Session Summary of Energy and Sustainability of Future Research Projects

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ESSRI 2024, Sept. 27, 2024

7 Excellent Talks

- **Energy Management and Sustainability Aspects for FCC** *Jean-Paul Burnet, CERN; 14:55 – 15:15*
- **Electron Ion Collider Energy Consumption and Sustainability** *Thea Vijaya Kumar, BNL; 15:15 – 15:35*
- **Plasma-based injector for PETRA IV** *Andreas Maier, Paul Winkler; DESY; 15:35 – 15:55*
- **Power Consumption at SLAC** *Matt Gibbs, SLAC (Zoom); 15:55 – 16:15*
- **Addressing Energy Responsibility in Particle Accelerators: Insights from the KITTEN Research Platform** *Giovanni De Carne, KIT; 16:45 – 17:05*
- **Design of Detectors for Future Colliders (FCC)** *Werner Riegler, CERN; 17:05 – 17:25*
- **Sustainability for Einstein Telescope Project** *Maria Marsella, University of Rome; 17:25 – 17:45*

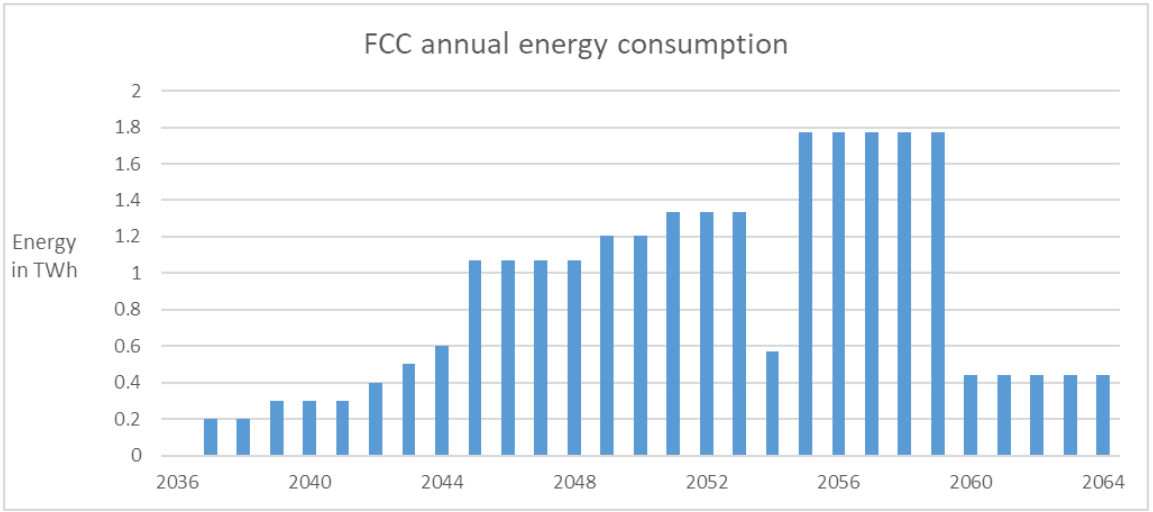
General comments

- There are many opportunities to reduce energy consumption and GHG emissions at present and future research facilities and projects.
- Every reduction of our energy and carbon footprint is important. We are publicly funded and we should be leading by example. Also, a research facility is often the leading power user locally.
- Even when the power is mostly from carbon-neutral energy sources, reducing energy consumption is still critically important as we are facing an energy gap that can not be filled with carbon-neutral energy sources any time soon.

Energy Management and Sustainability Aspects for FCC

Jean-Paul Burnet, CERN

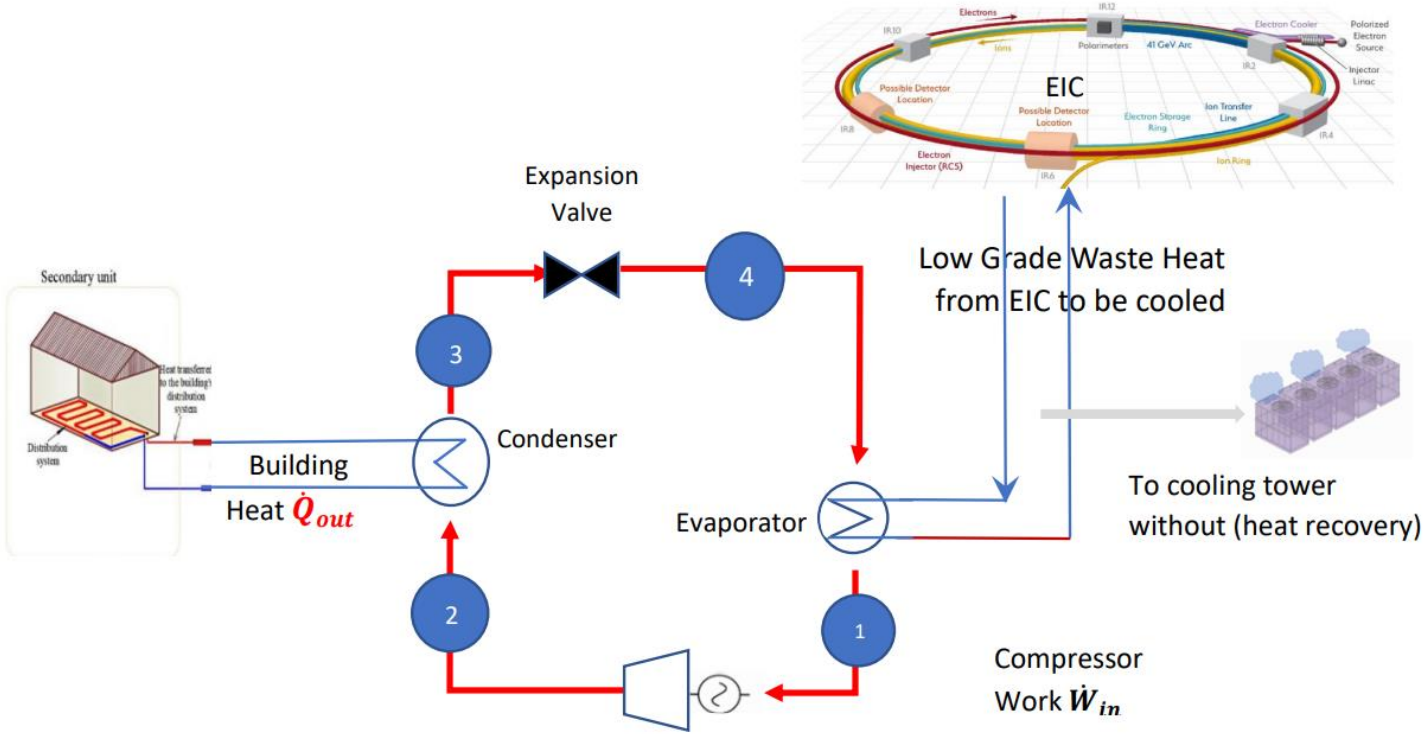
- Careful study performed of carbon footprint of FCC construction and operation
- Summary:
  - FCC needs low carbon power sources
  - FCC includes renewable energy supply (thanks to European green transition)
  - Sustainability is a key aspect of the project
  - All designs and R&D are focused on energy savings to reduce the power demand and energy consumption
  - The impact and challenge of detectors is not to be forgotten…
- *My comment:*
  - *Additional reduction of energy consumption of FCC would be very desirable*

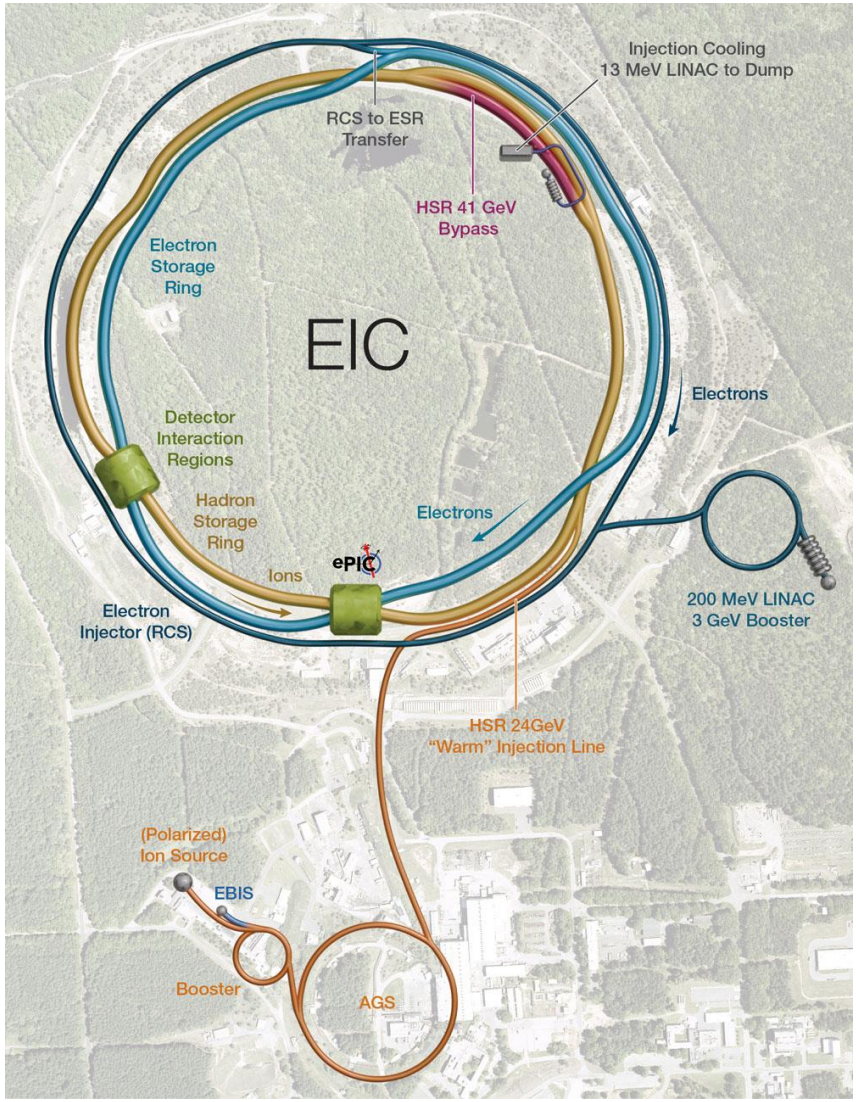


Electron Ion Collider Energy Consumption and Sustainability

Thea Vijaya Kumar, BNL

- Brookhaven EIC is presently the largest accelerator project
- Detailed presentation of using 41 MW of process heat for heating the buildings on campus using large scale heat pump

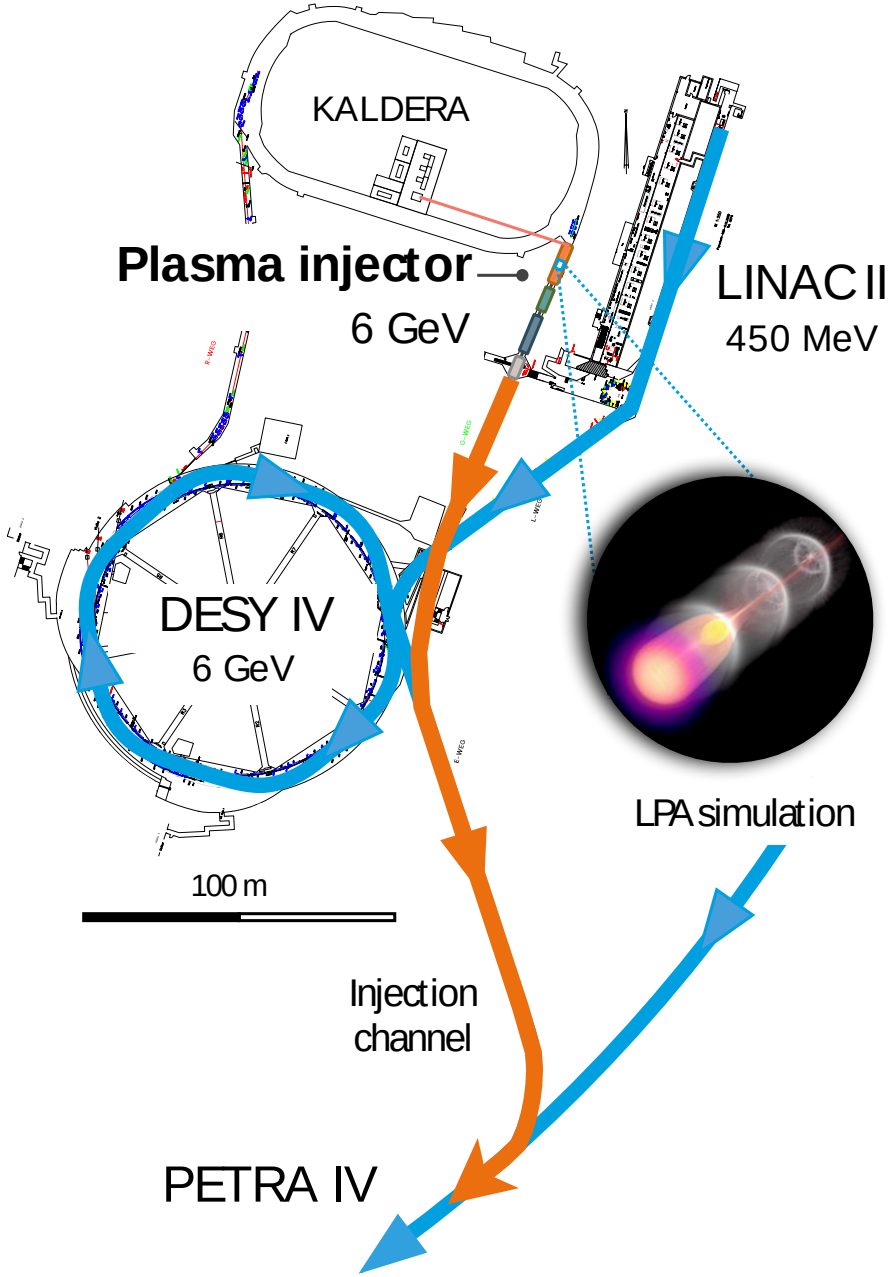




Plasma-based injector for PETRA IV

Paul Winkler; DESY

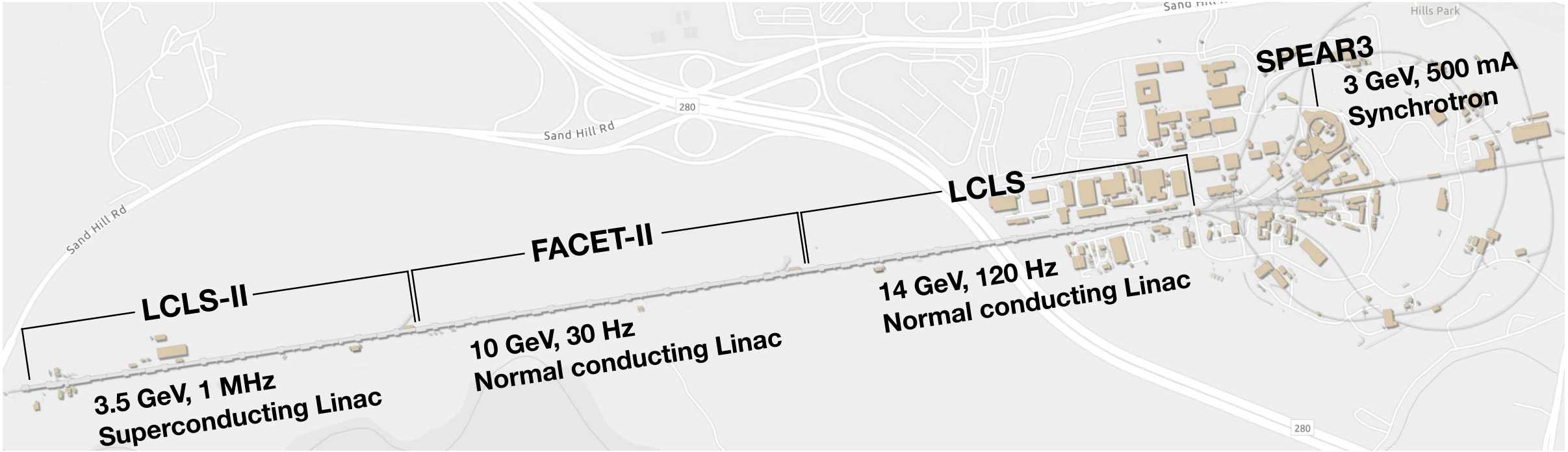
- Development of a compact 6 GeV injector to PETRA IV based on laser plasma acceleration (LPA)
- Fast energy correction provides stable injection beam energy
- LPA injector uses much less energy and hardware than the present DESY IV injector



Power Consumption at SLAC

Matt Gibbs, SLAC

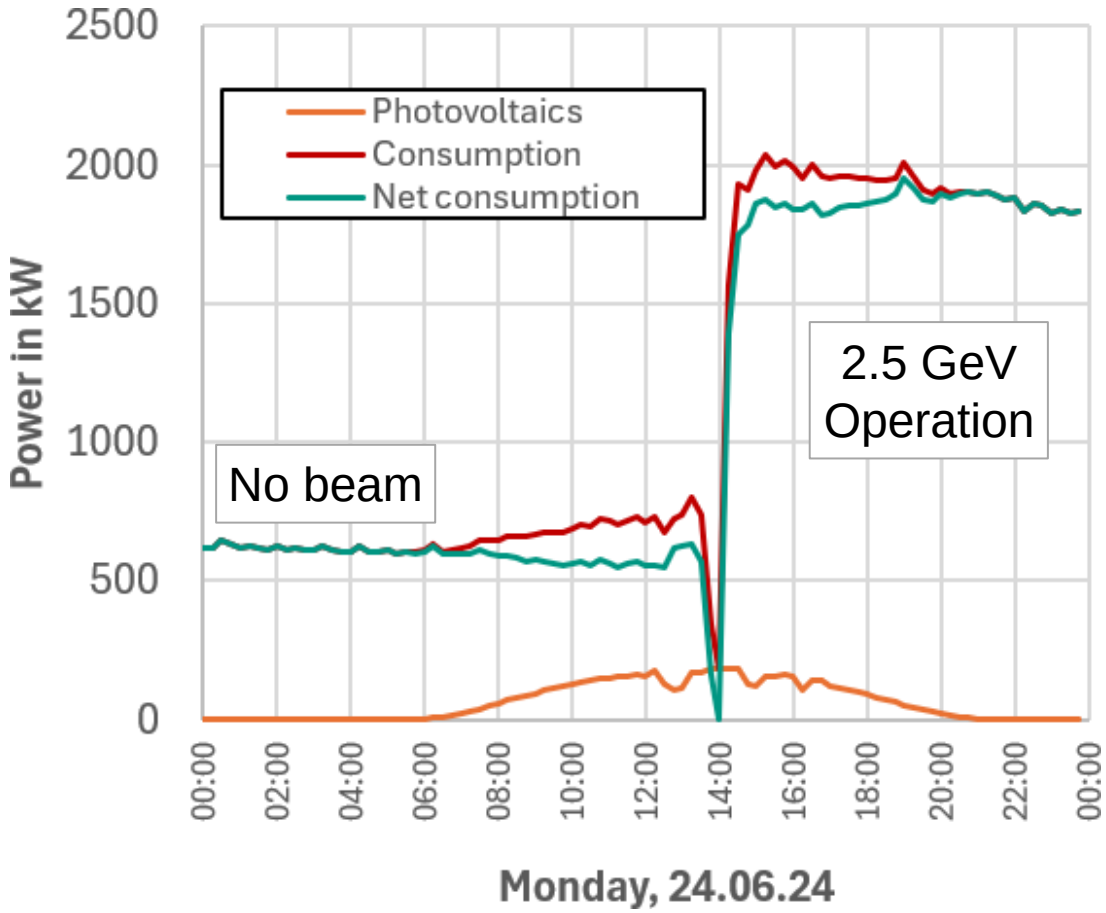
- Four facilities (SPEAR3, LCLS, FACET-II, LCLS-II) with power demand of 32 MW and growing
- Sophisticated control of 80 LCLS klystrons to turn off unused units to save power
- About 52% of power from carbon-free sources, need to get to 100% by 2030 – very challenging!
- Hydropower in US West is reduced because of historic drought



Addressing Energy Responsibility in Particle Accelerators: Insights from the KITTEN Research Platform

Giovanni De Carne, KIT

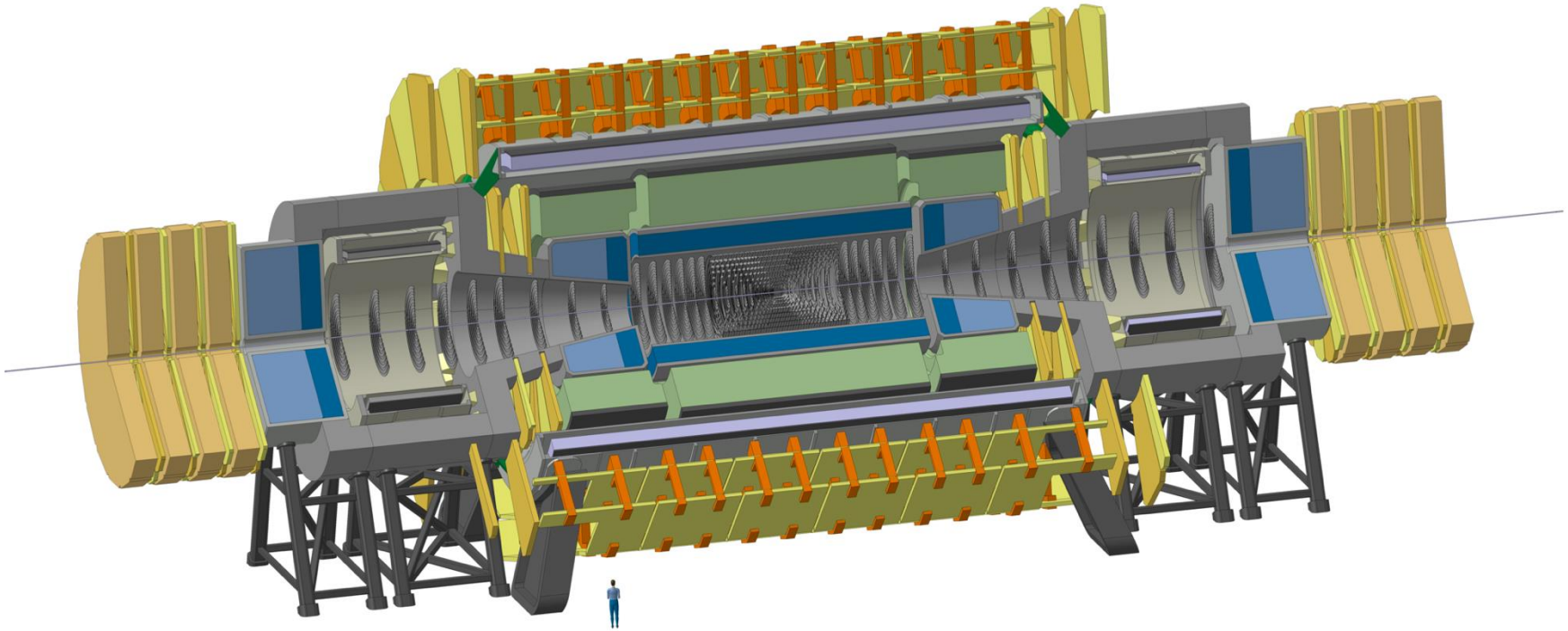
- Electric power analysis and simulation tool
- Shows the effect of solar panel energy source on accelerator operation
- Plan to add battery storage
- *My comment: renewable energy sources should have local energy storage*



Design of Detectors for Future Colliders (FCC)

Werner Riegler, CERN

- Detectors use about 10 MW, mainly for magnet. Small compared to accelerator power consumption
  - *My comment: it is still very desirable to explore reduction of power consumption (HTS?)*
- On-line computing for FCC-hh could use a lot of power
- Detectors dominate direct GHG emissions
- Main mitigation: leak fixing and alternative detector gases and cooling liquids



Sustainability for Einstein Telescope Project

Maria Marsella, University of Rome

- Einstein Telescope is a proposed underground facility to host a 3rd generation gravitational-wave observatory.
- 30 km tunnel, 3 large cavern, 3 – 4 M m^3 excavated material, surface buildings, computer center
- Sustainability study started
- Energy and carbon footprint important to the selection of project and location