# CANDU ADVANCED FUEL R & D PROGRAMS FOR 1997 - 2006 IN KOREA

**H. C. SUK, M. S. YANG, K-S. SIM and K. J. YOO**

**Korea Atomic Energy Research Institute**
**P.O. Box 105, Yusong, Taejon, Korea(R.O.K.), 305-600**

## ABSTRACT

*KAERI has a comprehensive product development program of CANFLEX and DUPIC fuels to introduce them into CANDU reactors in Korea and a clear vision of how the product will evolve over the next 10 years. CANDU reactors are not the majority of nuclear power plants in Korea, but they produce significant electricity to contribute Korea's economic growth as well as to satisfy the need for energy. The key targets of the development program are safety enhancement, reduction of spent fuel volume, and economic improvements, using the inherent characteristics and advantages of CANDU technology. The CANFLEX and DUPIC R & D programs are conducted currently under the second stage of Korea's Nuclear Energy R & D Project as a national mid- and long-term program over the next 10 years from 1997 to 2006. The specific activities of the programs have taken account of the domestic and international enviroment concerning on non-proliferation in the Peninsula of Korea. As the first of the development products in the short-term, the CANFLEX-NU fuel will be completely developed jointly by KAERI/AECL and will be useful for the older CANDU-6 Wolsong unit 1. As the second product, the CANFLEX-0.9 % equivalent SEU fuel is expected to be completely developed within the next decade. It will be used in CANDU-6 reactors in Korea immediately after the development, if the existing RU in the world is price competitive with natural uranium. The DUPIC R & D program, as a long term program, is expected to demonstrate the possibility of use of used PWR fuel in CANDU reactors in Korea during the next 10 years. The pilot scale fabrication facility would be completed around 2010.*

## 1. INTRODUCTION

As a country lacking of natural resources, Korea has made the development of nuclear energy a national priority to fill economic growth and satisfy increasing energy consumption in the future and to ensure self-reliance of energy supply. The nuclear program of Korea will remain in the coming 30 years at least as important and vital as it is today. The current status of Korea's nuclear power plants as of 1997 September is shown in Table 1. In Korea, twelve nuclear power plants, 10 PWRs and 2 CANDU-PHWRs(Canada Deuterium Uranium - Pressurized Heavy Water Reactors), are currently in operation, and 4 PWRs and 2 CANDU-PHWRs are under construction. The current operating power plants represent a total installed generation of 10,316 MWe which accounts for about 28 percent of the domestic installed generating capacity. The 1996 annual gross etectrical energy generation in Korea was 205,494 GWh of which 36 percent was produced by the nuclear power plants. In 2002, Korea will have a total installed nuclear power generation capacity of 15,742 MWe of which 18 % will be contributed by the 4 Wolsong CANDU-PHWRs as shown in Table 1.

Along with the active nuclear power programs, nuclear power plant and fuel technologies have been successfully developed for the localization and industrialization in Korea. For example, Korea Atomic Energy Research Institute (KAERI) successfully developed CANDU-6 fuel technology during 1981 to 1986 and then commercially produced and supplied more than 45,000 CANDU-6 bundles to Wolsong-1 during 1987 to 1996. As a first national project for more intensive, efficient and active development of nuclear energy, a Korea's Nuclear Energy R & D Project was established with the approval of Korea Atomic Energy Committee in 1992 June. It has been mainly performed by KAERI until 1997 July. For example, KAERI has successfully carried out the CANFLEX(CANDU Flexible Fuelling) and DUPIC(Direct Use of spent PWR Fuel in CANDU) fuel development programs under the national R & D project.

Korea's nuclear energy industrial structure was reformed at the end of 1996 as a follow-up of the national policy. For example, KAERI's commercial activities of CANDU fuel fabrication and PWR fuel design transferred to Korea Nuclear Fuel Company(KNFC). Also, the NSSS design and nuclear waste handling activities also moved to Korea Power Engineering Company, Inc. (KOPEC) and Korea Electric Power Corporation(KEPCO), respectively. In addition, the first Korea National Nuclear Energy R & D Project was reviewed by Korea Ministry of Science and Technology (MOST). Then, with the approval of the Korea Atomic Energy Committee, it expansively moved to the second stage of Korea's Nuclear Energy R & D Project for the next 10 years from 1997 to 2006. The Management Committee of the Korea National Nuclear Energy R & D Project decided on two main programs in the field of CANDU fuel technology to continue in the second stage of the national R & D project : (1) Technology Development of CANDU Advanced fuel as the CANFLEX-NU, -RU and -SEU fuel, (2) Technology Development of DUPIC fuel cycles. The following sections describe KAERI's product development directions and future prospects of CANDU advanced fuel with the background of selecting the two programs, including some product development guidelines by domestic and international environment concerning non-proliferation in the Peninsula of Korea.

## 2. PRODUCT DEVELOPMENT GUIDELINES BY DOMESTIC AND INTERNATIONAL ENVIRONMENT

Taking into account the domestic and international environment concerning non-proliferation in the Peninsula of Korea, some product development guidelines of the CANDU advanced fuel R & D may be summarized as i) enhancement of reactor and fuel safety and operation margin, ii) reduction of annual production rate of spent fuel volume, iii) no involvement and no use of enrichment and reprocessing technologies in Korea, iv) to be compatible with existing reactor without major change of hardware, v) improvement of economics by means of reduction of fuel cycle and/or reactor operating costs, and vi) consideration of future long term potential of nuclear fuel technology in the 21st century. These guidelines for fuel and fuel cycle R & D in Korea have been and will be applied not only for the CANDU advanced fuel R & D but also for the R & D of PWR fuel and others.

## 3. CANFLEX-NU FUEL DEVELOPMENT

Since 1992 February, KAERI and AECL(Atomic Energy of Canada Limited) have conducted the Joint CANFLEX Development Program (JCDP) to complete the development and proof testing of the fuel bundle to facilitate the use of natural uranium (NU), slightly enriched uranium (SEU) and other advanced fuel cycles in CANDU reactors. The AECL/KAERI JCDP Agreement was renewed to complete the CANFLEX-NU fuel development in 1996 September. CANFLEX is a new, 43-element fuel bundle designed to provide lower fuel ratings and higher critical heat flux (CHF) than the current 37-element bundle [1,2], and thus provide larger operating margins in CANDU reactors. The detailed description of the CANFLEX fuel bundle will be presented in Session 2 A of this Conference. The planned development testing of the CANFLEX-NU bundle is now nearing completion, and the next step is a small-scale demonstration in a CANDU-6 reactor. The remaining work scope for use of CANFLEX-NU fuel in Korea shall be completed within Phase 1 from 1997 July to 2000 March as follows:

(a) Documentation
- Safety Report will be produced by KAERI and reviewed by AECL
- Fuel Design Report will be produced by KAERI
- Physics Design Manual will be produced by KAERI and approved by KAERI and AECL jointly.
- In- and Out-Reactor Test Reports will be produced by KAERI and AECL, and approved by KAERI and AECL jointly.

(b) Tests for the design verification and/or characterization
- Endurance tests at KAERI
- Power ramp irradiation tests at AECL
- Water CHF tests will be carried out by AECL and KAERI jointly

(c) Licensing : Korean Government design approval

(d) Demonstration irradiation in a power reactor : On-going discussion with KEPCO.

## 4. CANFLEX-SEU AND -RU FUEL DEVELOPMENT

To prepare for the introduction of advanced fuel cycles such as slightly enriched uranium (SEU) including recovered uranium(RU), as an economical alternative to natural uranium as a fuel for existing or future CANDU reactors, KAERI and AECL also agreed a joint CANFLEX-SEU fuel development program in 1996 September. The prime objective of this joint program is the small-scale demonstration irradiation in a CANDU power reactor of 20 to 100 bundles of CANFLEX-0.9 % Equivalent SEU, followed by selective post irradiation examination of selected irradiated bundles. This is a necessary prerequisite to a full-scale conversion to CANFLEX-SEU. The program includes the necessary analysis and out-reactor tests. Also, in parallel with the agreement on AECL/KAERI joint CANFLEX-SEU fuel development program, a cooperative program was agreed between KAERI and BNFL (British Nuclear Fuels Plc) in 1996 November, as a similar cooperative agreement between AECL and BNFL, to complete the development and proof testing of recovered uranium fuel for CANDU reactors. The three Parties, KAERI, AECL and BNFL have implemented the three agreements to create one joint cooperative program.

The 0.9 % level of SEU or RU enrichment achieves most of the benefits of the optimal enrichment(around 1.2 % SEU), and is technically easier to introduce into an operating CANDU reactor. In particular, fuel management with 0.9 % SEU or RU is particularly simple, and the transition from a NU core to 0.9 % SEU or RU is expected to be straight forward [3, 4, 5]. Also, the fuel performance at this level of enrichment (corresponding to a bundle-average burnup of around 14 MWd/kgU for SEU fuel and 13 MWd/kgU for RU fuel) is not expected to be significantly different from the NU fuel. That is, the SEU and RU economic benefits associated with extended burnup, improved uranium utilization, and reduced spent fuel volume in CANDU are expected.

The composition of RU, as a by-product of conventional reprocessing, depends on the reactor type, initial enrichment, and discharge burnup of the reprocessed fuel. Un-enriched RU is only slightly more radioactive than NU. Having a potential for the direct conversion to $UO_2$, the RU from reprocessed PWR fuel has a nominal U-235 content of 0.9 %, and can be used in CANDU reactors without re-enrichment and with elimination of enrichment tails. Since CANDU spectrum is less sensitive to U-236 absorption, the U-235 content of RU would be burned down to low levels(0.2~0.3 %) in CANDU, compared to PWRs (0.8~1.0 %)[4]. Planned annual production of RU from reprocessing in Europe and Japan of spent oxide fuel will increase to about 3,000 t/a by the turn of the century. The cumulative quantity of RU available by 2000 will be about 25,000 t. To put this in perspective, annual refuelling requirement for RU fuel burnup of 13 MWd/kgU in a CANDU-6 is around 50 t/a. In other words, the annual spent fuel volume of RU fuel in the CANDU-6 is 60 % of that of NU fuel. Therefore, there should be no impediment to the use of RU fuel in Wolsong CANDU-6 reactors, if the RU fuel development and proof testing is completed and also if the cumulative quantity of RU in the world is available and also if it competes with natural uranium in price.

Anticipating the advantages of the use of each of these fuel cycle options for CANDU reactors in Korea, the CANFLEX-0.9 % enriched SEU and RU fuel development program is scoped into three phases for next 10 years as follows:

(1) Phase 1 for 1997 July to 2000 March : According to Phase 1 workscope recommended by the Management Committee of Korea's Nuclear Energy R & D Project, the related technologies and/or methodologies shall be established to lead them to the detailed design and analysis in Phase 2. Particularly, it shall show the overall evaluation and identification of the potential benefits, risks, and costs associated with the use of 0.9 % enriched SEU or RU to a CANDU-6 utility, in order to provide a rationale for the justification of the R & D efforts on it for the advanced fuel cycle of CANDU reactors in Korea. The justification includes security of supply issues for 0.9 % enriched SEU and RU. Also, it shall show the overall possibility to satisfy the licensing issues described in Korea Safety Review Guideline :

- (a) Compatibility with current operating reactors : Impacts on reactor control system, cooling system and thermal margin, pressure tube and calandria tube, fuelling machine, and spent fuel storage due to increased decay heat.
- (b) Radiation protection : Fuel fabrication, transport between fuel fabrication plant and reactor site, and fuel handling at site.
- (c) Safety : Power coefficient, consequence of LOCA(power pulse), and impact on exclusion area boundary due to increased fission product.
- (d) Design and Analysis tool : Validation of fuel design, reactor physics, safety and thermalhydraulics analysis codes and their reasonable uncertainty.
- (e) Fuel design & management : Fuel integrity at extended burnup and fuel management.
- (f) Operation : Reactivity feed back effect due to perturbation.

(2) Phase 2 for 2000 April to 2003 March : In Phase 2, the detailed fuel design, reactor physics, thermalhydraulics, and safety analyses, proof testing, and code validations will be performed to lead the small-scale demonstration irradiation in a commercial power reactor, if the overall evaluation and identification of the potential benefits, risks, and costs were shown in Phase 1. But this task will not be fully completed in Phase 2.

(3) Phase 3 for 2003 April to 2006 March : In this phase, the remaining workscope will be completed, and the fuel design licensing as a part of the Korean licensing process will be obtained. If the results from Phases 1 and 2 show sufficient merit, and if KEPCO is willing to participate in the small-scale demonstration, then a business case will be started in Phase 3 for which the business workscope would be drafted. Activities would include preparation of all safety and licensing documentation for irradiation of 20 to 100 bundles in a CANDU-6 reactor, including interaction with the Korean licensing authorities, and fabrication of those bundles in KNFC. Specific activities could be:

- detailed licensing analysis for small-scale demonstration irradiation (fuel design and performance, reactor physics, thermalhydraulics, safety etc.);
- provision of fuel loading licensing documentation
- fuel loading licensing approval;
- KNFC's fuel fabrication of bundles for small-scale demonstration irradiation
- identification by fabricators of infrastructure, strategy and cost for large-scale commercial fabrication;
- recommendation and decision on large-scale fabrication and irradiation.

In parallel with the R & D activities mentioned above, this Phase will briefly assess and review for an advanced fuel cycle equal to and/or higher than 1.2 % equivalent SEU cycle to reduce the annual production rate of spent fuel volume from CANDU reactors in Korea as much as that from PWRs in Korea. Also, it will review the option of extending the U-235 indefinitely through the use of fuel cycles based on thorium in Korea.

## 5. DUPIC FUEL CYCLE TECHNOLOGY DEVELOPMENT

Considering that spent PWR fuel contains enough fissile materials to be burned in a CANDU reactor, DUPIC[6,7] involves converting the spent PWR fuel into CANDU fuel by a thermal-mechanical dry process without any wet chemical processing. The potential benefits of the DUPIC fuel cycle in comparison with conventional wet reprocessing are (1) proliferation resistance due to the non-separation of the uranium, plutonium and fission products during the fabrication process, (2) a small amount of radioactive waste due to the nature of dry processing. Moreover, it will reduce the quantity of spent fuel to be disposed by utilizing spent PWR fuel and increasing the burnup in CANDU. It will also improve uranium resource utilization as a result of the natural synergism between PWR and CANDU-PHWR fuel cycles in Korea.

DUPIC fuel cycle development has been conducted in a tripartite cooperation between KAERI, AECL and the US Department of State. They have examined several possible DUPIC fuel options during the feasibility stage. These include converting the spent PWR rods into CANDU fuel bundles with or without double cladding; vibratory packing of milled PWR pellets into fresh CANDU sheaths; and thermal-mechanical processing of the spent PWR pellets to form sinterable CANDU pellets. All options were judged to be technically feasible, and the last option, called "OREOX"(oxidation/reduction of oxide fuel) was chosen for further study[7]. The current performance verification study in the tripartite cooperation involves fabricating elements and bundles, to confirm technical feasibility of the process, to optimize the process, and to obtain technical information that would enable an economic comparison to be made with alternate technologies[8].

Considering the potential benefits for use of DUPIC fuel cycle option for CANDU reactors in

Korea, the DUPIC fuel cycle technology development program[8] is also scoped into three phases for next 10 years as follows:

(1) Phase 1 for 1997 July to 2000 March : According to Phase 1 workscope recommended by the Management Committee of Korea Nuclear Energy R & D Project, the technologies and equipment related to the fuel design, reactor physics analysis, and laboratory scale fabrication and processing will be developed in the sub-programs of technology development. These include reactor physics and compatibility assessment of the fuel with CANDU-6 core, fuel fabrication, fuel quality and processing control, fuel fabrication facility development, fuel design and performance evaluation, and safeguard of the fuel cycle facility. Also this Phase shall show the overall compatibility of DUPIC fuel with current operating CANDU reactors in Korea, minimizing the hardware modification of the reactors. This compatibility assessment shall be followed to develop fuel which meets the requirements described in Session 4, related to the licensing issues described in Korea Safety Review Guideline. Beside these requirements, the compatibility assessment will involve reactor operation and controllability due to the small delayed neutron fraction of plutonium, and fuel bundle specific issues such as control of fuel content to be acceptable for operation, minimization of isotopes ratio variation, homogeneity of fuel content, and acceptable fuel density.

(2) Phase 2 for 2000 April to 2003 March: In Phase 2, the DUPIC fuel will be experimentally characterized in terms of the fuel design and fabrication technology development by manufacturing fuel elements and bundles for irradiation testing in the KAERI HANARO research reactor. Following the fuel irradiation in HANARO, there will be post-irradiation examinations in the KAERI hot cell facility.

(3) Phase 3 for 2003 April to 2006 March : As a followed up to Phase 2, the DUPIC fuel characterization and performance evaluation will be continued with the irradiation in HANARO to collect the database for the detailed design, reactor physics, thermalhydraulics and safety analyses of the fuel in the next R & D project. The technology for fuel fabrication and the facility developed in Phase 2 will be improved to approach the final target of use in CANDU reactors in Korea. If the results from Phases 1, 2 and 3 show sufficient merit and possibility of use of DUPIC fuel for CANDU reactors in Korea, then the R & D workscope for DUPIC fuel fabrication in a pilot scale would be drafted in this Phase and would be performed in the next Korea National Nuclear Energy R & D Project starting from 2006 April.

## 6. SUMMARY AND CONCLUSIONS

Korea is a country having a lack of national resources. Korea now has twelve nuclear power plants, 10 PWRs and 2 CANDU-PHWRs in operation, and 4 PWRs and 2 CANDU-PHWRs are under construction. In 2002, Korea will have a total installed nuclear power generation capacity of 15,742 MWe of which 18 % will be contributed by the 4 Wolsong CANDU-PHWRs. The CANDU-PHWRs are not the majority of nuclear power plants in Korea, but take production of significant electricity to contribute the economic growth as well as supply the needed energy in Korea. However, it must be noted that the spent fuel volume from the four Wolsong power plants is approximately the same as that from 14 PWRs in Korea, although the total activity is much less and the space required for long term storage or disposal is not great.

In Korea, it has been recognized that CANDU PHWR have a number of characteristics such as fuel cycle flexibility, large heat sinks and replaceable components that ensure the long-term applicability and future potential of the technology[9]. Since CANDU reactors are designed to be highly efficient burners of fissile material and to be highly efficient converters of fertile to fissile material, it has been recognized that CANDU reactors can burn many different fuels, and fuel supply can be secured for the foreseeable future, combining those burner and converters with on-power fuelling and a simple fuel design. This fuel cycle flexibility is a very attractive characteristic to Korea having a two reactor type of PWR and CANDU-PHWR, and create a motivation for CANDU advanced fuel developments such as CANFLEX-NU, -RU and -SEU, and DUPIC fuel cycle in Korea's Nuclear Energy R & D Project for the next 10 years from 1997 to 2006.

CANFLEX-NU fuel is one of the short-term products resulting from the R & D Project. The planned development testing of the CANFLEX-NU bundle is now nearing completion, and the next step is a small-scale demonstration in a CANDU-6 reactor. The remaining workscope for use of CANFLEX-NU fuel bundle being developed in the KAERI/AECL joint program is expected to be completed within a few years. From the beginning of the next century in both countries of Canada and Korea, CANFLEX-NU fuel with the reduced element rating and increased dryout margin of the bundle is expected to be used in the older CANDU-6 reactors having steam generator fouling or pressure tube creep.

To obtain one of mid-term products resulting from the R & D Project, KAERI just started to develop the CANFLEX-0.9 % enriched SEU and RU fuel with AECL and BNFL jointly, starting at the end of last year. The SEU and RU benefits of economic savings associated with extended burnup, improved uranium utilization and reduced spent fuel volume in CANDU are expected, where the un-enriched RU is only very slightly more radioactive than NU. This fuel is expected to be completely developed within 10 years, if the development and proof testing are expedited as planned by KAERI, AECL and BNFL. There should be impediment to the use of the fuel in Wolsong CANDU-6 reactors immediately after the development, if the cumulative quantity of RU in the world is available and is competitive with natural uranium in price.

One of the long-term products from the R & D Project is the DUPIC fuel cycle. The DUPIC process with OREOX offers a very high level of proliferation resistance. The current performance verification study in the tripartite cooperative program involves fabricating elements and bundles, to confirm technical feasibility of the process, to optimize the process, and to obtain technical information that would enable an economic comparison to be made with alternate technologies. If the results from the R & D program for the next 10 years show sufficient merit and potential for the use of DUPIC fuel in CANDU reactors in Korea, then the R & D workscope for DUPIC fuel fabrication in a pilot scale would be drafted and would be continuously included in the next Korea Nuclear Energy R & D Project starting from 2006 April. At this time, it is premature to establish the timetable of development completion and use of DUPIC fuel for CANDU reactors in Korea, because reliable technical information is not available for the complete evaluation of safety, compatibility with CANDU core, and economics.

Here, I would like to note that the Management Committee of Korea Nuclear Energy R & D Project expects to see the compatibility assessment of those new fuels with CANDU-6 core with respect to the licensing issues described in Korea Safety Review Guideline within the first phase of the Project.

KAERI has a comprehensive development program of CANDU advanced fuel and a clear vision of how the product will evolve over the next 10 years. The key targets of the development program are safety enhancement, reduction of spent fuel volume, and economic improvements, using the inherent characteristics and advantages of CANDU technology.

## REFERENCES


1. LANE, A. D., SEARS, D. F., OLDAKER, I. E., TOWNES, B. M., CELLI, A., SUK, H. C., CHUNG, C. H., and SIM, K-S., “Recent Achievements in the Joint AECL/KAERI Program to Develop the CANFLEX Fuel Bundle”, Proceedings of the 9th KAIF/KNS/OKAEA Annual Conference, Seoul, Korea, 1995 April.
2. LANE, A. D., DIMMICK, G. R., LAU, J. H. K., SUK, H. C., CHUNG, C. H., and CHOI, C. B., “CANFLEX : A New CANDU Fuel Bundle with Expended Operating Capabilities, Proceedings of the 11th KAIF/KNS/OKAEA Annual Conference, Seoul, Korea, 1996 April.
3. LANE, A. D., BOCZAR, P. G., TOWNERS, B. M., SUK, H. C., LEE, Y. O., JEONG, C. J. and SIM, K-S., “CANFLEX: A Fuel Bundle to Facilitate the Use of Enrichment and Fuel Cycles in CANDU Reactors”, Presented at IAEA Technical Committee Meeting on Heavy Water Reactor”, Toronto, Canada, 1993 July.
4. BOCZAR, P. G., SULLIVAN, J. D., HAMILTON, H., LEE, Y. O., JEONG, C. J., SUK, H. C. and MUGNIER, C., “Recovered Uranium in CANDU: A Strategic Opportunity”, Presented at the INC Conference, Toronto, Canada, 1993 October.
5. DONNELLY, J. V., D’ANTONIO, M. D., SUK, H. C., SIM, K. S. and MIN, B. J., “Fuel Management with 0.9 % SEU in CANDU-PHWR Reactors”,
6. LEE, J. S., PARK, H. S. and GADSBY, R. D., SULLIVAN, J. “Burn Spent PWR Fuel Again in CANDU Reactors by DUPIC”, Presented at Global ’95 Conference, Versailles, France, 1995 September.

7. LEE, J. S. and PARK, H. S., "The DUPIC Fuel Cycle Alternative : Status and Perspective", Presented at the 10th PBNC, Kobe, Japan, 1996 October.
8. YANG, M. S. and PARK. H. S., "The DUPIC Fuel Development Program in KAERI", Proceedings of DUPIC Fuel Workshop '97, KAERI, Taejon, Korea, 1997 July.
9. TORGERSON, D. F., "CANDU Development: The Next 25 Years", Proceedings of Canadian Nuclear Association Annual Meeting, Toronto, Canada, 1997 June.

Table 1. Current Status of Korea's Nuclear Power Plants as of September 1997

| Reactor Name | Reactor Type | Capacity (MWe) | Manufacturer | | Commercial Operation* |
|---|---|---|---|---|---|
| | | | Reactor | T/G | |
| Kori #1 | PWR | 587 | WH | GE | 1978 April |
| Kori #2 | PWR | 650 | WH | GE | 1983 July |
| Kori #3 | PWR | 950 | WH | GE | 1985 Sept. |
| Kori #3 | PWR | 950 | WH | GE | 1986 April |
| Wolsong #1 | CANDU-PHWR | 679 | AECL | NEI/PARSONS | 1983 April |
| Wolsong #2 | CANDU-PHWR | 700 | AECL | KHIC/GE | 1997 June |
| Wolsong #3 | CANDU-PHWR | 713 | AECL | KHIC/GE | (1998 June) |
| Wolsong #4 | CANDU-PHWR | 713 | AECL | KHIC/GE | (1999 June) |
| Yonggwang #1 | PWR | 950 | WH | WH | 1986 Aug. |
| Yonggwang #2 | PWR | 950 | WH | WH | 1987 June |
| Yonggwang #3 | PWR | 1000 | KHIC/KAERI/CE | KHIC/GE | 1995 March |
| Yonggwang #4 | PWR | 1000 | KHIC/KAERI/CE | KHIC/GE | 1996 March |
| Yonggwang #5 | PWR | 1000 | KHIC/KAERI/CE | KHIC/GE | (2001 June) |
| Yonggwang #6 | PWR | 1000 | KHIC/KAERI/CE | KHIC/GE | (2002 June) |
| Ulchin #1 | PWR | 950 | FRAMATOME | Framatome | 1988 Sept. |
| Ulchin #2 | PWR | 950 | FRAMATOME | Framatome | 1989 Sept. |
| Ulchin #3 | PWR | 1000 | KHIC/KAERI/ABBCE | KHIC/GE | (1998 June) |
| Ulchin #4 | PWR | 1000 | KHIC/KAERI/ABBCE | KHIC/GE | (1999 June) |

* Dates in brackets are the expected date for commercial operation of the reactors under construction in current.