
$$E = mc^2$$

Nuclear Hydrogen Production Project in Korea

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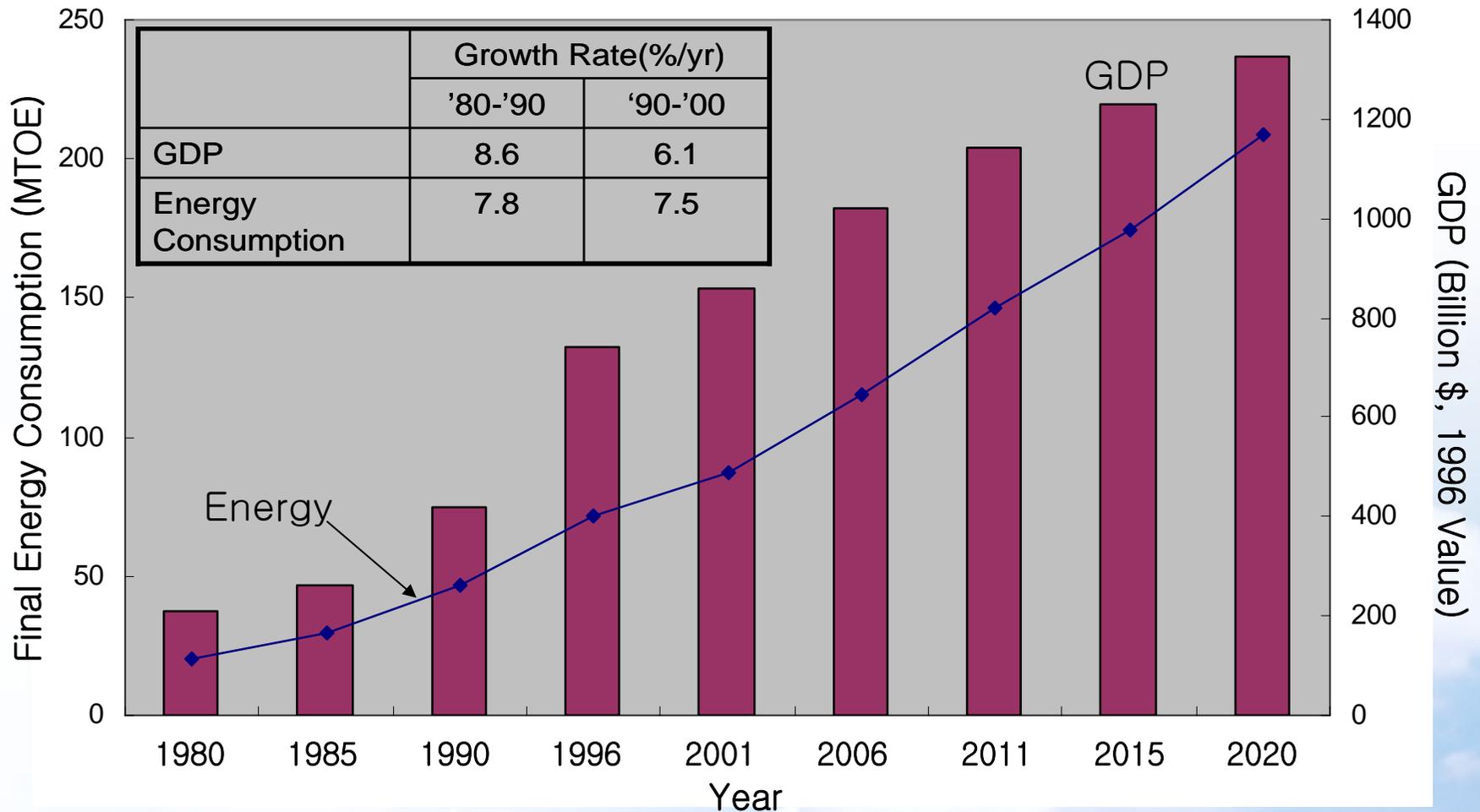
Summary

GDP vs Energy Demand

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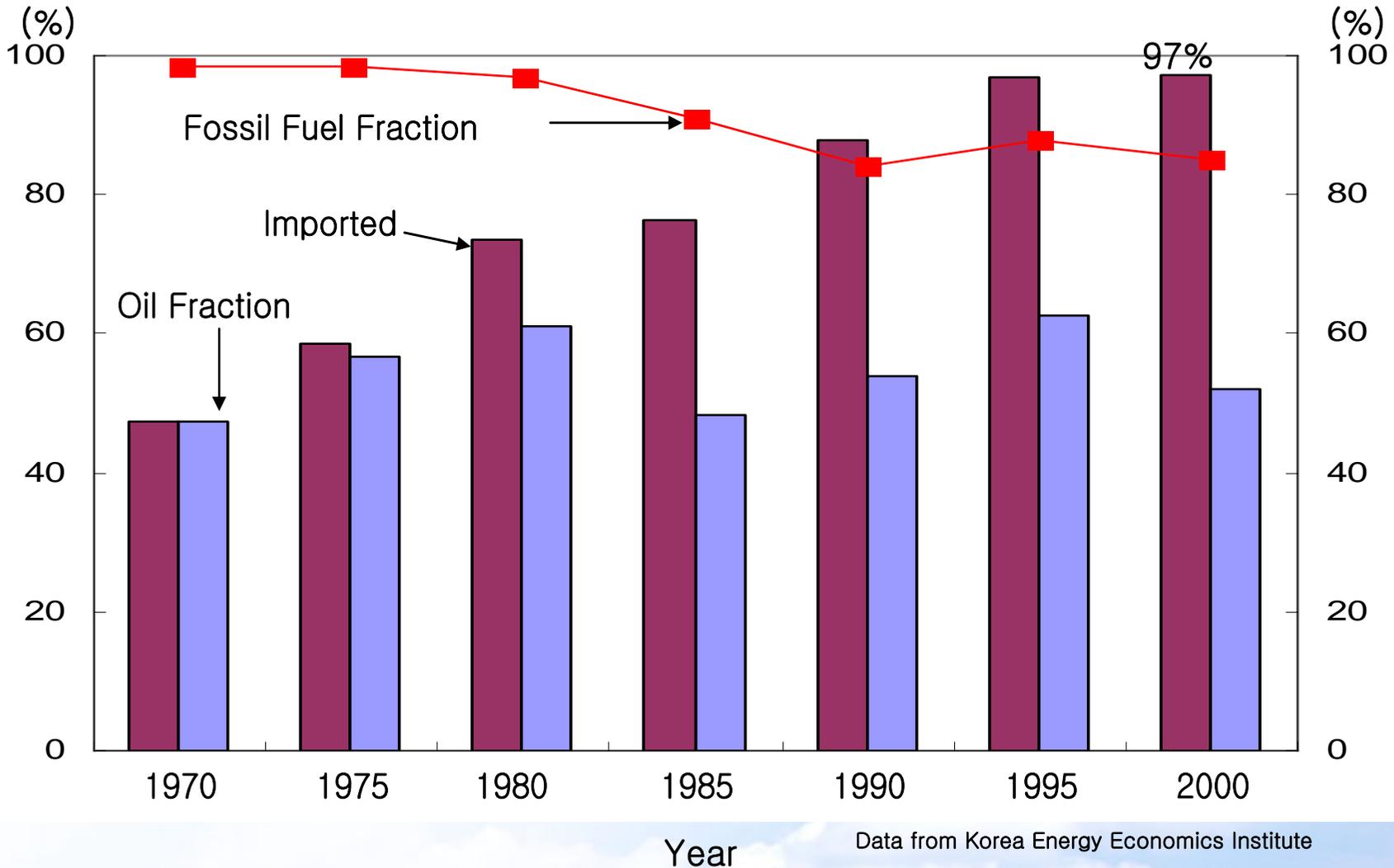


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Data from Korea Energy Economics Institute

Current Energy Supply System



Energy Paradigm Shift



Simple expansion of the current energy system for the sustainable development is not possible because of

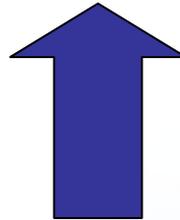
- Limitation of fossil (especially) energy resources
 - Unaffordable price
- Climate change (Kyoto protocol)
 - Korea is expected to ratify Kyoto protocol in the year 2007
- Energy security
 - Most of oil is being imported from middle east
 - Vulnerable to international energy crisis



Transition to “Hydrogen Economy”

NHDD Project Targets

- Complete the development and demonstration of the nuclear based hydrogen production technology by the year 2021.
 - Period : 2004 – 2021 (18 years)
 - Budget : ~ US\$ 1.0 Billion



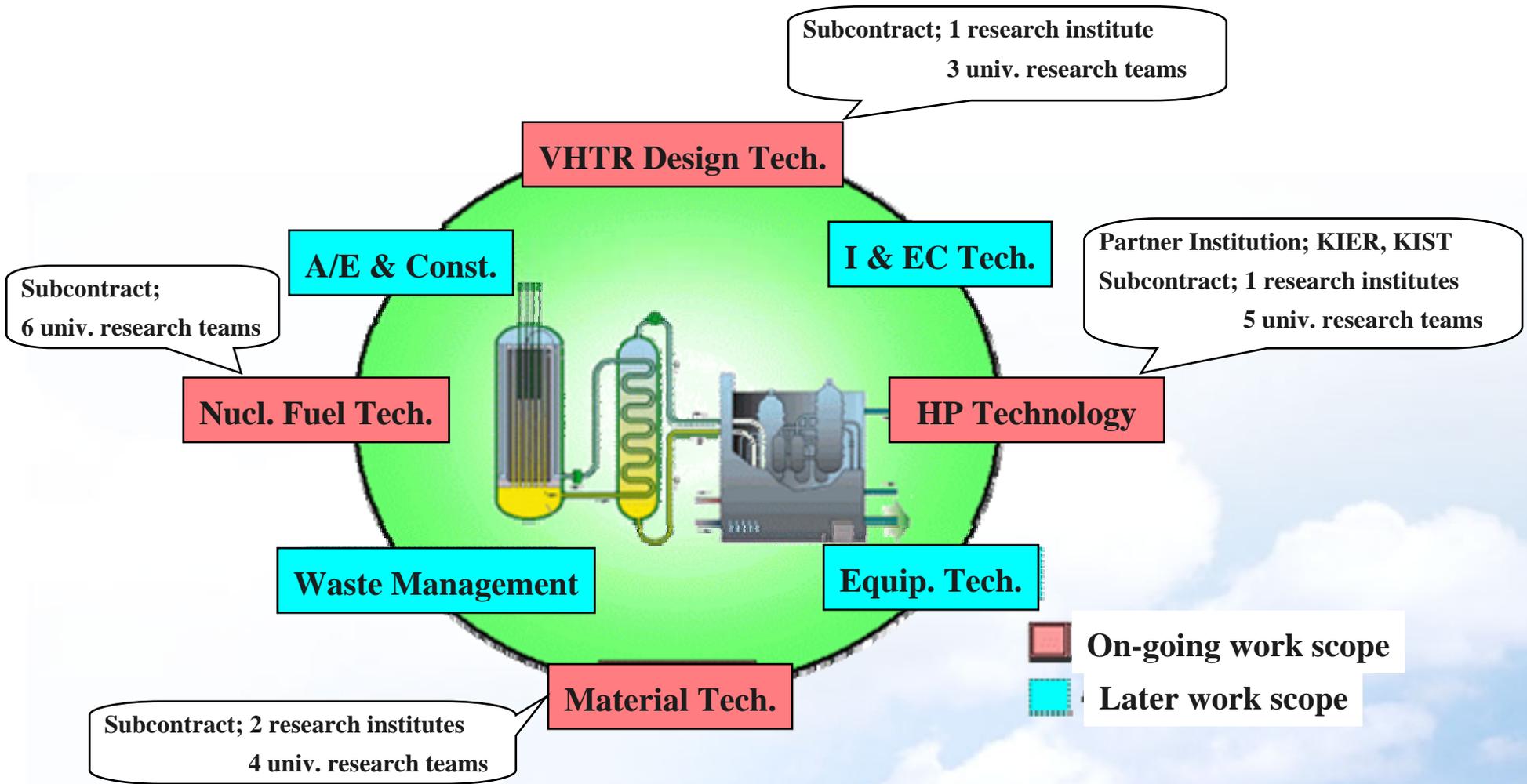
- Start producing commercial hydrogen by using nuclear power from the middle of 2020s
 - Production cost : ~ 1,500 won/kg (~\$1.5/kg)

Development Strategy



- ❑ In order to commercialize the developed technologies as soon as possible, the industries are required to participate from early development stage.**
- ❑ The industries will lead the construction and operation of the demonstration facilities while Government will lead the program in the design stages.**
- ❑ In order to assure cost-effective research, international collaboration will expand and be promoted continuously.**
- ❑ Cooperation through the GIF-VHTR/HP and the on-going bilateral collaboration would be fostered.**

NHDD Project Structure Management

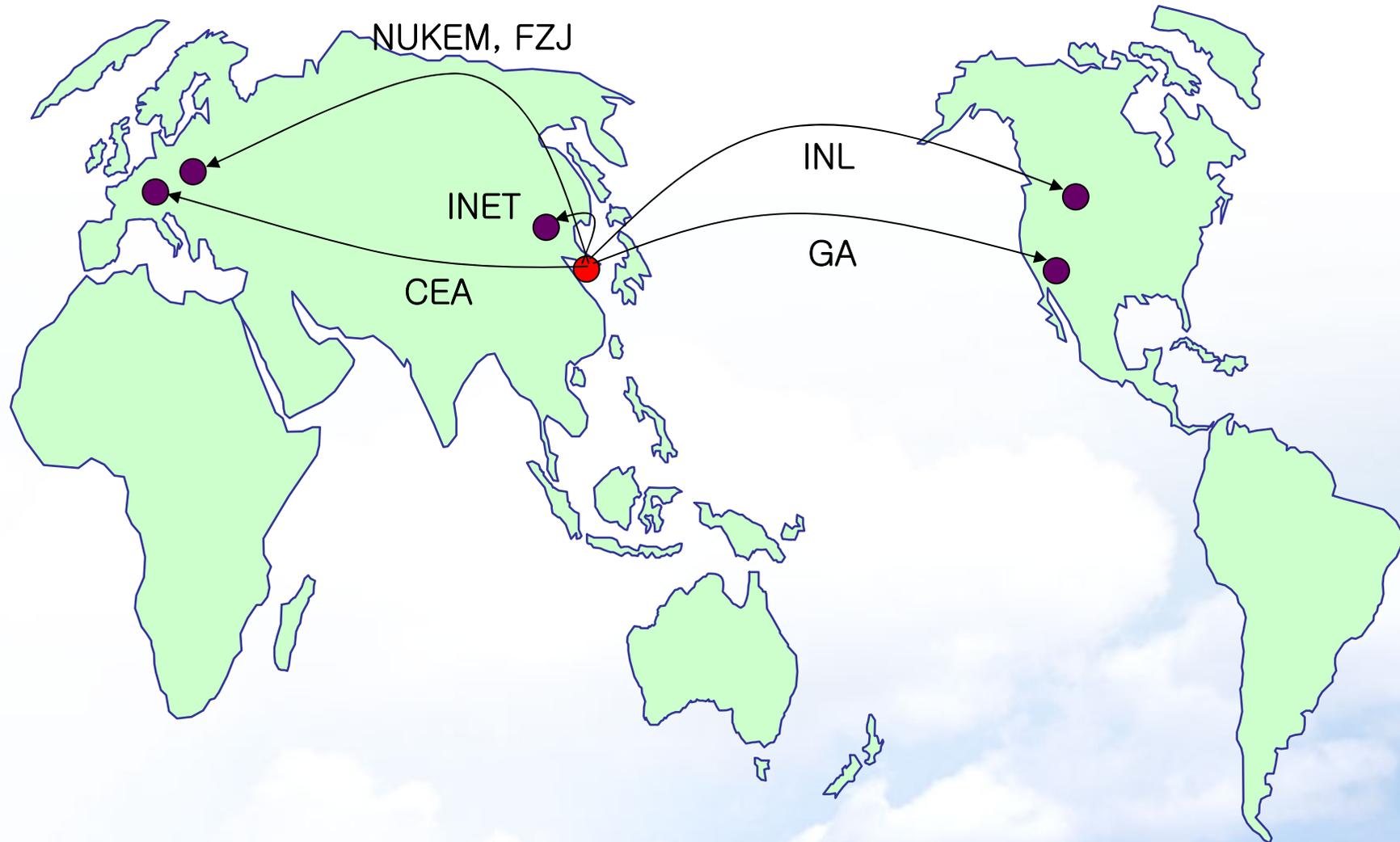


International Cooperation

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Development of the NHPT

☞ Assessment of NHPT

■ Three top-ranked cycles to be evaluated;

- *Sulfur Iodine(SI) Cycle*
- *High Temperature Electrolysis(HTE)*
- *Methane-Methanol-Iodomethane(MMI) Cycle*

■ Evaluation Activities

- *Collection and production of technical data*
- *Development of the flowsheet*
- *Comparison of thermal pathway and efficiency*

☞ Development of an Advanced SI Cycle

■ Membrane-based high technology

- *HI concentration by electro dialysis*
- *Membrane reactor for hydrogen separation*

■ High temperature materials

- *Screening test for equipment material selection*
- *Coatings and fabrication technology*

■ Scale-up and engineering

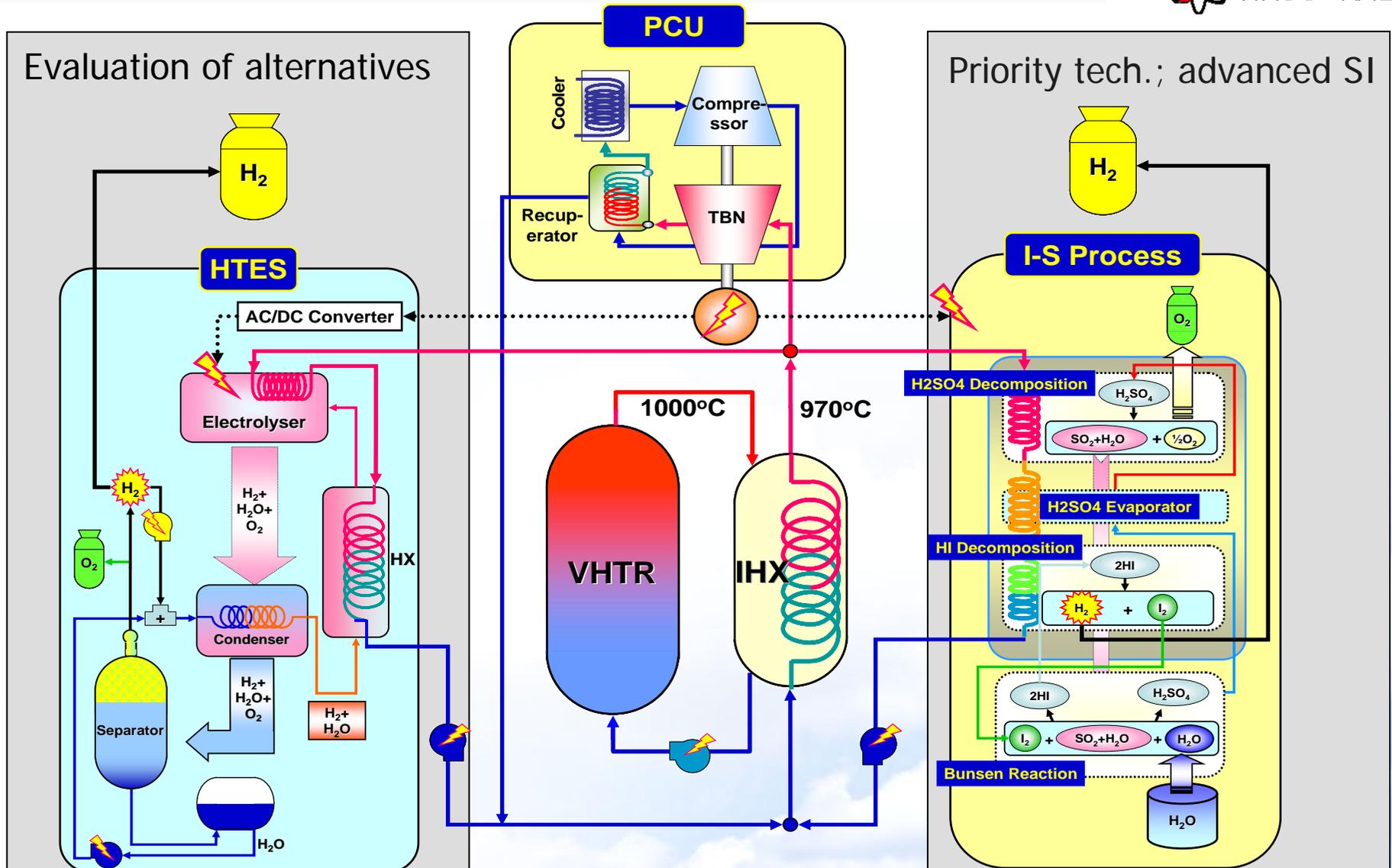
- *Key technologies*
- *Lab-scale test (~1,000NL/hr)*
- *Pilot-scale test (~100Nm³/hr)*
- *Demonstration facilities (~10,000Nm³/hr)*



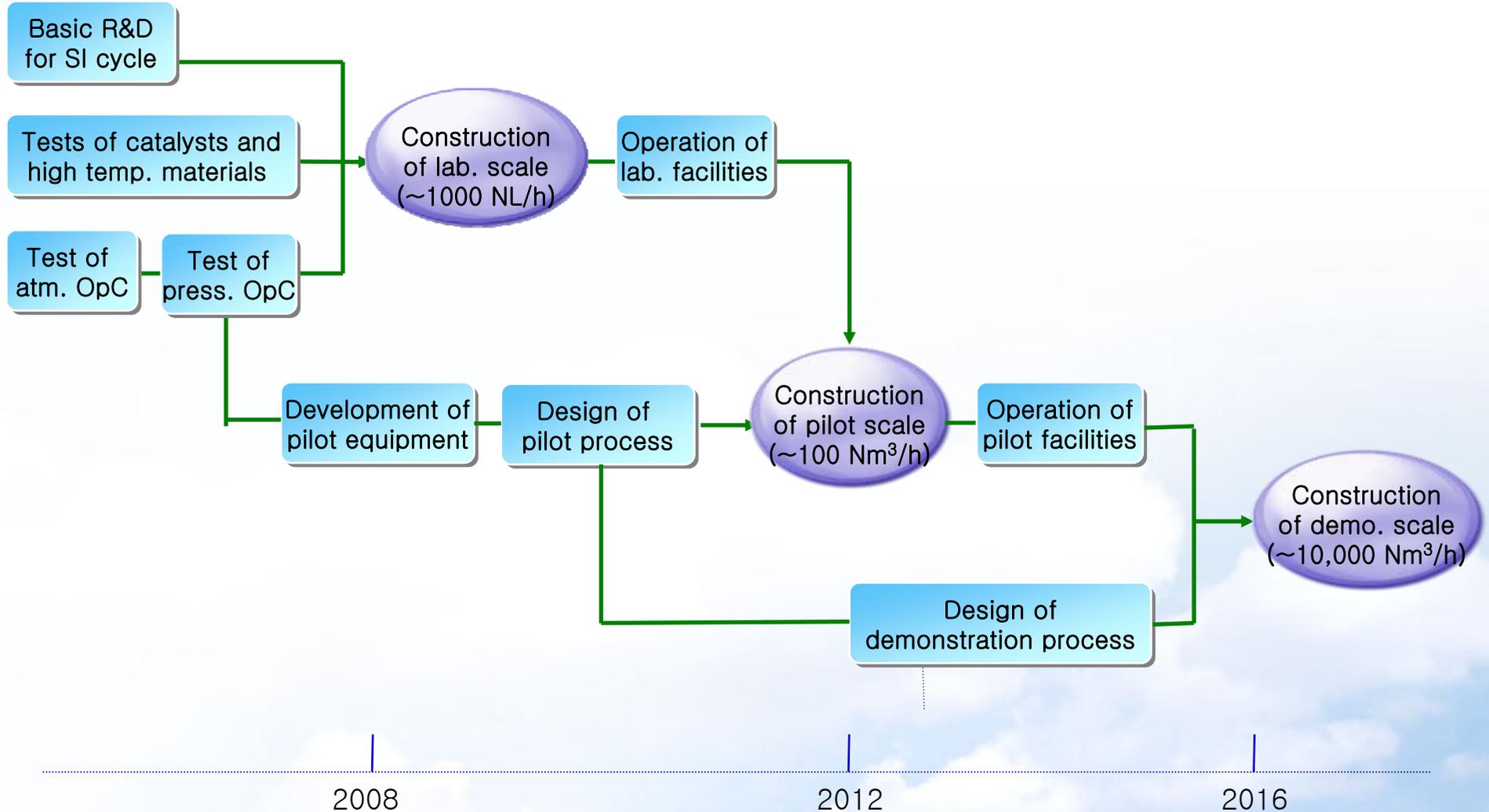
- Thermal efficiency**
- Availability and cost of chemicals, materials and equipment**
- Economics of scale-up**
- Hazard and operability**
- Conversion of chemical reactions and side reactions**
- Separation of materials and phases**
- Corrosion problems**
- Materials handling (continuous or semicontinuous operation)**

NHDD-HP Research System

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Advanced SI Cycle Development Schedule

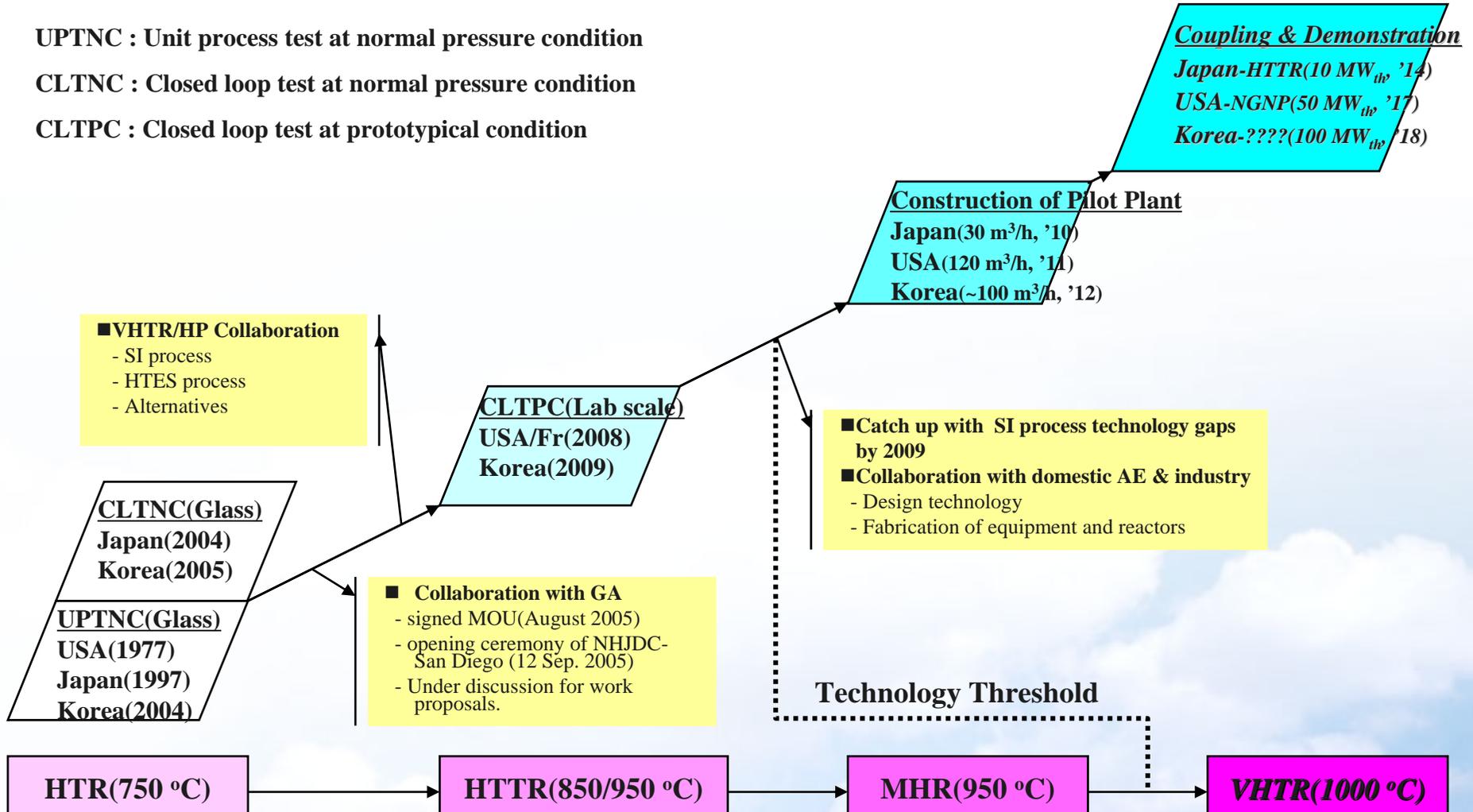


Evolutionary Path of SI Technologies

UPTNC : Unit process test at normal pressure condition

CLTNC : Closed loop test at normal pressure condition

CLTPC : Closed loop test at prototypical condition



Summary

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- ❑ Korea launched nuclear hydrogen program in the year 2004. The program's target is to develop and demonstrate the nuclear based hydrogen production technology by the year 2021.
- ❑ Large part of R&D activities are currently focused on
 - development of the VHTR,
 - TRISO fuel fabrication technology development,
 - high temperature material development,
 - development of an advanced SI process.
- ❑ KAERI is very open and positive to the international collaboration.

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Thank You.

<http://www.hydrogen.re.kr/>