

Team Korea for Nuclear Project

April 5

**Committee on Laying the Foundation for New and Advanced Nuclear
Reactors in the United States**

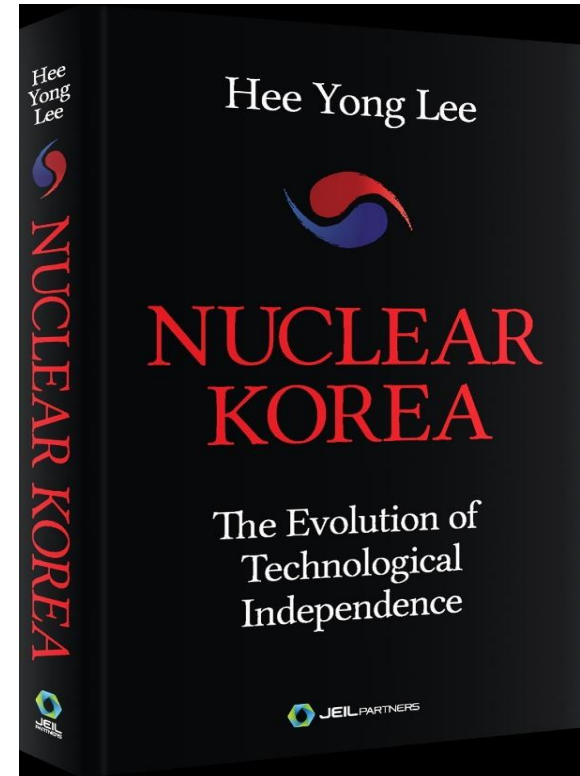
The National Academies of Sciences•Engineering•Medicine

Hee Yong LEE
0603barbi@gmail.com

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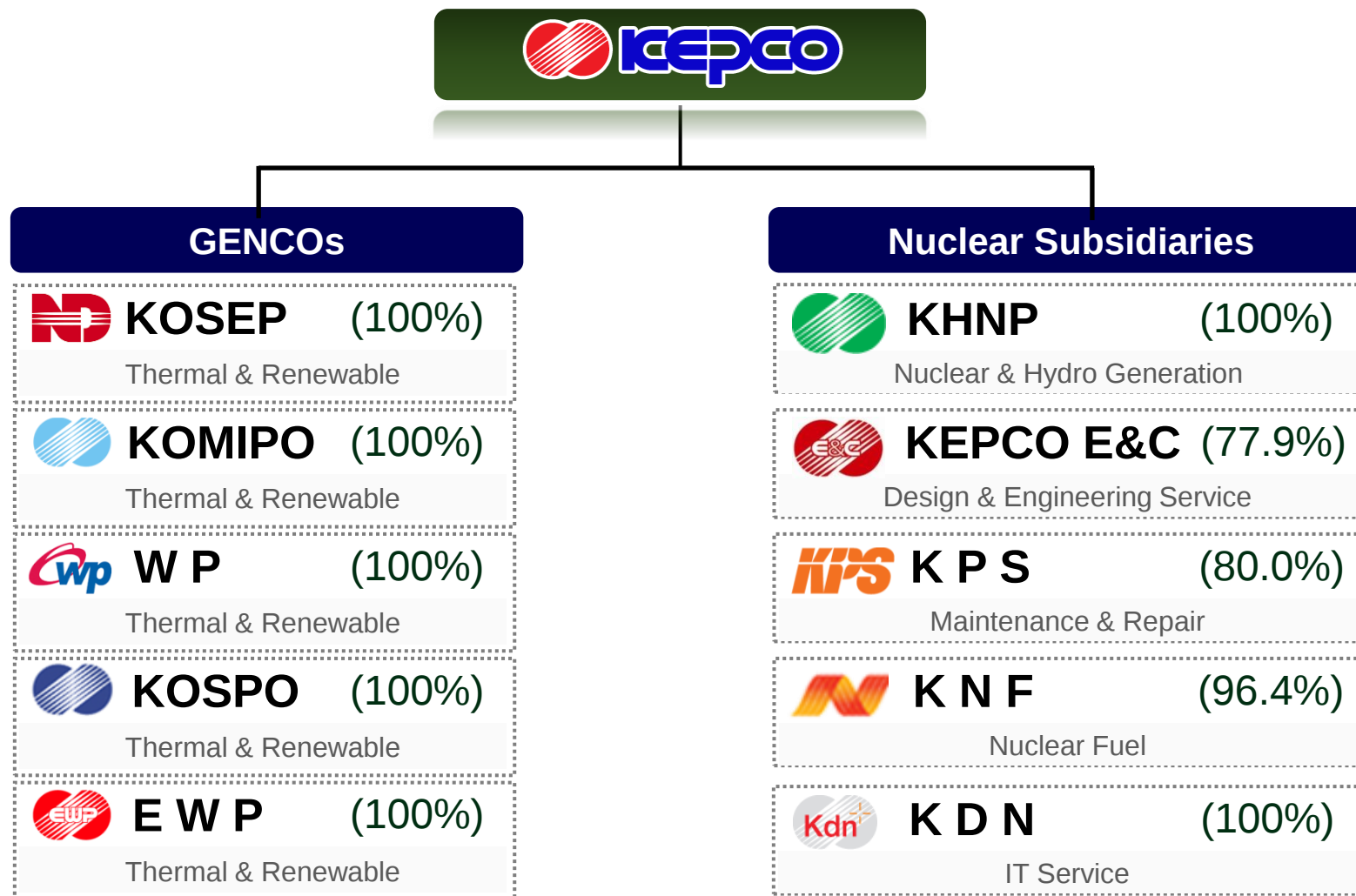
- Co-CEO of JEIL Partners
- Member of the Committee on Nuclear Power of ENEC in the UAE
- Former EVP of KEPCO(Korea Electric Power Corp)
- Contract award of BNPP project to construct 4 APRs.
- Nuclear export marketing in UK, Hungary, Turkey, Vietnam, India, Malesia, Egypt, etc
- Certified Senior Reactor Operator
- Professional Engineer for Nuclear Power Operation



- Description of nuclear power development of Korea from the introduction of the first unit until the first nuclear export

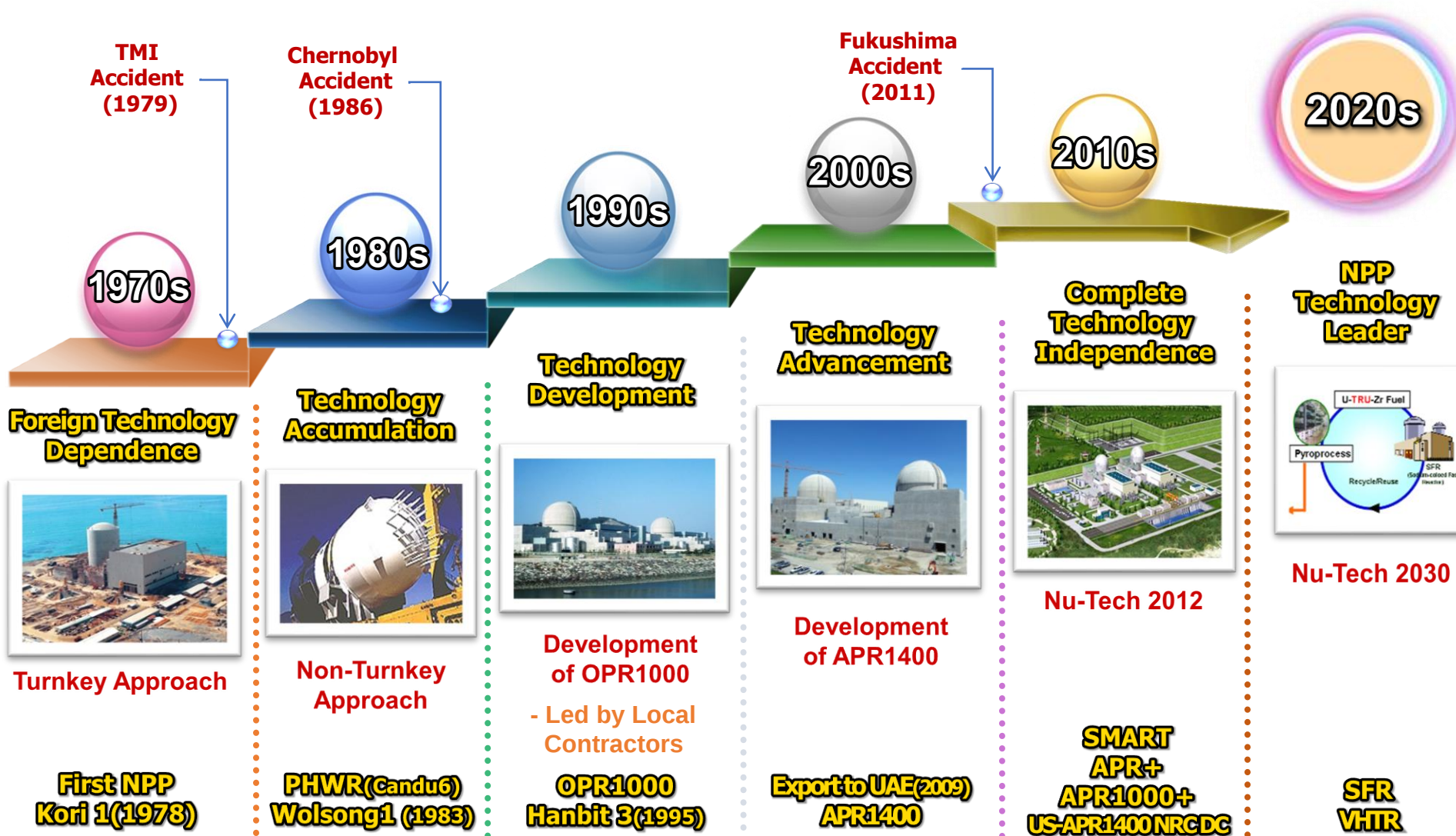
Overview of KEPCO(Korea Electric Power Corporation)





* () : % of KEPCO's ownership

Nuclear Technology Development in Korea



Reactor Technology in Korea

APR1400 (*Evolutionary Gen - III Reactor*)



Type	PWR
Design Life	60 Years
Electric Output	1,400 MWe
Construction Period (Nth)	54 Months
Seismic Design Basis	0.3 g



OPR1000 (*Proven Technology*)



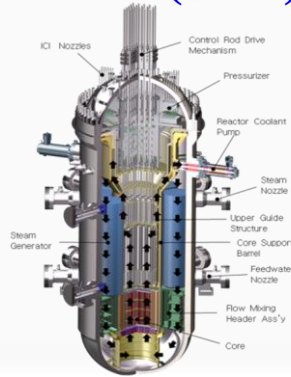
Type	PWR
Design Life	40 Years
Electric Output	1,000 MWe
Construction Period (Nth)	52 Months
Seismic Design Basis	0.2 g



- APR1400 : Advanced Power Reactor 1400MW
- OPR1000 : Optimized Power Reactor 1000MW

Reactor Technology in Korea

SMART (SMR)



Type	Integral PWR
Design Life	60 Years
Electric Output (Twin Module)	220 MWe(2x110)
Construction Period (Nth)	36 Months
Seismic Design Basis	0.3 g



- SMART : System integrated Modular Advanced Reactor

Nuclear Lessons Learned

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The Most Significant Lessons

- Follow-on replica stations are cheaper than first-of-a-kind
- The design must be mature and licensing issues resolved prior to start of construction
- Establish a highly qualified team to develop the design, secure the safety case, plan the procurement and build schedule in detail in collaboration with main contractors
- Ensure subcontractors are of high quality and experienced construction or are taught the necessary special skills and requirements for quality, traceability and documentation

Low Cost Plants

- Design at or near complete prior to construction
- High degree of design reuse
- Experienced construction management
- Low cost and highly productive labour
- Experienced EPC consortium
- Experienced supply chain
- Detailed construction planning prior to starting construction
- Intentional new build programme focused on cost reduction and performance improvement
- Multiple units at a single site
- NOAK design

High Cost Plants

- Lack of completed design before construction started
- Major regulatory interventions during construction
- FOAK design
- Litigation between project participants
- Significant delays and rework required due to supply chain
- Long construction schedule
- Relatively higher labour rates and low productivity
- Insufficient oversight by owner

Team Korea for Nuclear Project



Capacity of Team Korea

**On Time
Within Budget**

**Operation
Excellence**

**Robust Supply
Chain**

**Competitive
Construction
Cost**

**Localization
Support**

**Systematic
Project
Management**

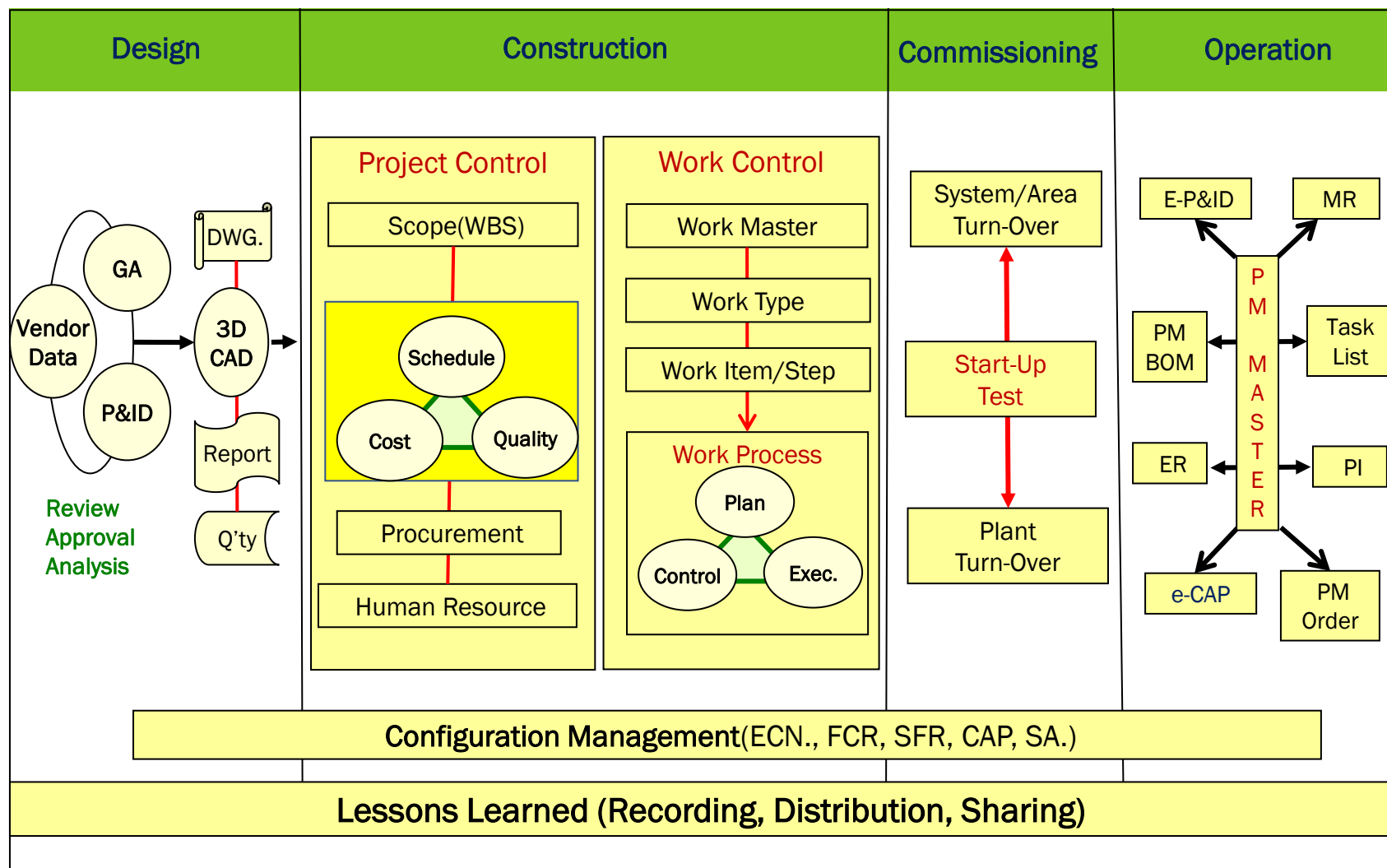
**Highly
Qualified
Experts**

**Advanced
Reactor
Technology**

**Continuous
Improvement**

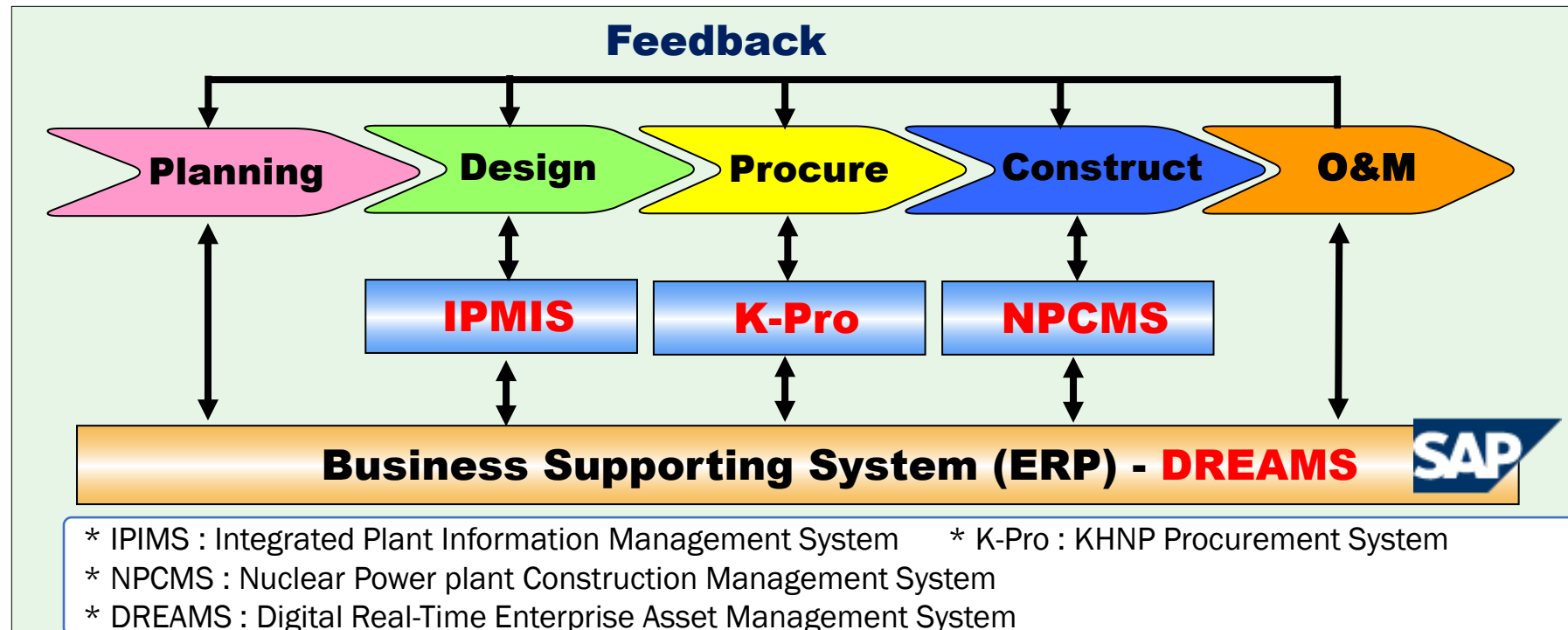
60 years
of Continuous Construction Experience

NPP Asset Life Cycle Management

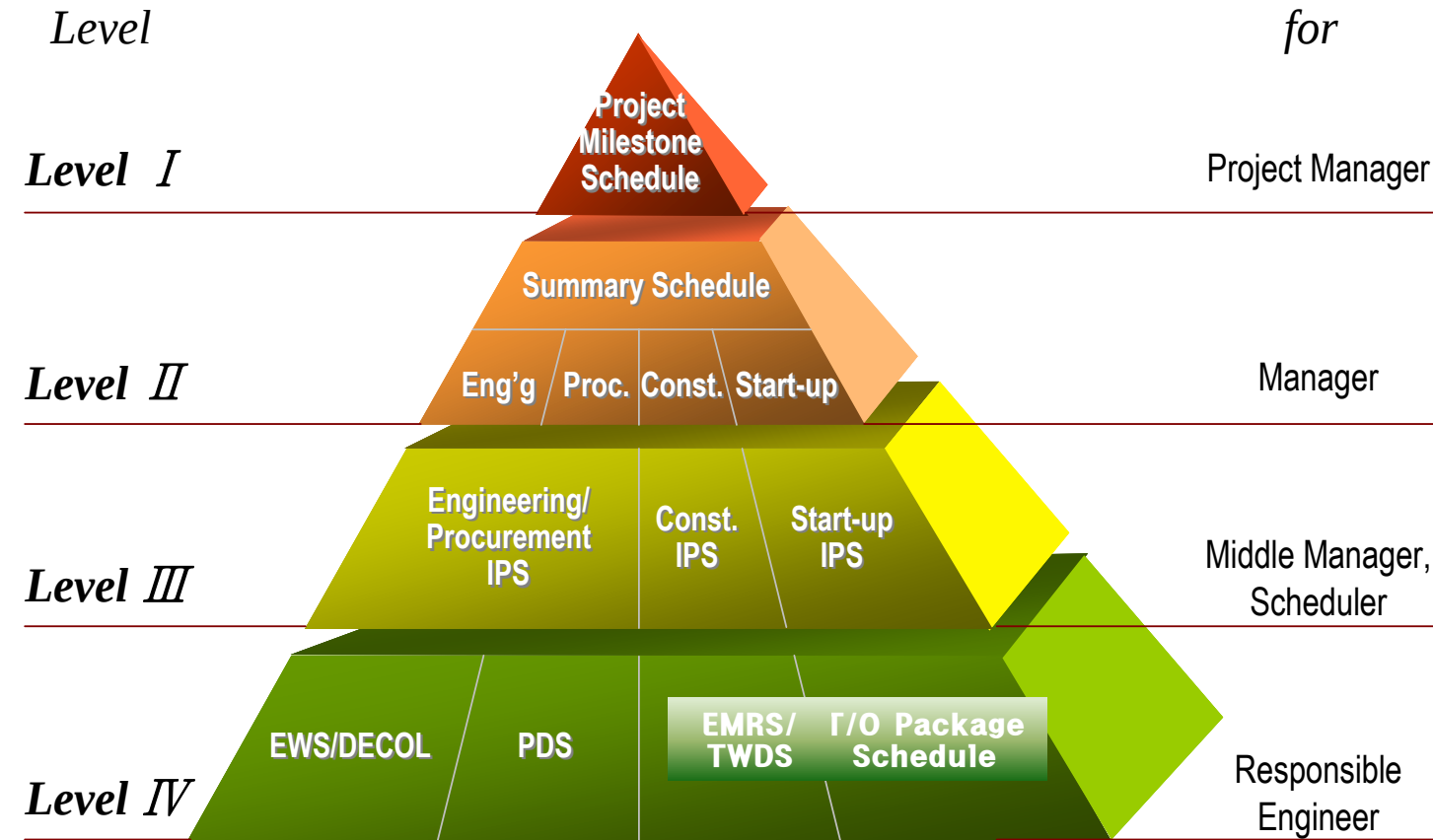


Information Management Sysytem

- **NPP typically operates for longer than 60 years**
 - ➔ In order to optimize operation cost and asset value of the NPP, efficient life cycle data management strategy is essential
- **KHNP has established and is operating the Information Management System**
 - ➔ Based on the 30-year experience of constructing and operating NPPs, and
 - ➔ Referred to the EPRI Advanced Light Water Reactor URD(Utility Req' Documents)



Project Schedule Hierarchy



IPS: Integrated Project Schedule
 EMRS: Eight Months Rolling Schedule
 DECOL: Detail Control Log

PDS: Procurement Detail Schedule
 EWS: Engineering Working Schedule
 TWDS: Three Weeks Daily Schedule

NPCMS of SKN 3&4 (Reference of APR1400)

원전건설관리시스템 - [신고리 3,4 서버]

KHNP 원전건설관리시스템 (NPCMS)

IT 조치내역 NPCMS업데이트 공지사항 조회 업무문의 ☎

건설운영개선(C-CAP) 0

공정관리 사공정보 건설자재 토목/건축 콘크리트 시험실 기계 배관 보온 전기/계측 케이블 비파괴검사 FCR 관리 SFR 관리 시운전/발전정보 시스템관리 34 건

종합공정률 조회		NPCMS 개선사항 조회	
☉ 2010년 08월말 기준			
구 분	계 획	실 적	달 성 률
설 계	90.90	90.89	99.99
구 매	81.78	81.86	100.10
시 공	45.20	45.61	100.91
시 운 전	0	0	0
사업종합	57.39	57.65	100.45

DREAMS NPCMS
Nuclear Power Plant Construction Management System

원전건설 사업정보 관리시스템 건설 KMS 종합 구성도 사용자 안내서 건설 서식 동영상 자료실 Q&A 결재건수 조회 재접속 종료

NPCMS of BNPP Based on Reference Plants



Major Nuclear Components of Doosan Heavy Industry

NUCLEAR STEAM SUPPLY SYSTEM

- Reactor Vessel
- Steam Generator
- Reactor Coolant Pump
- Man Machine Interface System
- Reactor Internals
- Control Element Drive Mechanism
- Integrated Head Assembly
- Pressurizer
- Primary Piping
- Fuel Handling System Equipment



BALANCE OF PLANT

- Heat Exchangers
- Pressure Vessels & Tanks
- Gas Stripper
- Boric Acid Concentrator
- Moisture Separator Reheater

FUEL STORAGE

- New and Spent Fuel Racks
- Spent Fuel Transportation Cask / Canister



Experienced BOP Vendors

PKG	ITEM				
C208	Containment Liner Plate	H285	Waste water treatment	M205	Turbine operated feedwater pump
C210	Stainless Steel Liner (RTM)	J202	radiation monitoring system	M206	Aux feedwater pump
C215A	Piping Support	J204	Sampling system	M208	Condensate pump
C215B	Non-Safety Piping Support	J205	CCTV	M210	Screen wash pump
C215C	Snubber(RTM)	J206	Ultrasonic transducer	M212	Centrifugal pump
E201	Power Transformer	J209A	AHU control panel	M214	Diesel oil pump
E204	Distribution Transformer	J216	Ultrasonic Level Measurement System	M220	Circulation water pump
E207	HV Breaker Control	J217A	Level gauge	M220S	Sea water bypass pump
E208	LV Breaker Control	J217C	Ultrasonic Level Measurement System	M224	Air compressor
E209	Motor Control Panel	J218	Orifice	M226	Non-safety class chiller
E210	Isolated Phase Bus	J219	Differential pressure gauge	M227	Sfaety calss chiller
E211	Generator Breaker	J221	Gauges (Temperature Pressure)	M228	Feedwater reheater Dearator
E212	Battery	J224A	Safety related Pitot Tube	M229A	Non-safety class heat exchanger
E214	Safety class charger and Transformer	J224B	Non-safety class Pitot Tube	M229B	Non-safety class heat exchanger
E215	Non-Safety class charger and Transformer	J225	Flow meter	M232	Aux boiler
		J226	Thermal dispersion type gas flow meter	M233A	Water treatment system
		J227	Safety class temperature transmitter		

Human Resource Development

Industry

KINGS

International Nuclear Graduate School

- Nuclear Business & Technology Expert
- Master's/Doctoral Courses

KHNP (Korea Hydro & Nuclear Power Co.)

Nuclear Power Education Institute

- NPP Construction & O&M Personnel

Nuclear Site Training Center (4 facilities)

- Operator / Local Engineer

KPS (Korea Plant Service & Engineering Co.)

Nuclear Training Center

- Nuclear Maintenance Engineer

Institute/Academy

KAERI (Korea Atomic Energy Research Institute)

Nuclear Training & Education Center

- Nuclear Policy and R&D Manpower
- International Nuclear Training Program

KINS (Korea Institute of Nuclear Safety)

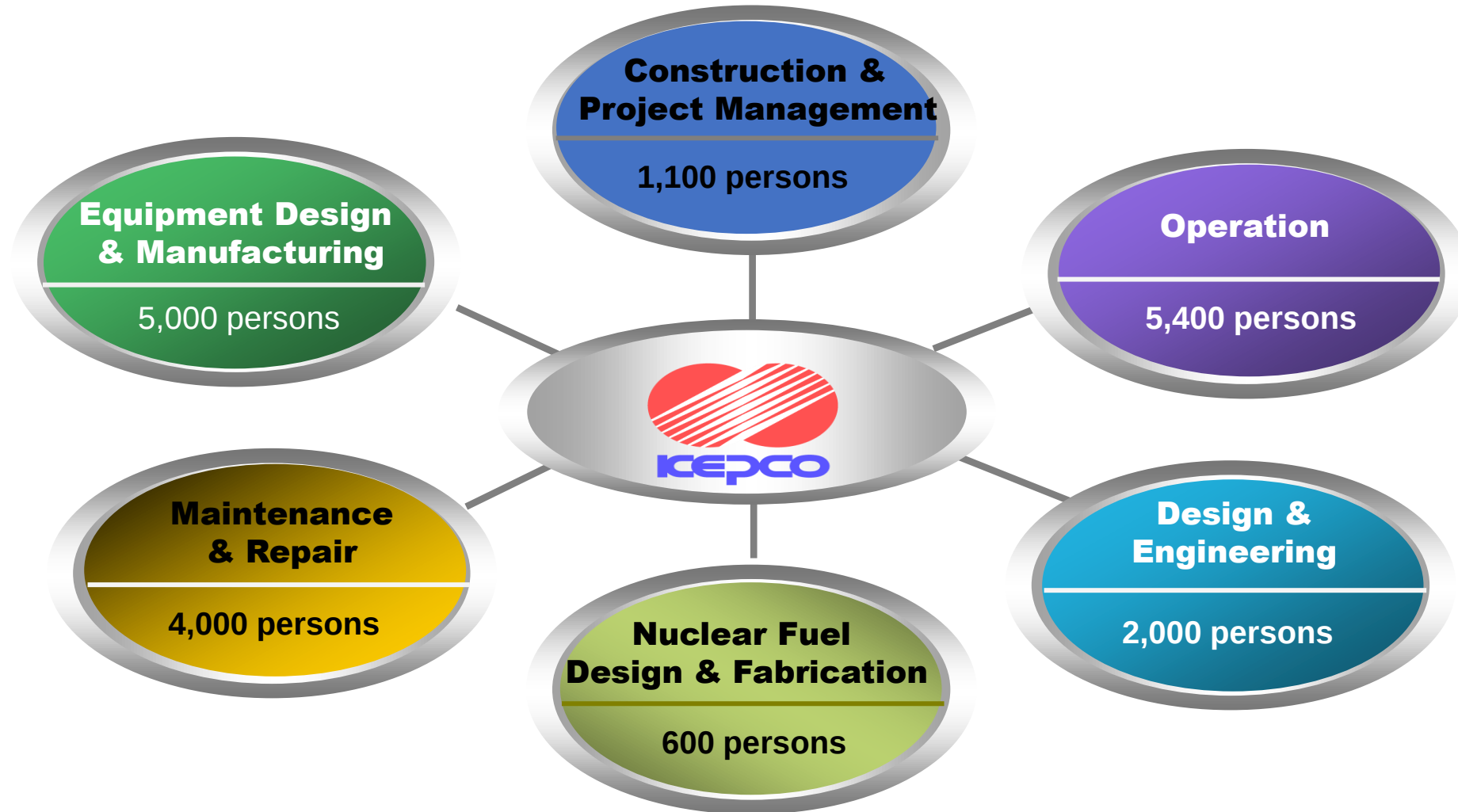
International Nuclear Safety School

- Nuclear Safety & Regulatory Manpower
- International Nuclear Safety Master's Program

Universities

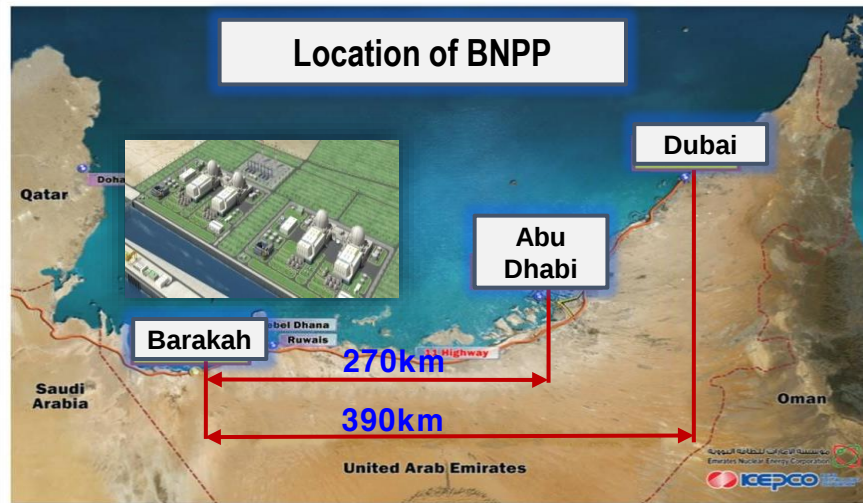
- Seoul National University
- Korea Advanced Institute of Science & Tech. (KAIST)
- Hanyang University
- Kyung-Hee University, etc

Human Resource Pool in Korea



UAE BNPP Project

Overview



Owner

Emirates Nuclear Energy Corporation(ENEC)

Prime Contractor

KEPCO

Scope of Supply

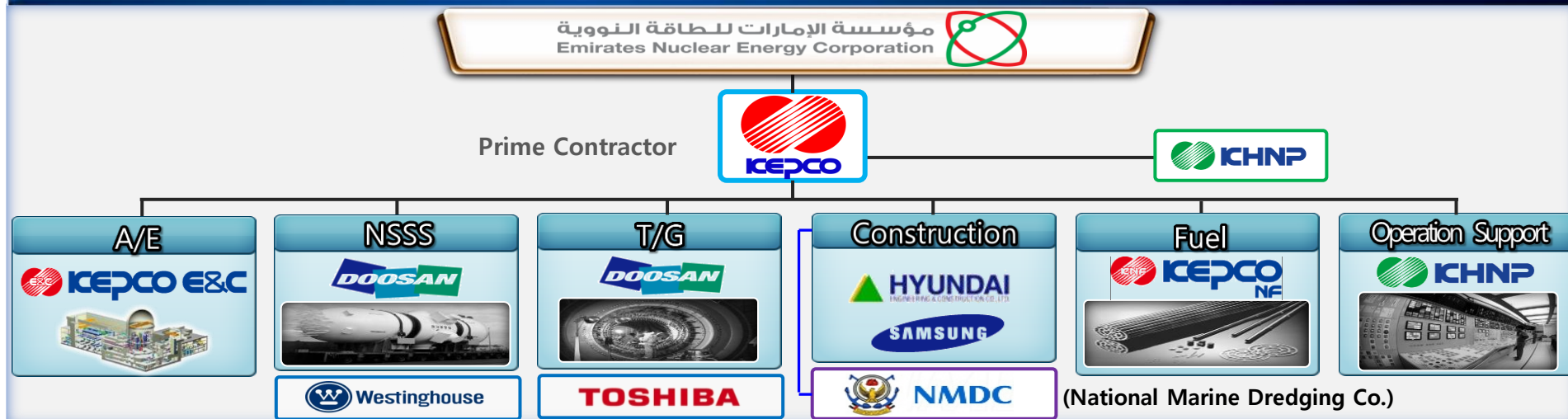
- APR1400 X 4 Units (5,600MW)
- Nuclear Fuel(initial core + 2 reloads)

Target Completion date

May 1, 2017(Unit 1)

* Units 2-4 will be completed consecutively for each year after Unit 1 is complete

Project Structure for Construction



Mindset of Team Korea

- **Ownership and accountability**
- **Work done first**
- **Field centered**
- **Family mind**
- **Sacrifice oneself**
- **Succession**
- **Feedback & feedback**



Bibimbob Culture : Put together, Mix and Share

