Asian Site

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History

JLC site study committee (Sep. 2000 - Oct. 2001)

- Studied tolerances for seismic motion at the JLC site
- Listed up items to be studied to select site candidates
- --> Published as High Energy News Vol. 20 Extra Edition Aug. 2001

JLC site study group (Sep. 2001 - Mar. 2003)

- Selected JLC site candidates
- 9 hard rock areas + 5 Research Developing Bases
- --> Published as KEK Report 2002-10

ILC Site study committee (Sep. 2004 - Mar. 2005)

- Examined site candidates by the committee including specialists in geology, under ground water and road construction

History (cont.)

- Candidate sites have been winnowed down to four hard rock areas to accommodate superconducting 50km long LC in 2004

- Since 2006
  Committee on Rock Mechanics and Tunnel Engineering Committee of Japan Society of Civil Engineers established Subcommittee on Civil Engineering for ILC Project.
  It has been examining our study results.

  And we have been studying under the cooperation of several consultant companies on civil engineering and siting of ILC.

Site candidates for JLC

Asian Site

Site Candidates in Japan

I. Area with good geology

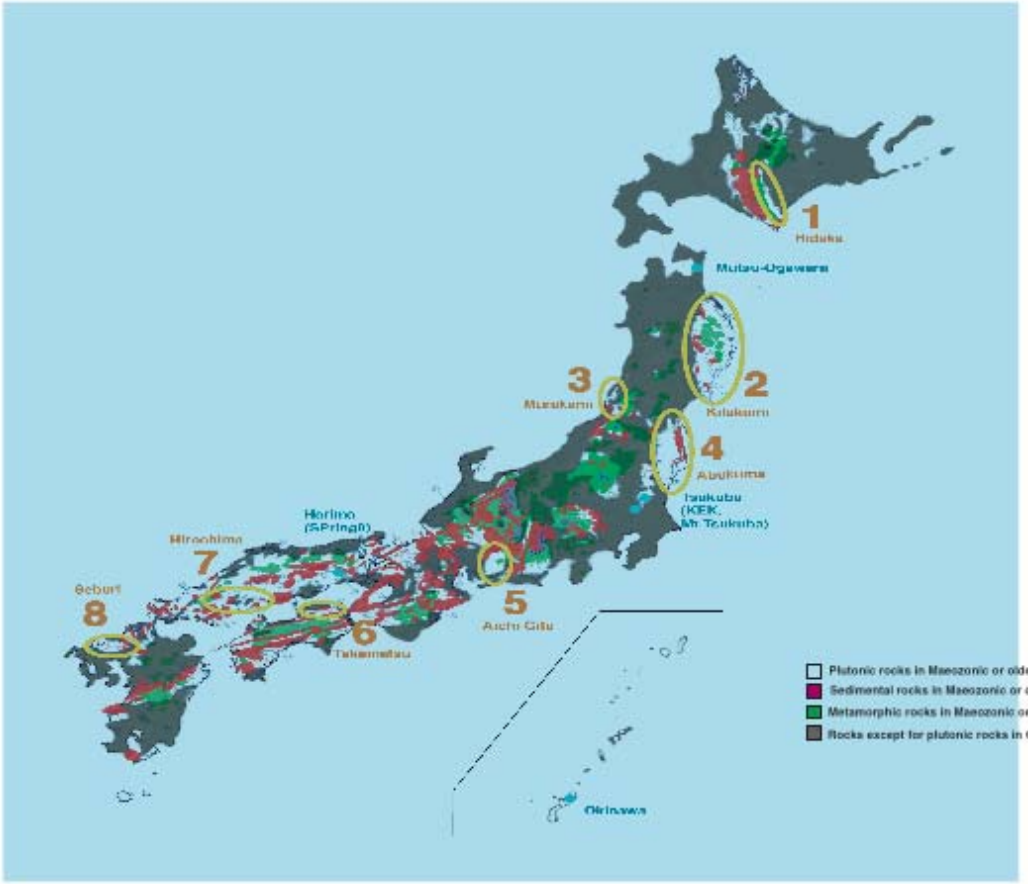
1. Hidaka
2. Kitakami
3. Murakami
4. Abukuma

4b Kita-Ibaraki

5. Aich-Gifu
6. Takamatsu
7. Hiroshima
8. Seburi

II. Research and development bases

1. Mutsu-Ogawara
2. Tsukuba (KEK)
3. Mt. Tsukuba
4. Harima (SPring-8)
5. Okinawa



Main points to select

- Uniform geology
- Tunnel depth < 600m
- Avoid residential area, because
  hard to get acknowledgement from the inhabitants from the view point of radiation problem and public construction
- Avoid active fault
- Avoid major epicenters (M>6) having taken place within 50km since AD1,500
- Avoid large fault (W > 1m),
  especially those running parallel to the tunnel route
- Enough electric power supply
  We need about 350 MW
- Enough length to accommodate 50km tunnel

--> Winnowed down to 4 sites

- Examined on 51 items for each candidate site

Following information is presented:

- Geographical conditions
- Firm bed rock area
  --> Geological map
- Tunnel depth less than 600m
  --> Cross sectional view
- Avoid active faults
  --> Map of active faults
- No large epicenters (M>6) within 50km since AD1,500
  --> Map of major epicenters

Asian Site (ILC-RDR) - P1

5.3 ASIAN SITE

5.3.1 Location

A set of about 50 criteria have been used over the past decade to evaluate a large number of ILC candidate sites in Japan. Out of these candidates, a sample site was selected for the RDR with an endorsement by the ILC-Asia group at its 4th meeting in November 2005. It satisfies the following criteria, some overlapping with the criteria matrix developed by the CFS Global Group:

- Firm and uniform geology to ensure stable beam operation at the interaction region.
- Sufficient length to accommodate straight tunnels spanning over 50 km.
- Absence of any known, active faults in the neighborhood.
- Absence of epicenters of any known earthquakes exceeding M6 within 50 km from anywhere in the site since AD1500.
- Uniform altitude of the terrain so that the ILC tunnel depth is less than 600 m throughout.
- Availability of sufficient electrical power for ILC operation.
- Existence of a practical construction plan for the underground tunnels and caverns.
- Suitable environment, in terms of climate and access, for smooth operation.

The Asian site is located in a moderate plateau area (low mountains) in uniform solid rock. It is within 10 to 20 km of cities which provide a living environment with reasonable quality of life. The neighboring cities are connected to an international airport within several hours by both bullet train and highway.

Asian Site (ILC-RDR) - P2

5.3.2 Land Features

The site surface is dominated by woods and is partly occupied by an agricultural area which is crossed by occasional local paved roads. Only a few local residences exist along the tunnel route. There are no major high-ways or streets with heavy traffic and no large river systems which cross the tunnel route. Hence, very few sources of natural or human-made vibrations exist. An adequate flat surface area is available to accommodate surface facilities. Existing local roads can be utilized as access routes to entrances of the tunnel.

5.3.3 Climate

The climate is mild. There is snowfall in winter but only for a short period. It is not too hot in summer. There is no recorded history of major typhoons.

5.3.4 Geology and Tunnel Structure

The 31 km ILC tunnels for the first project phase can be constructed within solid hard rock. In the second project phase, when the tunnels are extended to 50 km, one side of the main linac tunnel will pass through an area with sedimentary rock, but this geology is also solid. The depth of the tunnels, which will be built in a low mountainous part of the site, is in the range between 40 m and 600 m. Most of the access to the tunnel is provided by sloped ramps

Asian Site (ILC-RDR) - P3

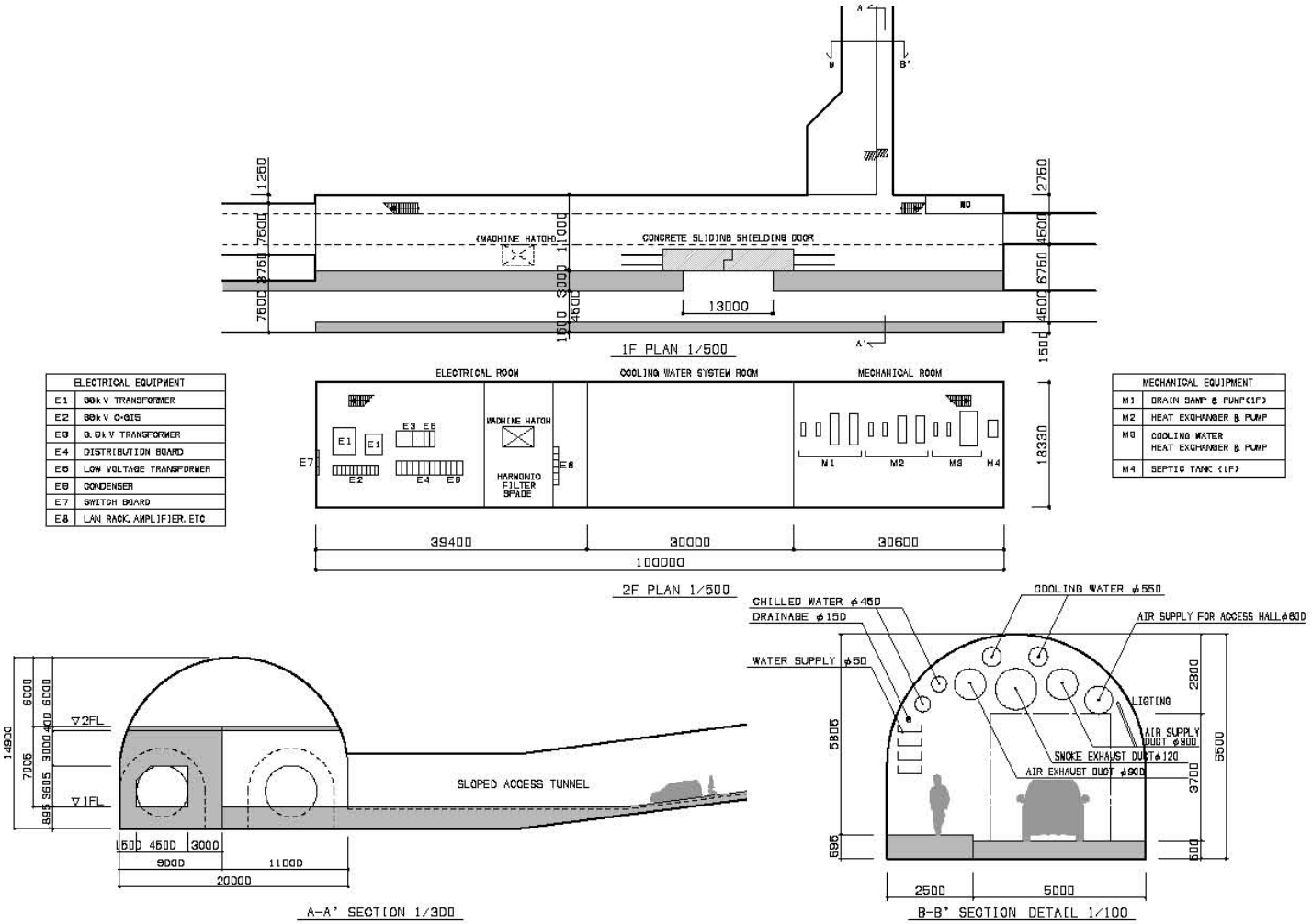


FIGURE 5.3-1. Detail of an access ramp for the Asian Sample Site.

Asian Site (ILC-RDR) - P4

(Figure 5.3-1). An exception is the access to the interaction region which has a vertical shaft approximately 112 m deep.

Past experience with Japanese construction projects indicates that the uniform granite has sufficient strength that the tunnels and caverns do not require reinforcement by rock bolts or concrete lining. Shotcrete is used to cover the inner surfaces of the tunnels. Excavation of very large caverns, such as the experimental hall, may require reinforcement by rock bolts.

5.3.5 Power Distribution System

The site is located in the neighborhood of an existing 275 kV power grid. It is considered to be reasonably straightforward to supply the power of 240 MW required for the 500 GeV ILC. Power failures in Japan are very rare, and even if they occur, the system average interruption duration index (SAIDI) [1] has been only 13 minutes, according to the statistics of the Ministry of Economy, Trade and Industry of Japan.

5.3.6 Construction Methods

The geology is uniform hard granite below 20 m of softer topsoil and weathered rock. The access shafts are sloped tunnels excavated by NATM (New Austrian Tunneling Method),

[1] System average interruption duration index = sum of customer interruption durations normalized by the total number of customers served

Asian Site (ILC-RDR) - P5

except for the IR hall. These tunnels match the mountainous geography and allow vehicle transport of personnel and materials. They are 7.5 m x 7.0 m to accommodate access for the TBM. From the surface to a depth of 20 m, the tunnel is reinforced by rock bolts, a 15-20 cm thick shotcrete liner and steel supports. In the granite, the tunnel is reinforced by rock bolts and 5 cm thick shotcrete.

The IR vertical shafts are excavated by drill and blast, with metal supports and a concrete lining. Caverns are excavated by NATM. The top of the arch is excavated by advancing top drift method with drill and blast. Reinforcement is by rock bolt, pre-stressed bolt and sprayed concrete 20 mm thick with a metal mesh, overlaid by a 1.5 m thick cast concrete liner on the arch. The lower part of the cavern is excavated by drill and blast. After reinforcement in the same method as the top, the side wall is finished with 1.0 m thick concrete, and the concrete floor cast 2.0 m thick. Passageways are excavated manually and finished with sprayed mortar and pre-mixed fiber 20 mm thick.

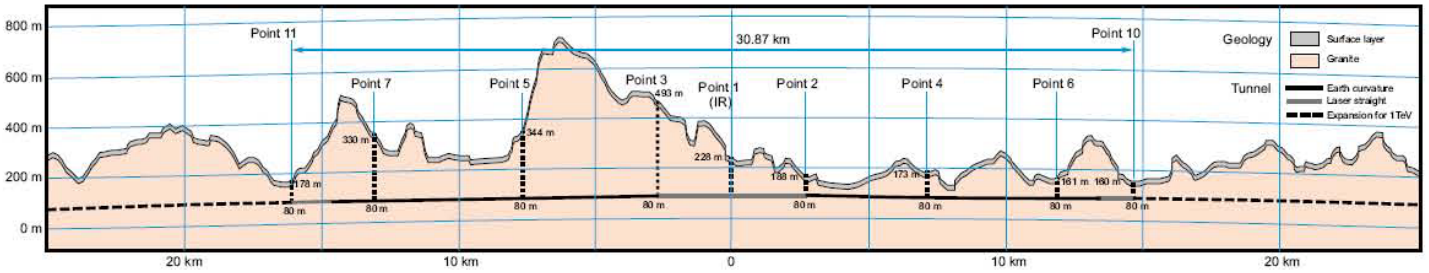


FIGURE 5.3-2. Longitudinal profile of the Asian Sample Site in Japan.

Summary

- Asian candidate sites for ILC construction have been winnowed down to four sites in Japan.
- Those have been examined in detail
- Japan Society of Civil Engineers have been cooperating on site study since 2006. They are examining our site candidates from the point of professional civil engineers' view
- We are expecting we could start discussion with Japanese government soon on ILC project because the J-PARC construction have been completed

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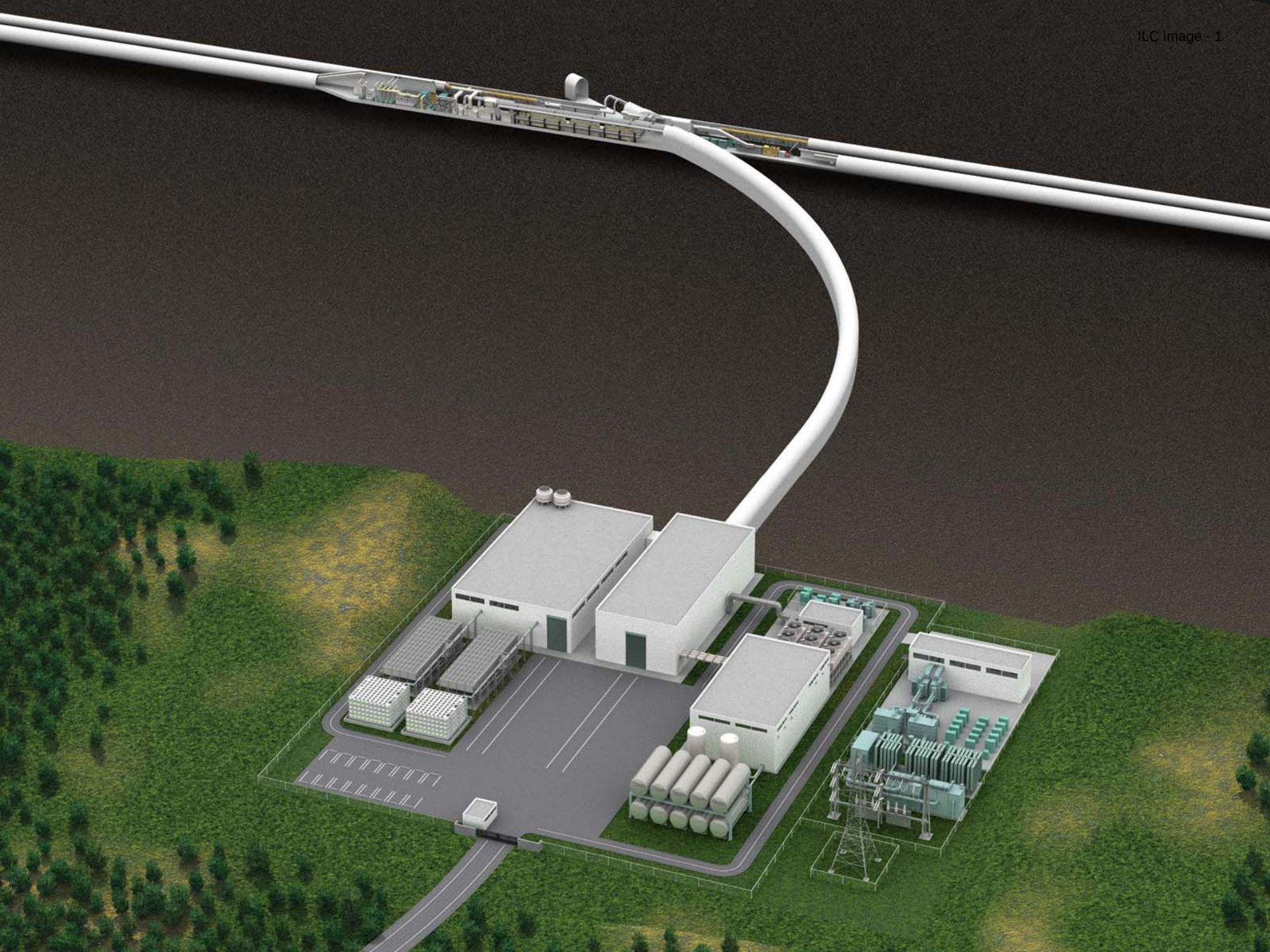
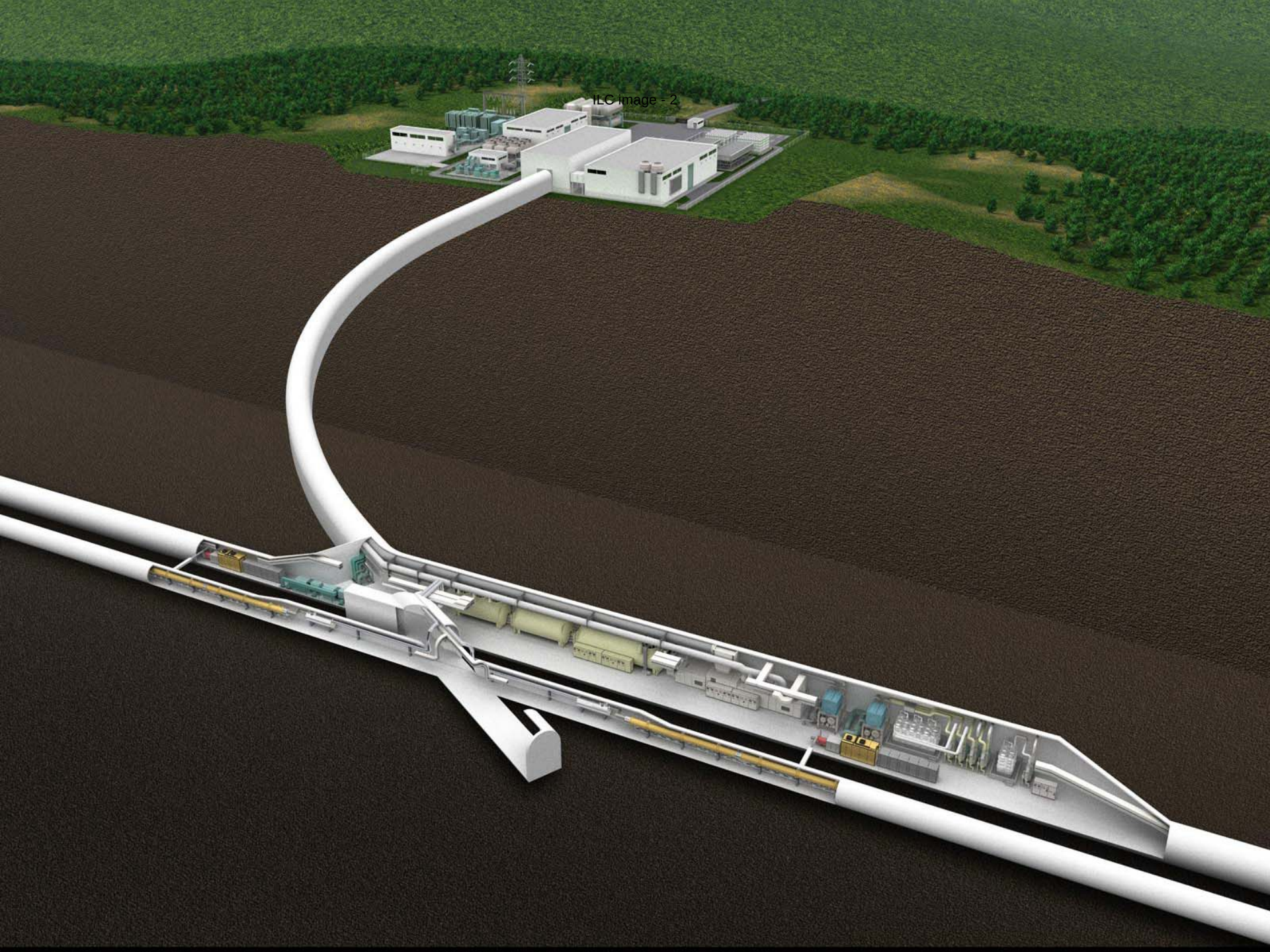

ILC image - 1


ILC image - 2