

2018 TWG-SMR

Update of SMART Cooperation for Deployment in Saudi Arabia

April 24, 2018

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Korea Atomic Energy
Research Institute

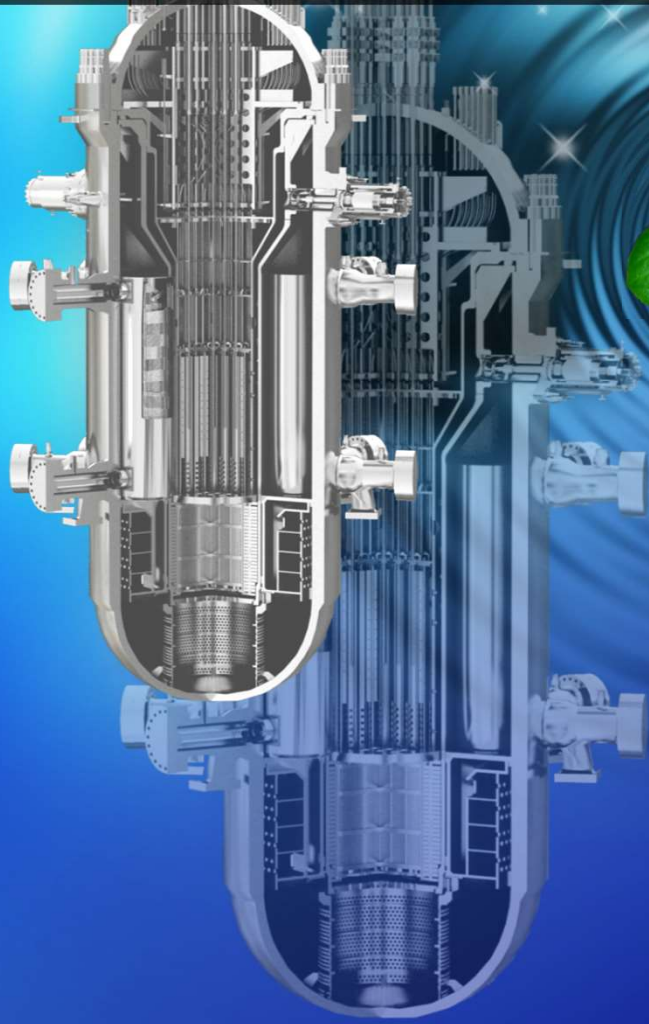
I. SMART Development

II. SMART Characteristics

III. SMART Partnership with KSA

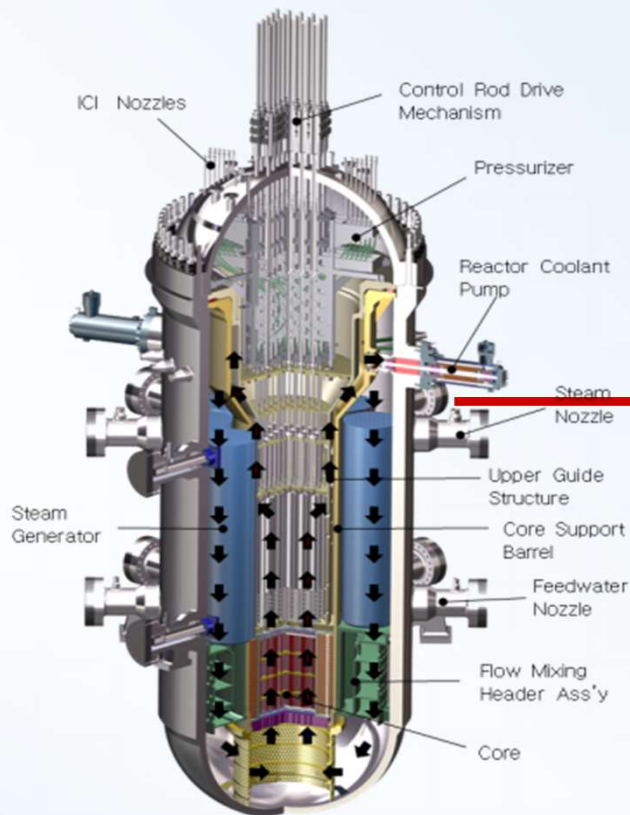
IV. Summary

I. SMART Development



System-integrated Modular Advanced Reactor

Advanced Integral PWR for Electricity Generation and District Heating or Desalination



Thermal : 365 MWt

Electricity : 100 MWe

Fresh Water : 40,000 t/day

Steam
Transformer



Hot Water

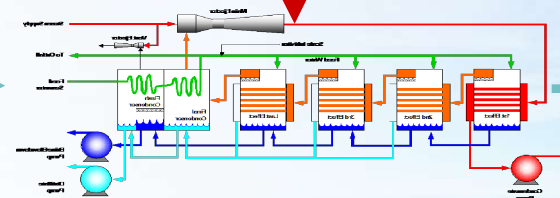
Heat pipe



Steam

Sea Water

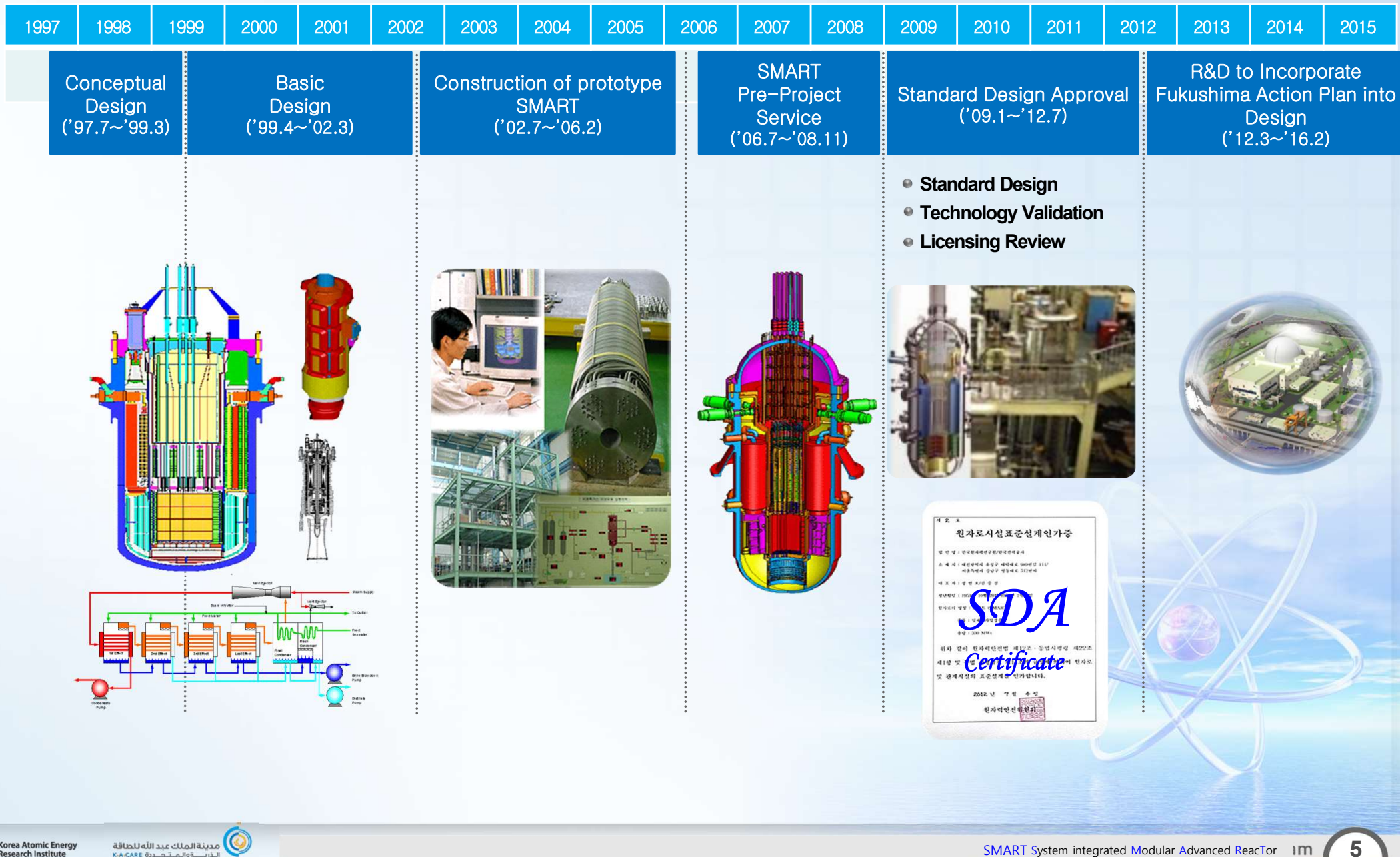
Fresh
Water



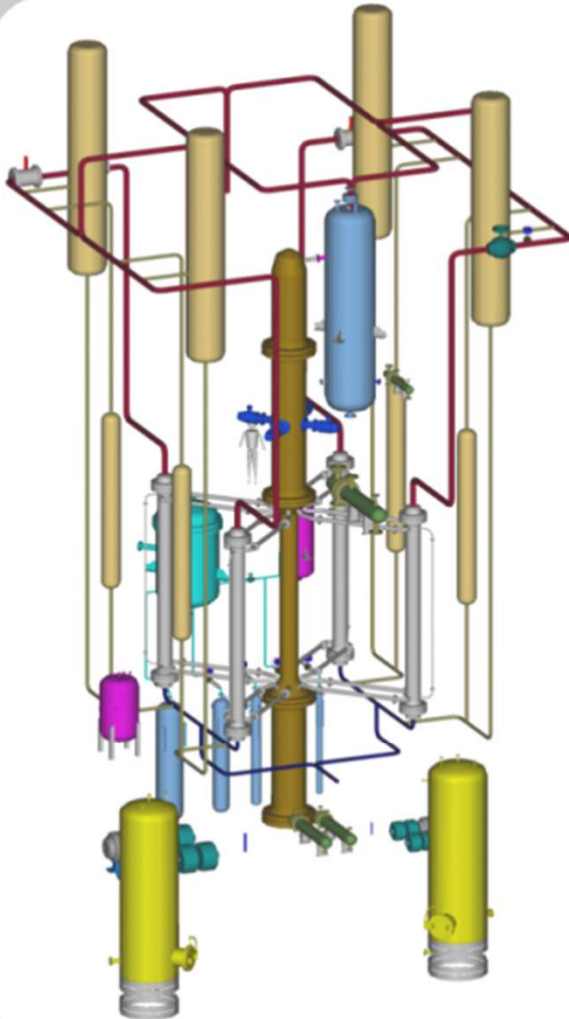
Desalination Plant



Chronology of SMART Development



- World's Unique and Largest Full Scope Accident Simulation
 - 1:1 Height, 1/49 Volume



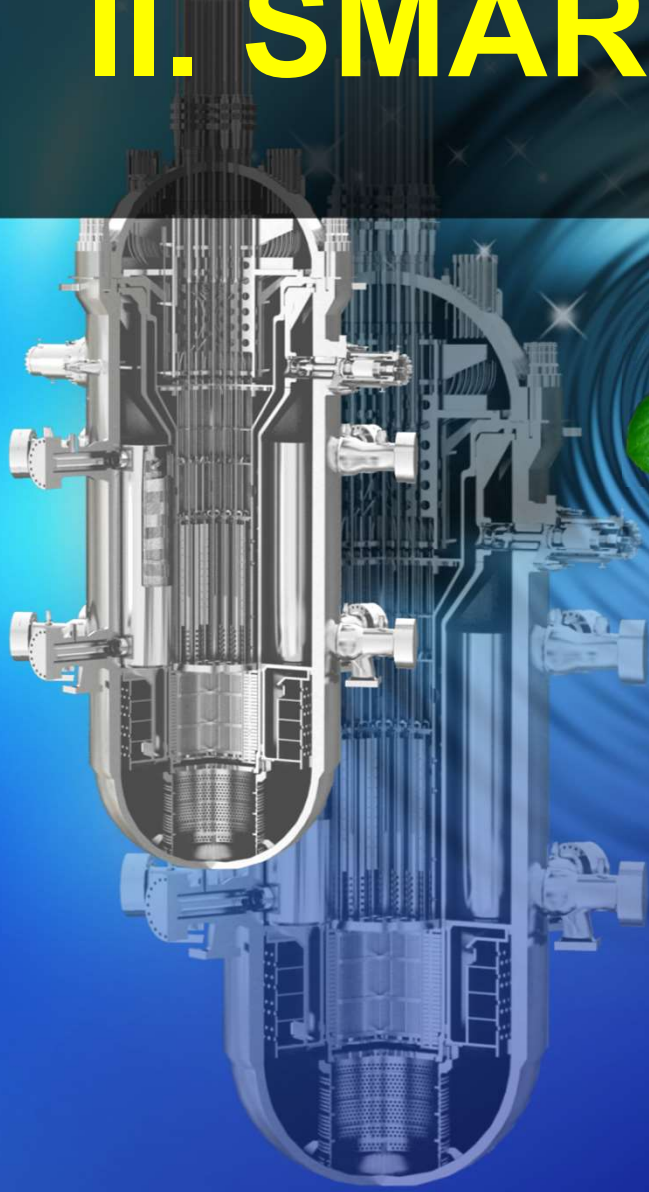
SMART ITL (Integral Test Loop)



SMART-MCR Simulator

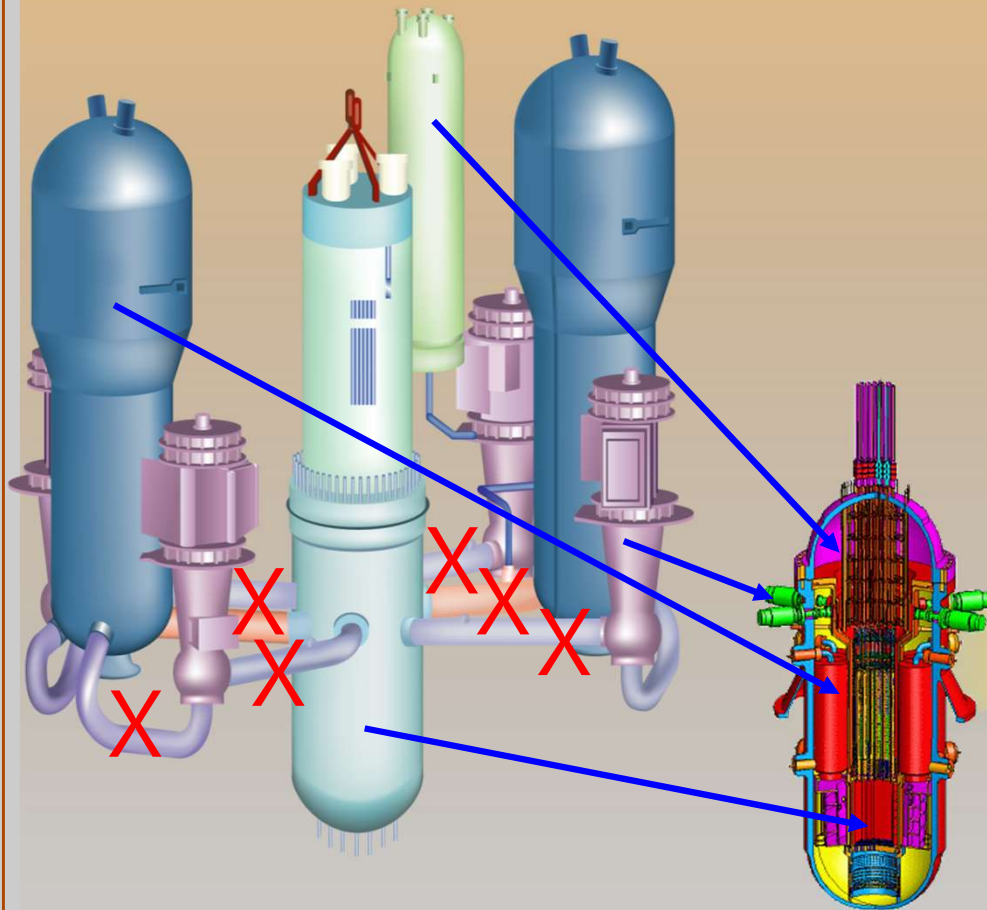


II. SMART Characteristics

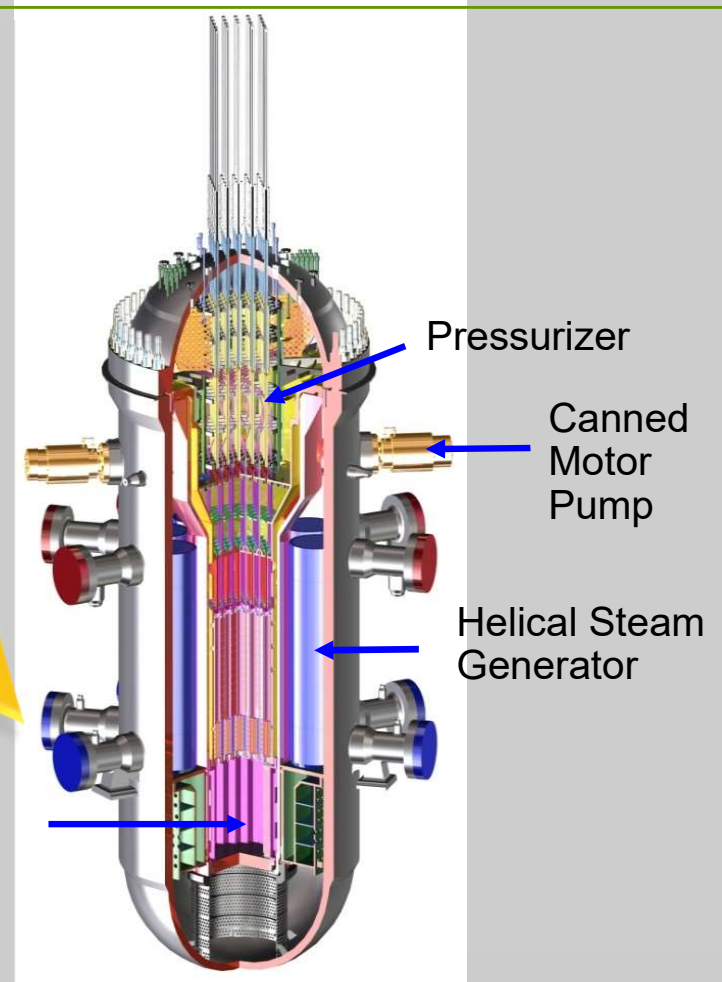


Reactor Vessel Assembly

Loop Type PWR

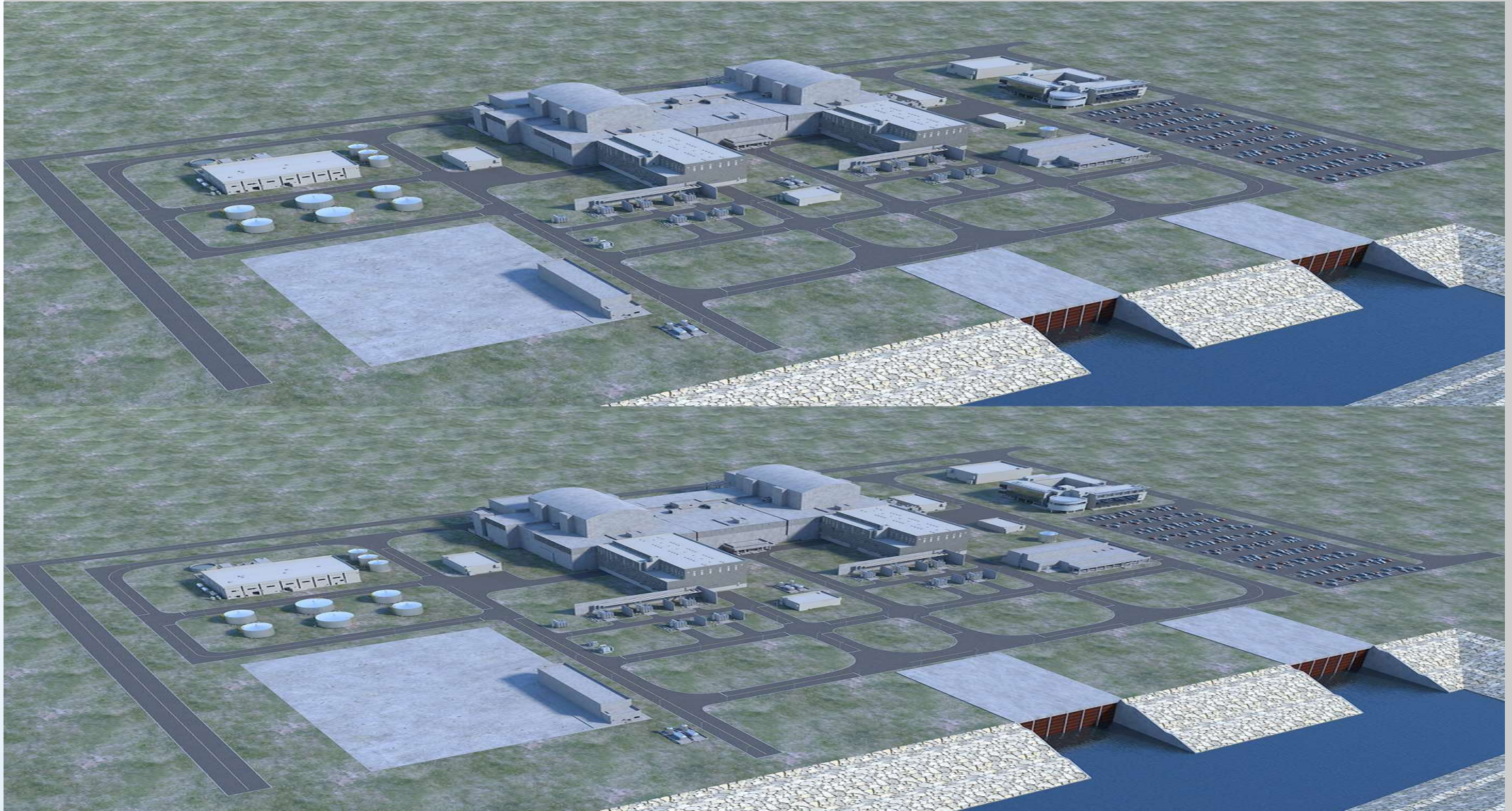


Core



Enhanced Reactor Safety: No LBLOCA

SMART FOAK Plant



SMART 1&2 UNITS (System-integrated Modular Advanced Reactor)

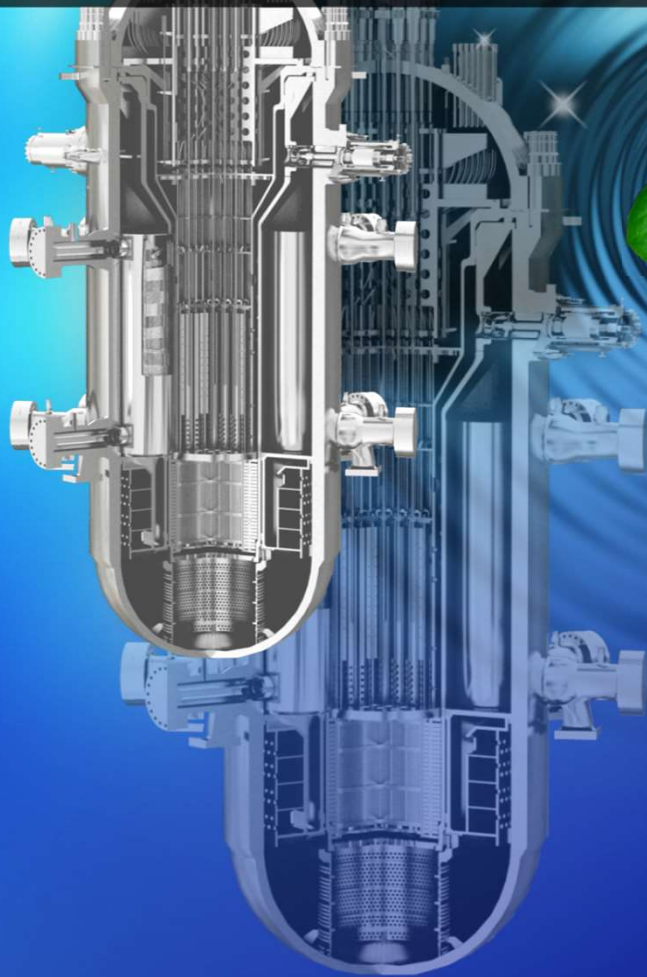


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الذرية والمتجددة K.A.CARE
King Abdullah City for Atomic and Renewable Energy



III. SMART Partnership with KSA



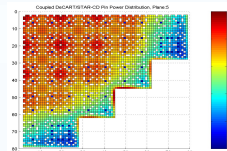
SMART Partnership

Technology Development

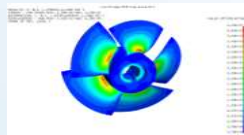
Korea

SMART Development

- SMART Standard Design
- Technology Validation Licensing
- Safety Enhancement for Post Fukushima Action Plan



Design Documents

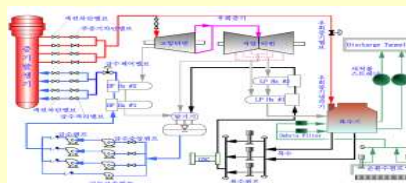


1997 ~ 2015

Korea & KSA

Pre-Project Engineering

- FOAK Engineering Design
- K.A.CARE HCB
- PSAR



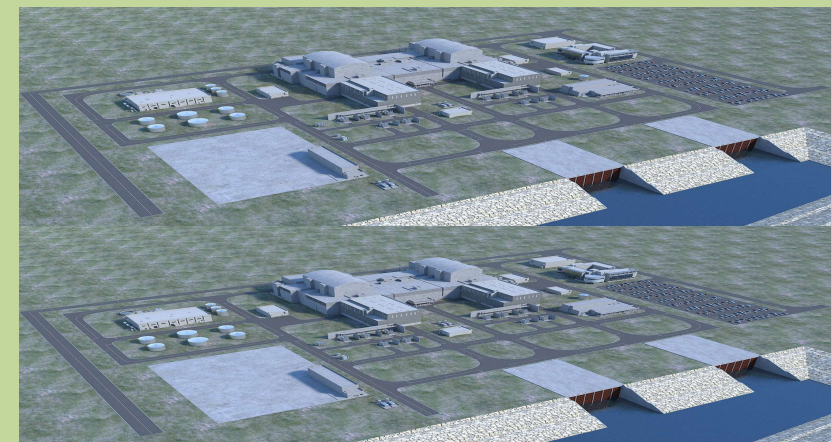
3 Yr

Technology Deployment

KSA

FOAK Plant Construction

- 2 FOAK Plants Construction
- Licensing (CP, OL)

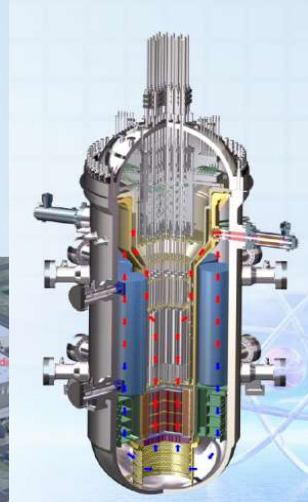


5~6 Yr

SMART PPE Project

❑ FOAK Engineering Design for SMART

- Project Period: 2015.12 ~ 2018.11(3 Years)
- Work Scopes
 - Reactor System Design
 - Fuel Design
 - Balance of Power Design
 - Main Component Design and Validation



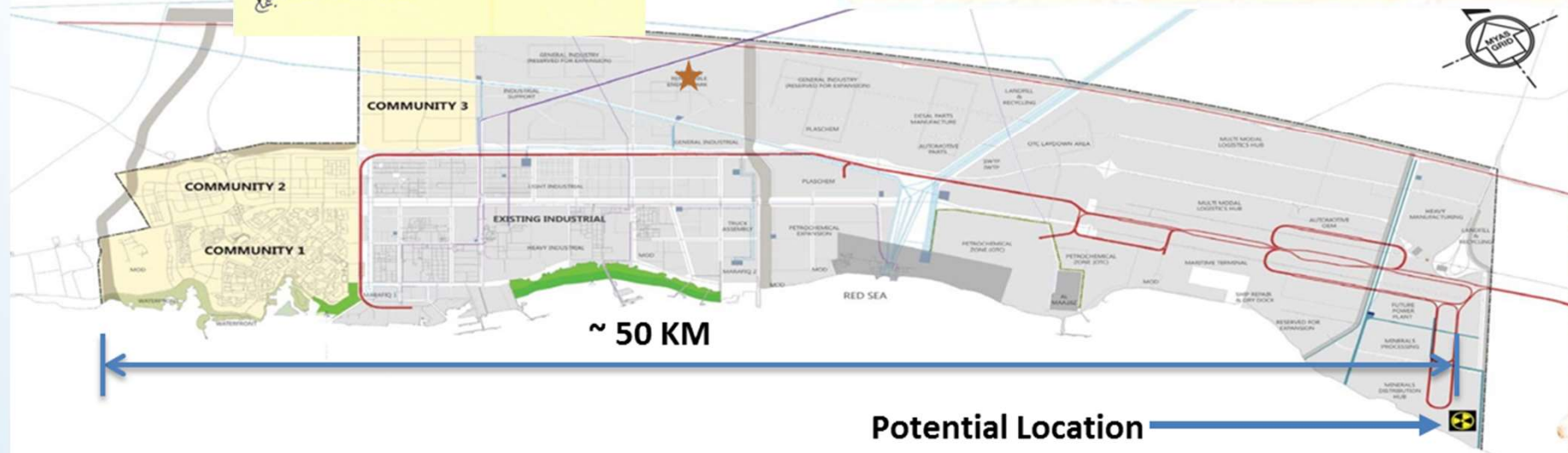
❑ Human Capacity Buildup for KSA Engineers

- CRT-Basic, CRT-Technical, OJT and OJP
- 41 Experts

The First Phase for SMART Partnership Cooperation

SMART Construction Site

□ Royal-Commission Yanbu



HCB for KSA



FY-2017 Weekly Task Report			
Design Group	Sub-group	Core Design	
Instructor's Name / Signature	Dr. Kyung-Won	DG Manager's Name / Signature	Bongseung, Kim
Engineer's Name / Signature	Mazen Abdullah Basmam		
This Week (05-29 to 06-02)	1. Cross flow and flow mal-distribution analysis using MATRA-S. - Submitted a calculation note about cross flow and flow mal-distribution. 2. Flow blockage analysis - Writing a calculation note about the flow blockage and DNBR. 3. Flow instability - A practical analysis of flow instability		
Next Week (06-05 to 06-09)	1. Flow blockage analysis - Submit a calculation note about the flow blockage and DNBR. 2. Reading assignment - OFI margin. 3. Preparation of analysis input data for Evaluation of the OFI margin.		
Remarks	1. By Engineer 2. By Instructor (if needed) 3. By Manager (if needed)		



SMART HCB Program - OJT -

1. OJT

DG OJT Plan provided by individual KAERI E-mail

Reference plan and individual schedule can be adjusted depending upon DG/Engineer discussion

Recommend to keep vacation periods for summer and winter

CRT-Technical (FD)

7 CD + 6 MD engineers only

2 In-house CRT @ KRC 3rd/4

Identical format w/ other CRT-Technical

DG-HCB Coordinator

Dr. Kang, Heung Taek

Material & S/W

DG will provide Material in PDF form

Identical to CRT-Technical

DG will install necessary S/W on PC or Server, if required

2. Newly assigned DG-HCB Coordinators

DG Manager (or Designated Instructor)

CD Dr. Koo, Bon Seung

MD Dr. Kim, Jong Wook

Dr. Lee, Kang Heon

Dr. Lee, Joon Koo

Dr. Kim, Young Jo

Dr. Choi, Hyun Joon

Dr. Bae, Kyu Heon

Dr. Lim, Sung Won

Dr. Kim, Sung Yeon

Dr. Park, Rae Joon

Dr. Park, Hyun Sik

Dr. Yang, Jin Hee

3. Assignments/Progress Check by Weekly Task Report

FY-2017 Weekly Task Report

Each Engineer prepares With

Signature

Important to understand task assigned

Do each assignment, keep due date

Due last Working Day of the Week

Reviewed and signed by

DG Manager or Designated Instructor

Signature

Due last Working Day of the following Week



FY-2017 Weekly Task Report			
Design Group	Sub-group	Core Design	
Engineer's Name / Signature	Dr. Kyung-Won	DG Manager's Name / Signature	Bongseung, Kim
This Week (05-29 to 06-02)	2D and 3D drawing of RPVA and RCHA using AutoCAD and Inventor software's. Drawing attached.		
Next Week (06-05 to 06-09)	Cont. 2D and 3D drawing of RPVA and RCHA using AutoCAD and Inventor software's.		
Notes	These drawing for RPV and RCH on the 3D drawing for RPV are quite good. confidence. If you have any questions or concerns about the drawings, please feel free to ask for additional information about our design.		

Questionnaire for Learning Achievement

HCB PROGRAM: On-the-Job-Training

experience and guide the planning of future course, we will ask you to

quantitative and qualitative characteristic. In the case of quantitative (time), please respond to each of the questions below by circling the

And, short-answer questions require you to write down your opinion.

as you can...

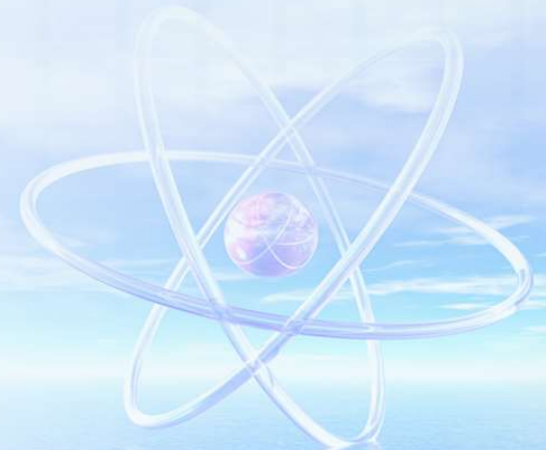
100% (e.g., BENE/Non-nuclear, i.e., BENE)

range after this course by marking the level of knowledge of before a higher knowledge level.

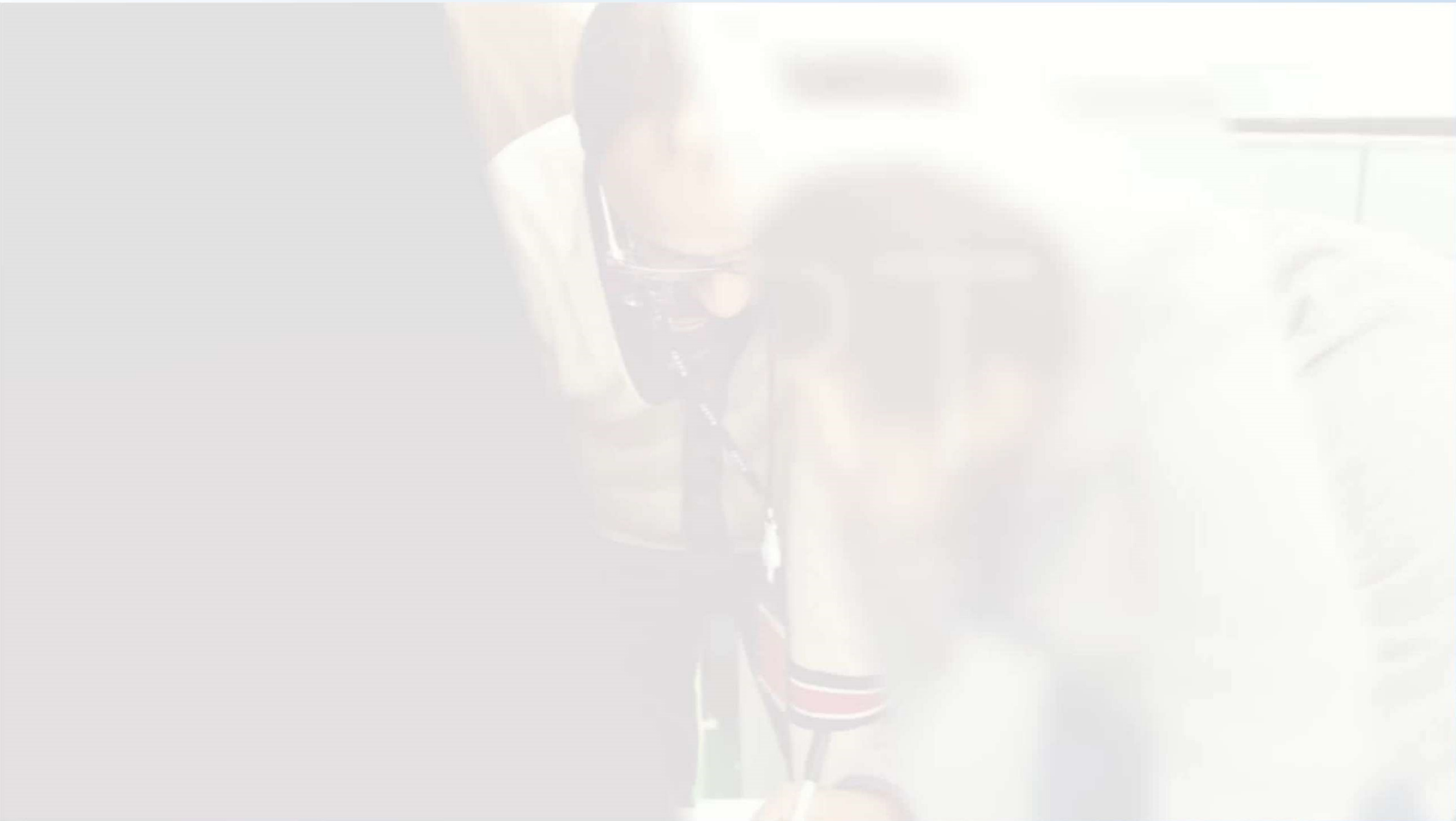
Subject	Before	After
1. Thermal margin analysis: analysis method	1	2
2. Thermal margin analysis: analysis model	1	2
3. Thermal margin analysis: analysis condition	1	2
4. Thermal margin analysis: fast running DNBR analysis code	1	2
5. Thermal margin analysis: fast running DNBR analysis code	1	2
6. Thermal margin analysis: fast running DNBR analysis code	1	2
7. Thermal margin analysis: fast running DNBR analysis code	1	2
8. Thermal margin analysis: fast running DNBR analysis code	1	2
9. Thermal margin analysis: fast running DNBR analysis code	1	2
10. Thermal margin analysis: fast running DNBR analysis code	1	2
11. Thermal margin analysis: fast running DNBR analysis code	1	2
12. Thermal margin analysis: fast running DNBR analysis code	1	2

SMART HCB for KSA

- ❑ **CRT-Basic (CRT1): *Completed***
 - **3 Months on Nuclear Engineering Fundamentals**
 - 12/June ~ 23/June/2016 (2 Wks) at Riyadh
 - 18/July ~ 23/Sept/2016 (9 Wks) at KAERI
- ❑ **CRT-Technical (CRT2): *Completed***
 - **3 Months on SMART Design Fundamentals**
 - 26/Sept ~ 23/Dec/2016 (13 Wks)
- ❑ **OJT : *Completed***
 - **6~12 Months on SMART Design**
 - 16/Jan/2017 ~ 22/Dec/2017
- ❑ **OJP : *Ongoing***
 - **6~17 Months for SMART PPE Design Participation**



HCB Training



Infrastructure for NPP

The IAEA Milestones Approach for Nuclear Power Infrastructure Development



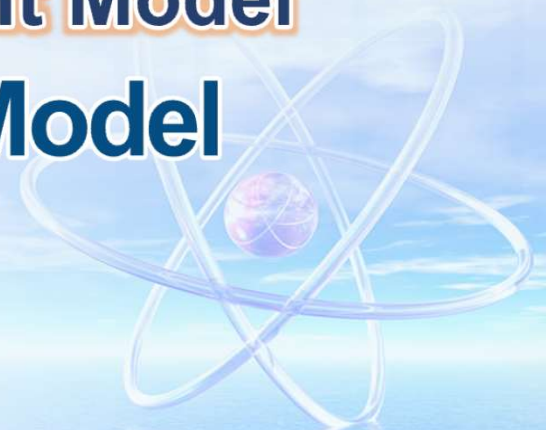
Challenge for Global Deployment

❑ Can a country, especially small country, establish all necessary infrastructure by itself?

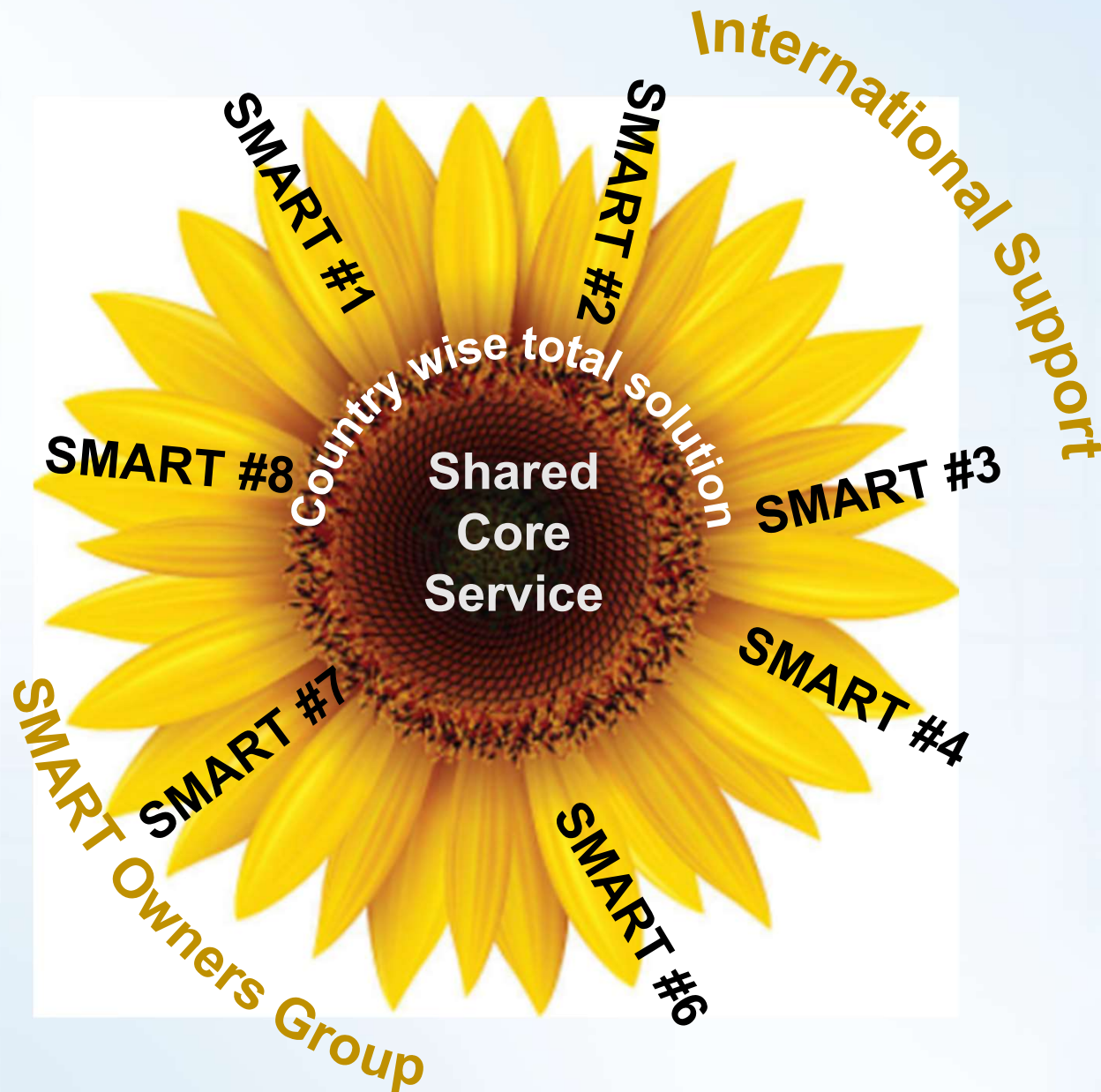
- Licensing and Regulation
- Operation and Maintenance
- Technical support and Emergency preparedness,
- Education and Training, Supply...

SMR Project Needs a New Deployment Model

→ **Multilateral Collaboration Model**

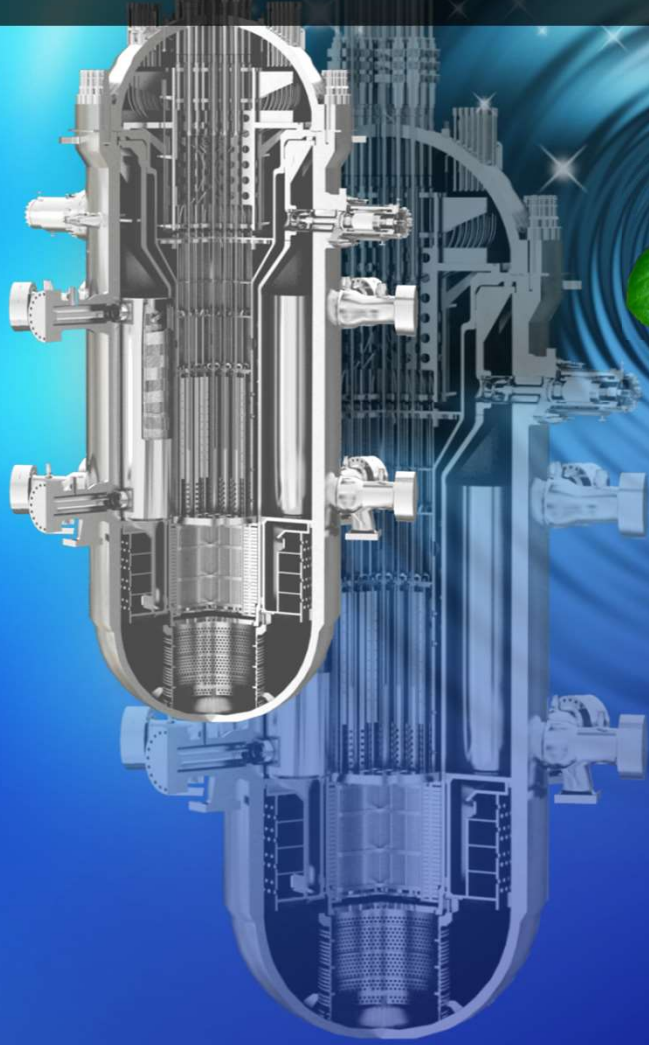


Multilateral Collaboration Model



- To support countries who don't have enough infrastructure
- Based on the SMART Partnership between ROK and KSA
 - Major Role for Core Service
- Run by SMART Owners Group with International Support
 - ❖ Shared Core Service
 - Maintenance
 - Training and Education
 - Licensing Support
 - ❖ Country-wise Total Solution

IV. Summary

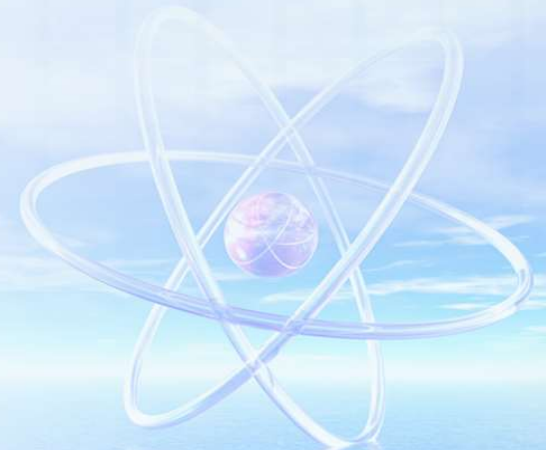


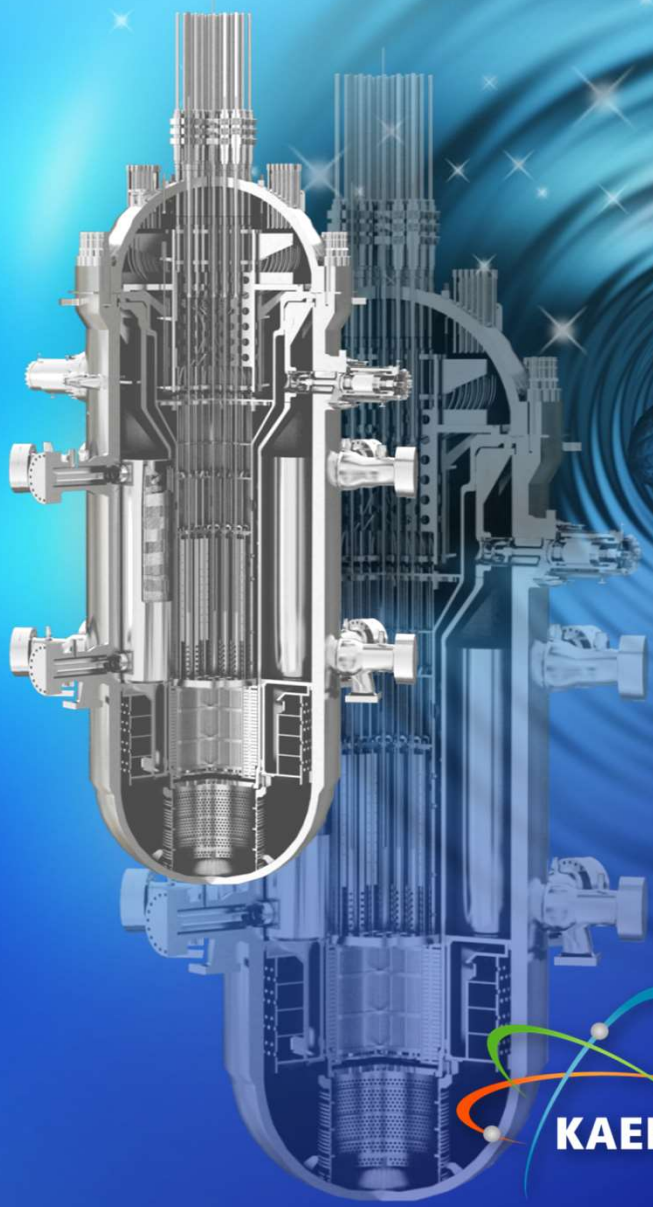
❑ SMART is Ready for Deployment.

- Advanced Small Size Modular Reactor
- All Technologies Implemented in SMART had been proven through Comprehensive Technology Validation Program

❑ SMART Partnership Cooperation with KSA

- SMART@KSA will be the lead plant for Global SMART
- Multilateral collaboration model





Thank you



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