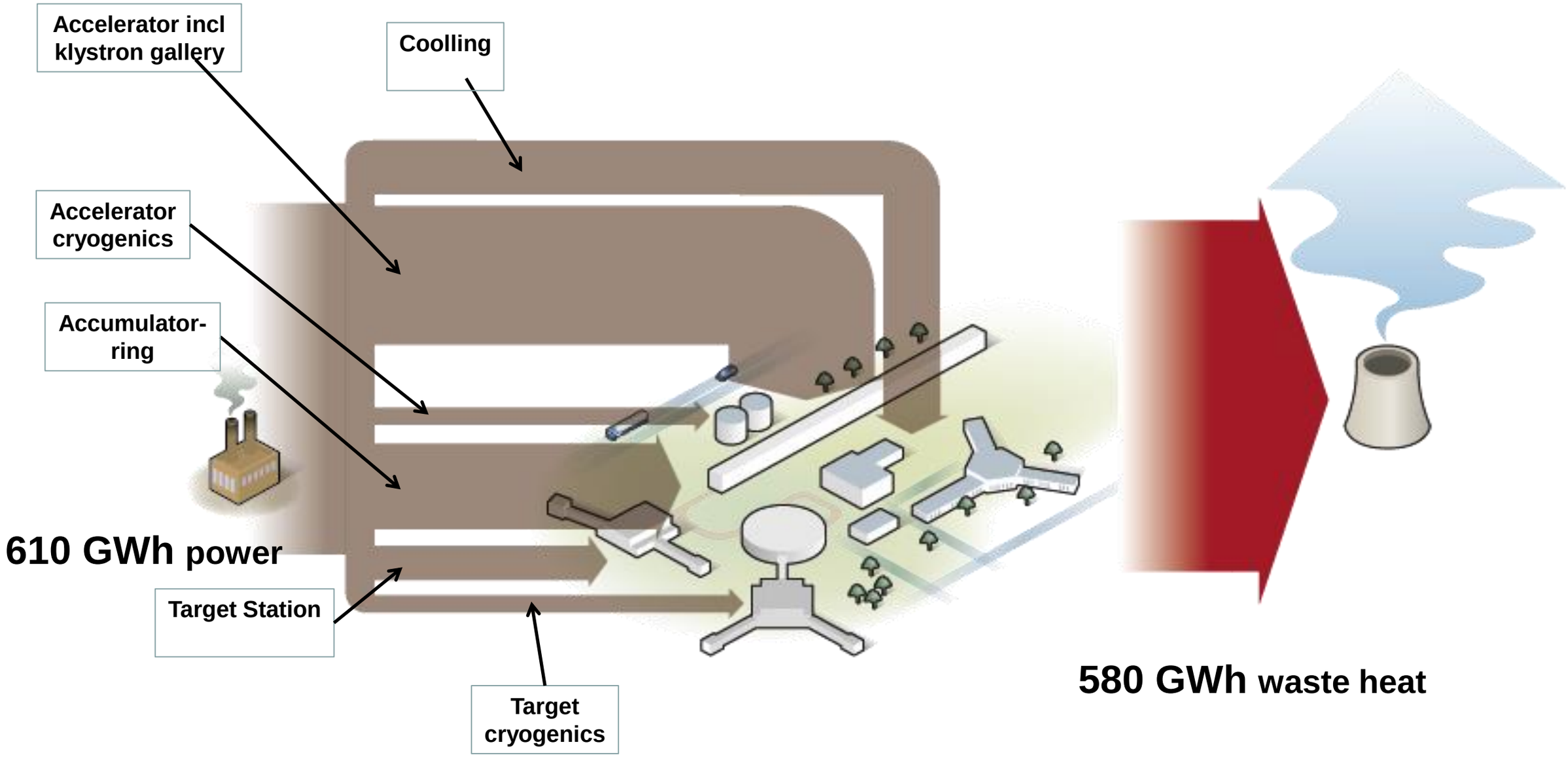
Example of an argument of the sustainability value of an accelerator.



Energy Inventory
Spallation Neutron Source at
Oak Ridge National Laboratory
At 1 MW beam from accelerator



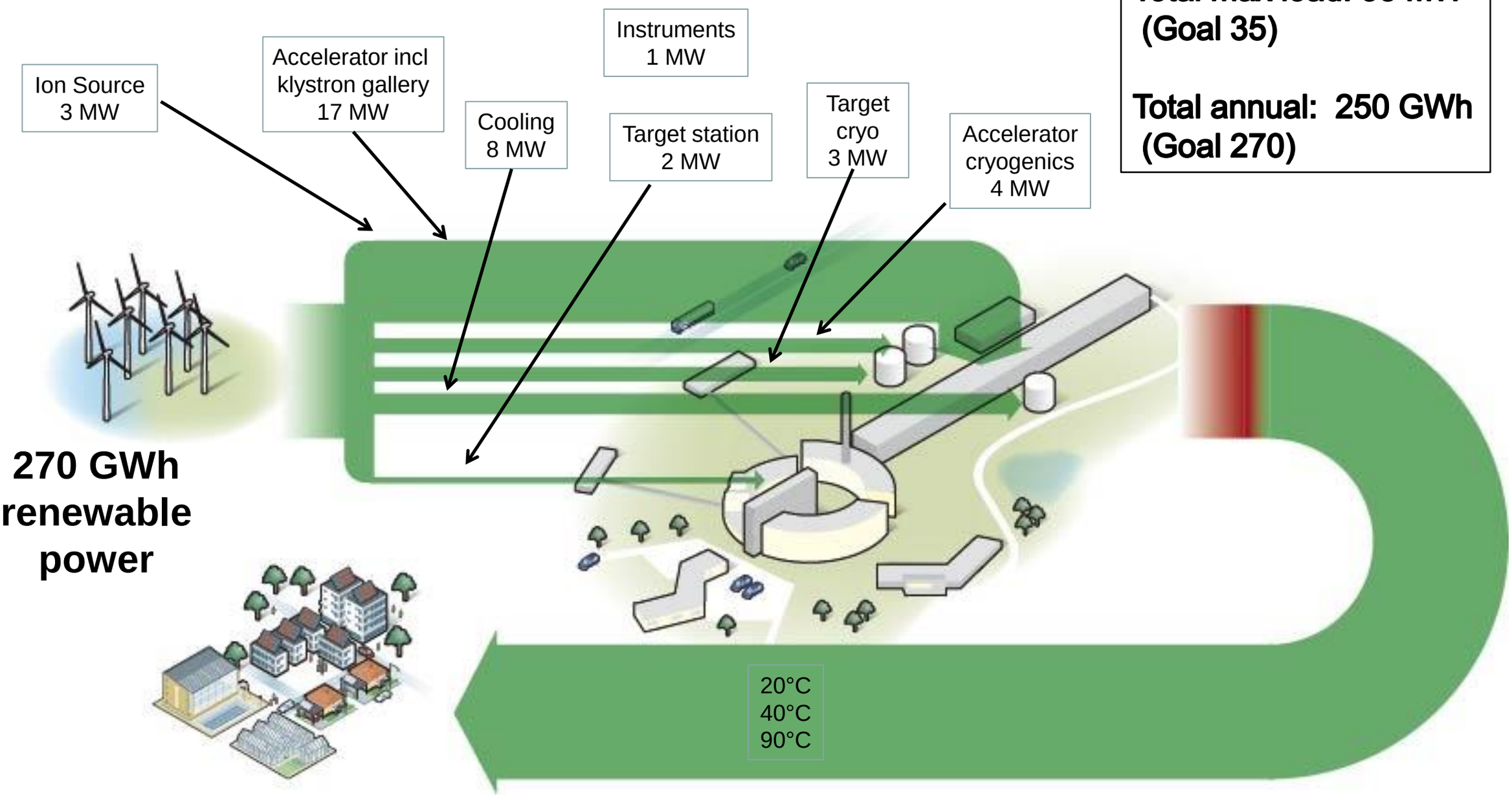
Energy Inventory
ESS Pan-European Project 2002
5 MW beam on target



Energy Inventory ESS 2012, 5 MW

Total max load: 38 MW (Goal 35)

Total annual: 250 GWh (Goal 270)

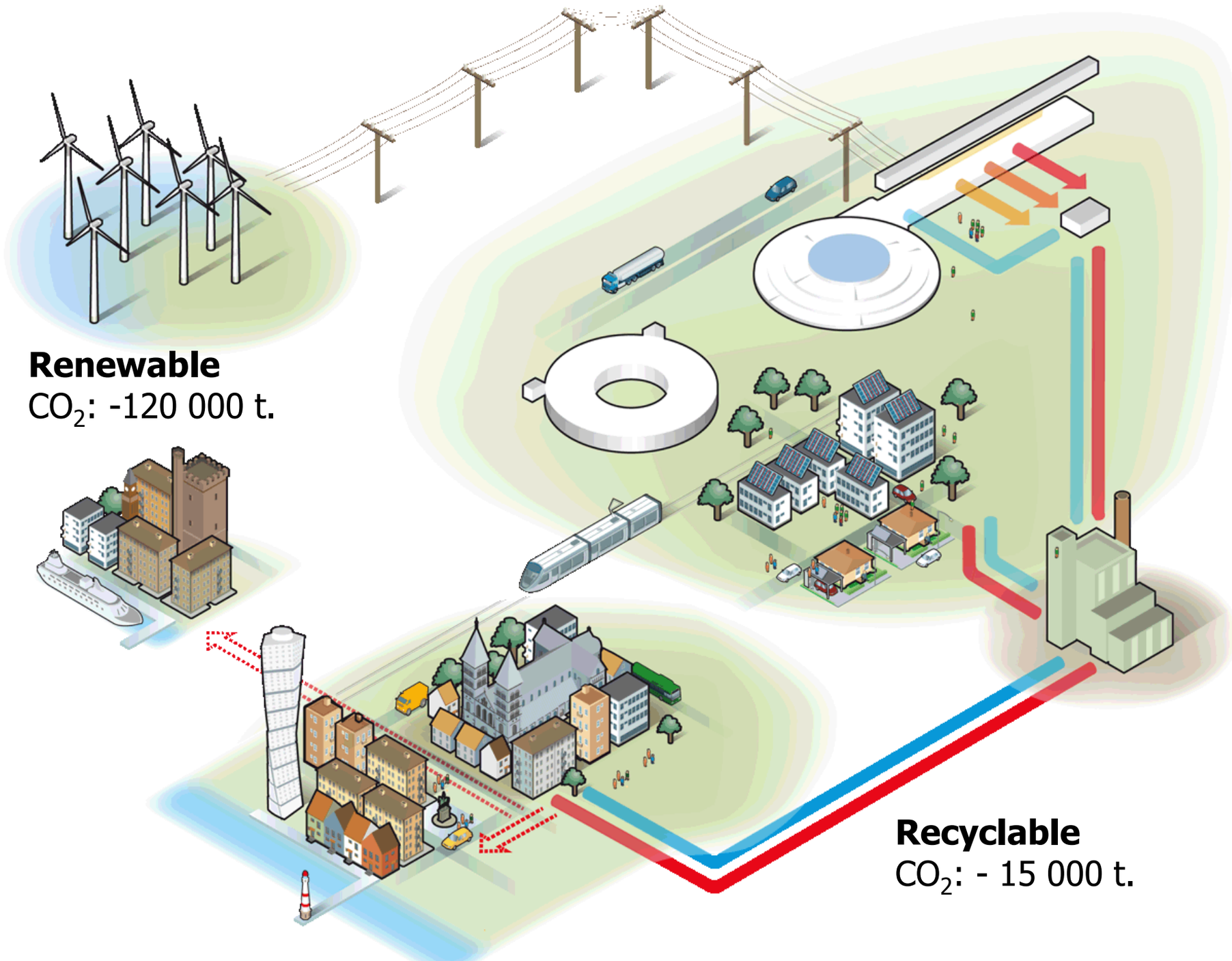


270 GWh renewable power

200 GWh recycled

Responsible – Renewable – Recyclable

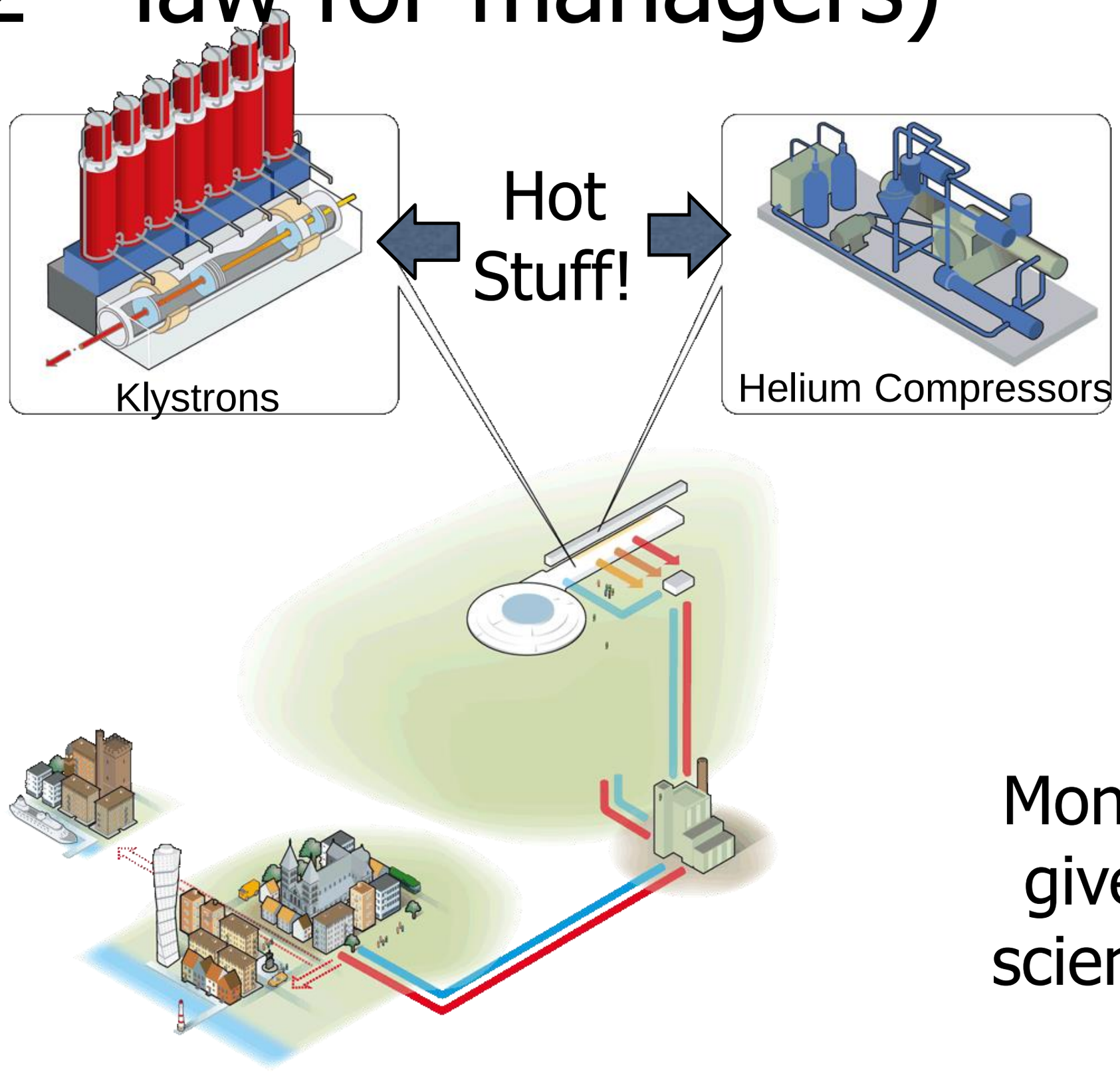
- Benchmark for future projects
- Based on local conditions
- Not perfect



How to do heat recycling

1. Don't. Efficiency – avoid creating the heat
2. 2nd law. High temperature cooling
3. Create uses of low grade heat

Temperature is Money (2^{nd} law for managers)



Money gives science

Energy for Sustainable Science Workshop

Tobias Krantz, SVENSKT NÄRINGSLIV:
"One of the most important research investments in Sweden ever."

Catherine Césarsky, Atomic Energy and Alternative Energies Commission:
"The Research Infrastructures are very appropriate tools for addressing scientific issues to confront global Climate and Energy challenges

Beatrix Vierkorn-Rudolph, Federal Ministry of Education and Research, Tyskland:
"Increasing energy efficiency is a major goal"

Workshop Energy for Sustainable Science

CERN

ESS EUROPEAN SPALLATION SOURCE

ERF European Association of National Research Facilities Open to International Access

Executive Summary

- Research Infrastructures (RIs) => R&D =>materials, processes and products => sustainability
- More collaboration between RIs
- ESFRI => opportunity to coordinate and support in EU
- RIs can act as training ground, test bed and billboard for energy management

2nd Workshop

Energy for Sustainable Science

at Research Infrastructures

CERN, GENEVA, SWITZERLAND 23-25 OCTOBER 2013

ENERGY.SUSTAINABLESCIENCE2013@CERN.CH
HTTP://CERN.CH/ENERGY.SUSTAINABLESCIENCE2013

Conclusions

- Science is dependent on technology, research infrastructure.
- The technology of science needs increasing energy.
- Science must demonstrate benefit (sustainability) in excess of cost to attract funding.
- Energy is percieved to have a higher cost than the price (energiwende, emissions cap and trade).
- As energy demands increase, and the negative perceptions of energy production as well.
- => Energy will weigh more on the cost side of new science investment.
- “Responsible, Renewable, Responsible” is neither perfect nor universal, but a benchmark for future devlopment.

Thank you for listening.

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