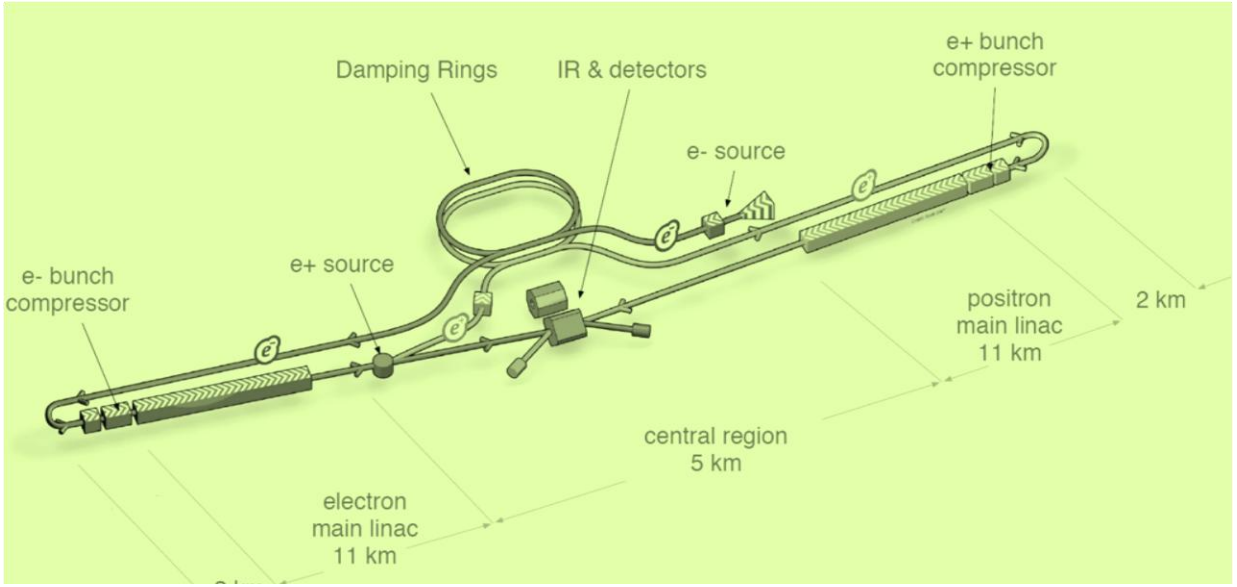


THE GREEN ILC

LN2 Economy

Energy for Innovation and Innovation in Energy

Denis Perret-Gallix@in2p3.fr
CNRS/IN2P3LAPP - KEK

Green ILC Objectives

ILC : lower running cost, better operational flexibility, environment friendly

Revisiting all ILC components:

1. Energy Saving: improving efficiency …. 80% lost as heat waste
2. Operational saving
3. Energy Recovery and Recycling

Alternative energies:

1. Renewable energy production, best for ILC and ILC site
2. Energy Storage (recovery, intermittency)
3. Distribution and Management: Smart Grid

Energy for: societal needs and world economy,

1. Basic Research
2. Synergies: expertise (SC, magnets, beams, computing), photon, neutron factories
3. Technology innovation
4. ILC as a test bench: Pilot plants for ILC

Denis Perret-Gallix@in2p3.fr
CNRS/IN2P3LAPP - KEK

Global organization for Green ILC

ILC Energy Center

ILC High-Energy Research Center

- Fundamental Research
- HEP Applications

ILC Sustainable Energy Research Center

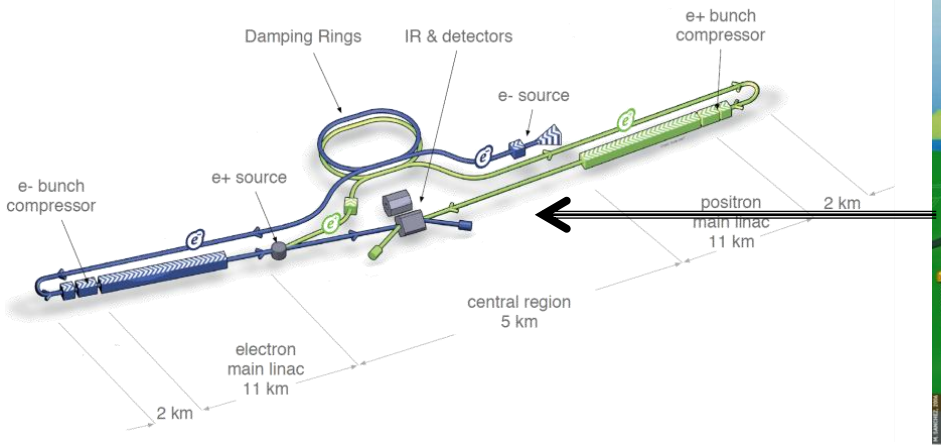
- Basic Research
- Application R&D
- Pilot Power plant for ILC

Industry

Electrons, photons, neutrons factories HPC/GRID Computing

High-Energy community

Energy community



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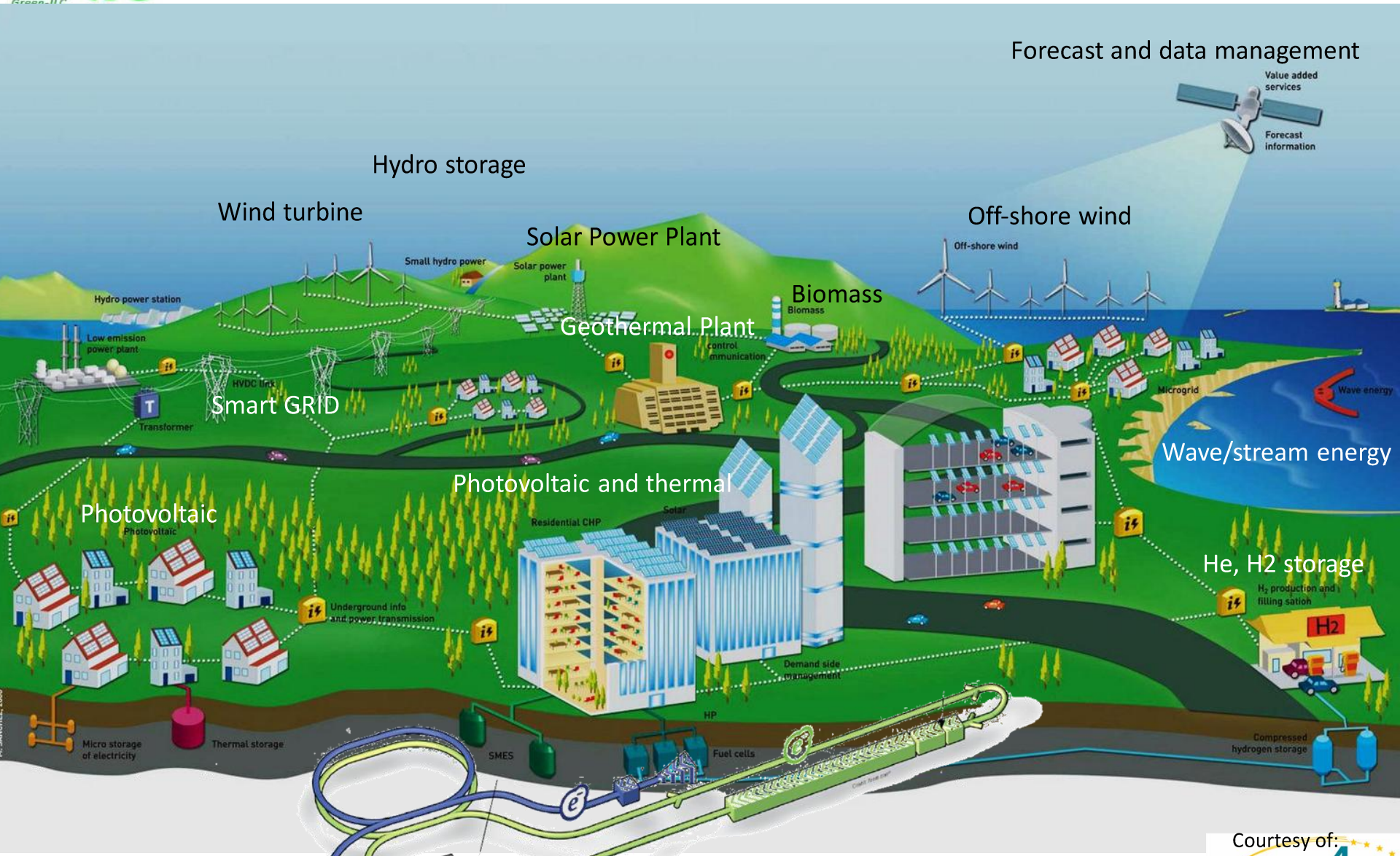
ILC Energy center (artistic) view



Courtesy of:

GRID4EU
INNOVATION FOR ENERGY NETWORKS

D[illegible]erret-Gallix@in2p3.fr
CNRS/IN2P3LAPP - KEK

An LN_2 Economy for ILC

The ILC cryogenics is consuming ~ 40 MW (25% of ILC AC power)

- In current design all cooling is done with LHe. LN_2 as a primary coolant -> 20 MW
- LN_2 cooling: HTc (MgB2) power transmission lines, NC magnets, electronics/computers,
- LN_2 could be used to recycle low grade heat waste (including beam dumps)
- And produce electricity with high-pressure gaz turbine

LN_2 could be produced by sustainable energies

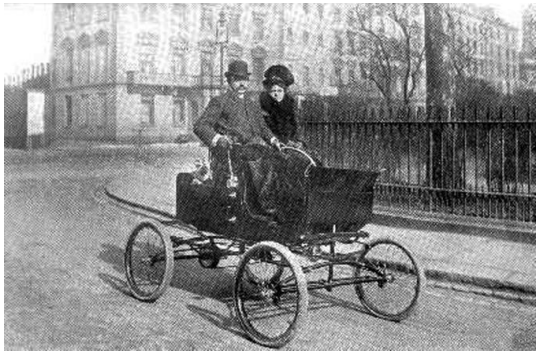
- Close to or at the ILC site (wind, solar, geothermal energy)
- Wind energy: from electricity or direct compression

LN_2 Energy storage

- With the heat waste, turbine produce electricity when needed. 70% efficiency

Sumimoto

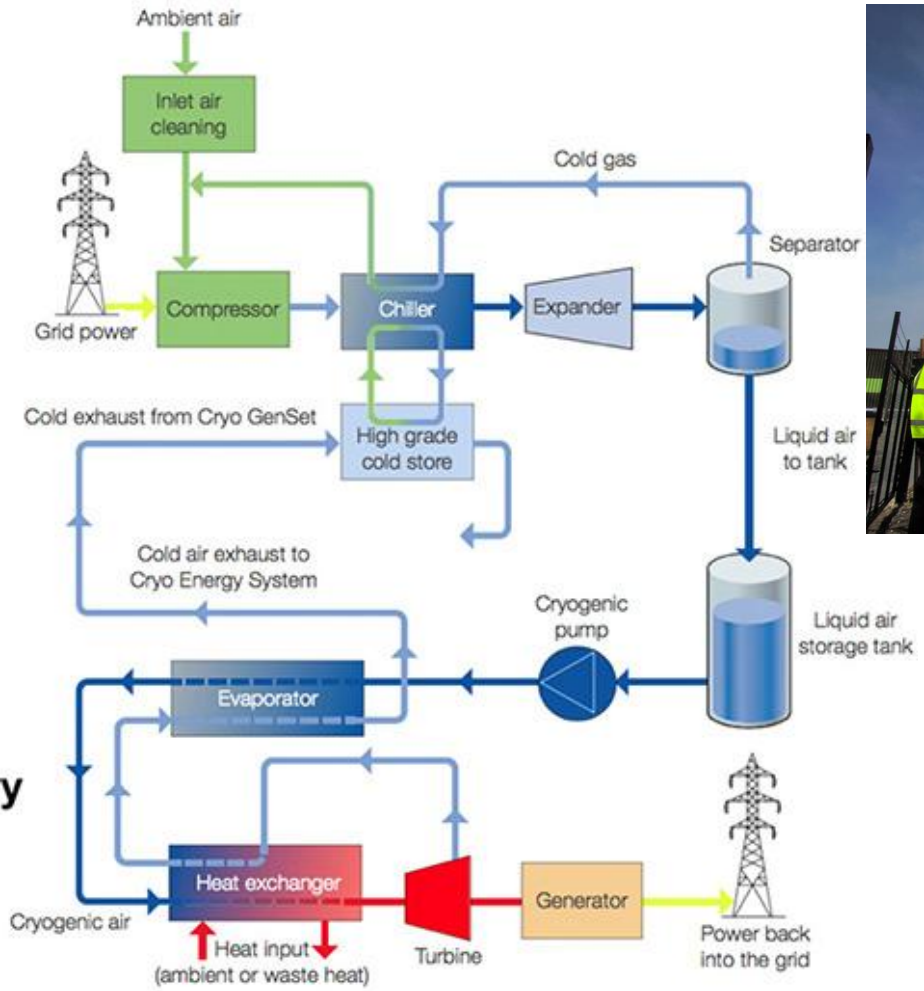
First LN_2 car



Liquid air energy network

Denis Perret-Gallix@in2p3.fr
CNRS/IN2P3LAPP - KEK

LN2 as energy storage

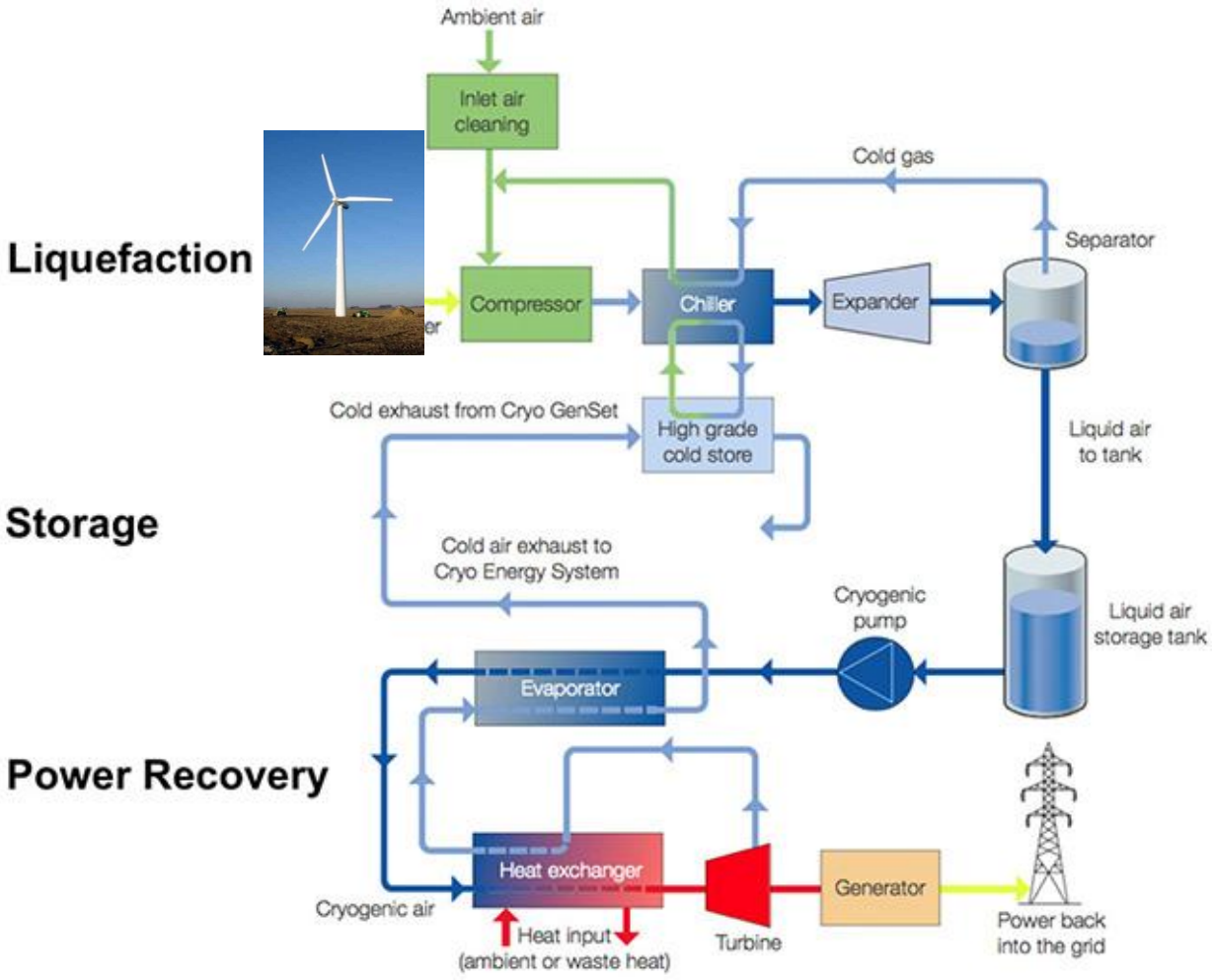


Highview Power Storage (UK)

Expected Efficiency up to 70% using heat waste (~ 115 C)

Denis Perret-Gallix@in2p3.fr
CNRS/IN2P3LAPP - KEK

LN2 from Wind



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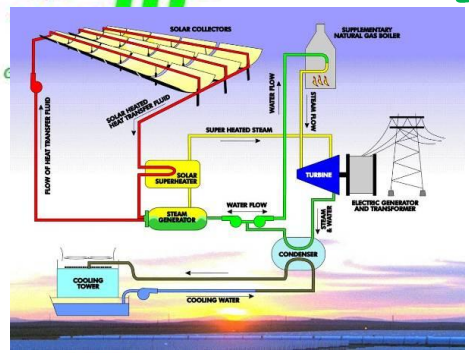
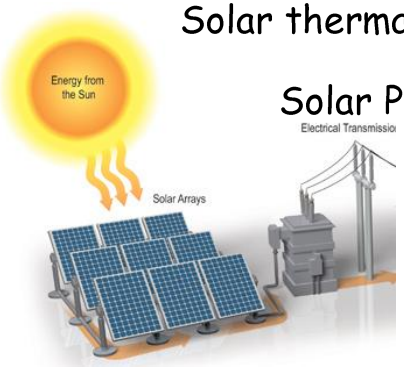
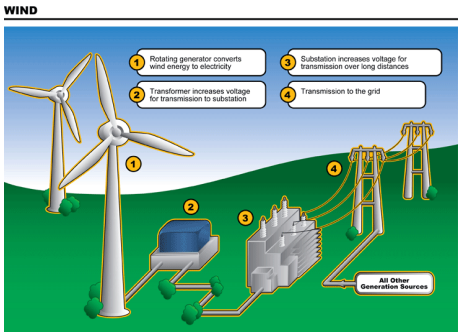
LN2 Electrical Production and Transport



Solar thermal



Solar PV

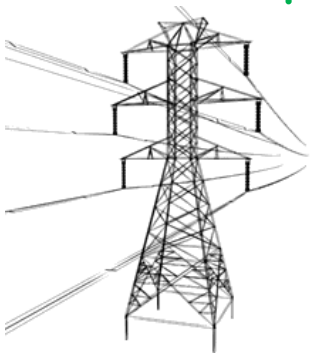


Wind,
Geothermal, biomass

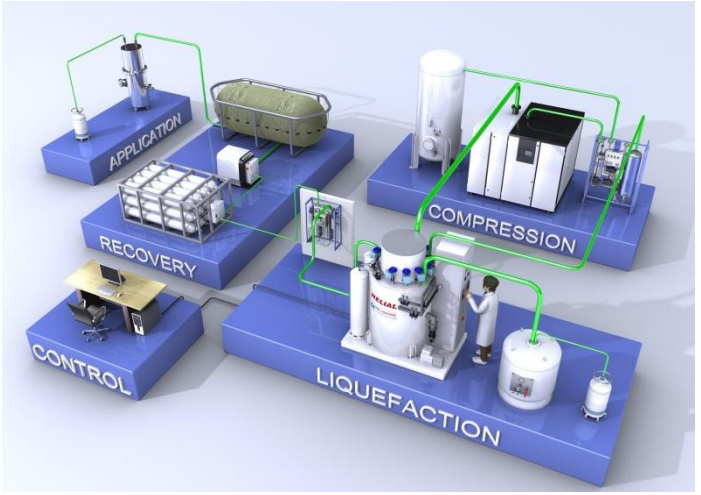
Electricity

OR .....

Grid/ILC



Make LN2

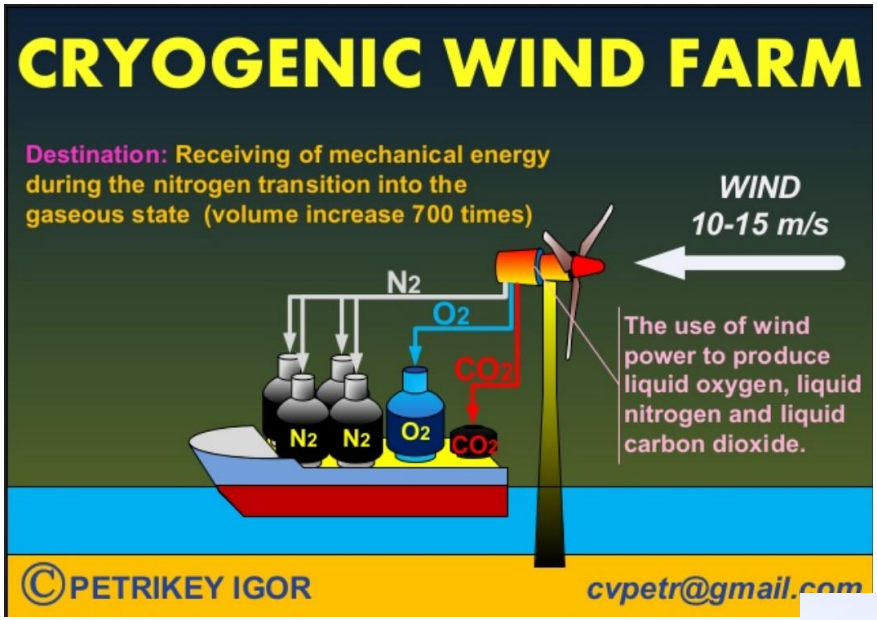


By Cryo Pipeline
Longest LNG ~ 5 km

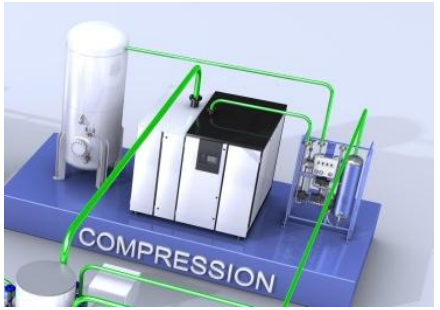
HTc SC power line (project)
by 20 Km long section

Denis Perret-Gallix@in2p3.fr
CNRS/IN2P3LAPP - KEK

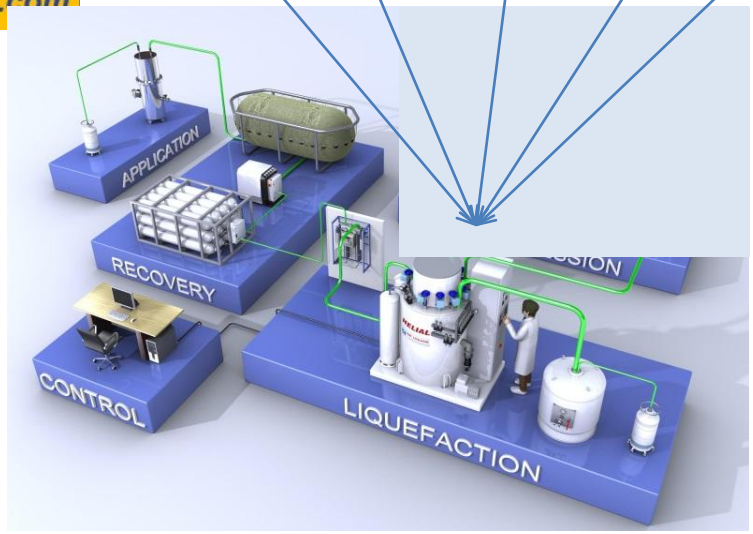
LN2 direct from wind, no electricity … ???



Only compressor in the nacelle



Or …

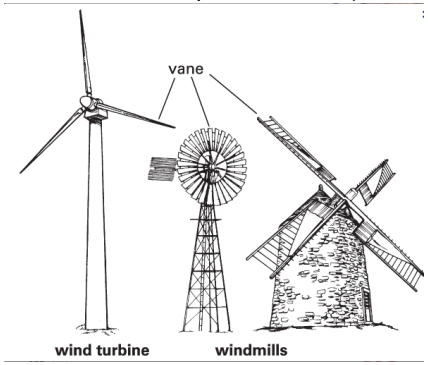


Denis Perret-Gallix@in2p3.fr
CNRS/IN2P3LAPP - KEK

LN_2 process cycle

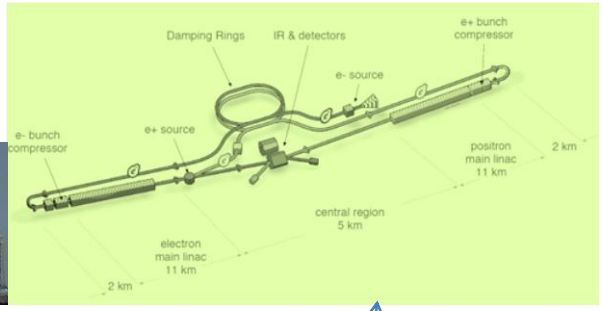
- Cryocooler may save 50% electrical power
- Cooling NC magnets
- HTc power Transmission lines
- Cooling electronics and computers

Compressor/liquefier inside



LN_2

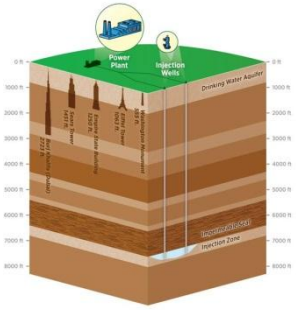
Energy storage



LO_2, LAr, SCO_2 Dry ice

To Industry

For Cooling or Sequestration



LN2 heat waste

Turbine → electrical generator

N2 gas applications

Electricity Back to ILC/GRID

i.e. Drying and preservation industry

Air cleaning !!!

Denis Perret-Gallix@in2p3.fr
CNRS/IN2P3LAPP - KEK

LN2 for ILC, just as an example Needs R&D

Many positive aspects:

- Negative (less than zero) carbon emission technology, air cleaner
- Important cryogen for ILC:
  - Cooling: cryocooler, HTc transmission lines, ..
  - Heat waste recovery
  - Storage: 1 gazometer (like for NLG): ILC runs ~ 4 days
    - Fast startup (minutes)
    - Long life-time

Applications to industry

- Energy Storage
- Heat waste recovery
- Drying

Safety issues, specially in ILC tunnel:

- N2 gas suffocation
- Cryogenic fluid hazard
- LN2 may liquefy ambient oxygen

Other discussions …. Hydrogen economy

Denis Perret-Gallix@in2p3.fr
CNRS/IN2P3LAPP - KEK

Soon at: Research-up.kek.jp/group/Green-ILC

Green ILC

Energy for Innovation, Innovation in Energy

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MAR 30TH, 2014

The Green ILC Project

ILC, the International Linear Collider, is the next fundamental science project in high energy physics and the first ever true global basic science center.

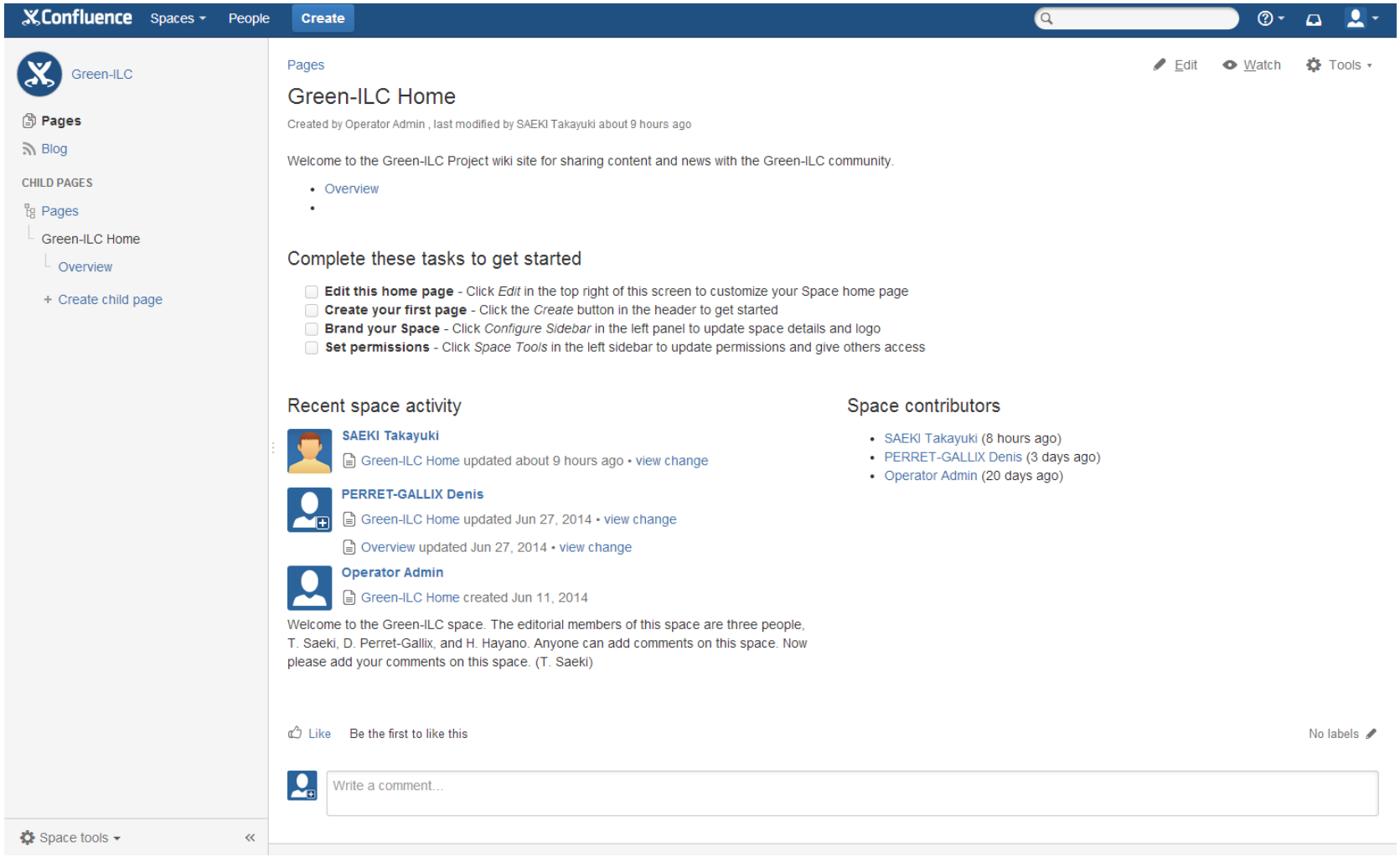
What CERN did for the European HEP community, ILC will do for the world. But the e+e- ILC project may go even beyond mere fundamental science and contribute to one of the world most pregnant issue: Energy, not merely high-energy but, more generally: energy for the society.

Artistic view of the ILC center in Kitakami (Japan)

The ILC scientific goal is simple: high precision study of the Higgs particle recently discovered at LHC (CERN) and other signals LHC could possibly single out. New effects will also be searched for, effects which could have been missed by the LHC due to the heavy background. Higher precision here concerns, more particularly, the various Higgs couplings, limited at LHC, in part, by the

Recent Posts

Wiki site for Green-ILC internal discussion:
http://wiki.kek.jp/ Space-> Green-ILC



Denis Perret-Gallix@in2p3.fr
CNRS/IN2P3LAPP - KEK

Thank you

Denis Perret-Gallix@in2p3.fr
CNRS/IN2P3LAPP - KEK