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The ANS Globe

…e-news from the ANS International Committee

From the editors

The ANS Globe is the Bulletin of the American Nuclear Society's International Committee. *The ANS Globe* has as its mandate the dissemination of news of international interest to International Committee members and to others.

We would like to keep *The ANS Globe* current and relevant. Please send us your letters, articles, news and/or comments for consideration towards the next issue.

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Contents

From the Chair

Best Regards,
Corey

The ANS International Committee's Web Page

Visit the enhanced ANS International Committee's Section on the ANS website, located at http://www.ans.org/const/international. It includes:

- Background information about the ANS International Committee
- Connections to ANS International Local Sections
- An overview of Society alliances with international organizations (INEA, INSC, and PNC), along with contact information
- Connections to 30 ANS Agreement Societies/Organizations, and
- Current/back issues of *The ANS Globe*, which features ANS International Committee activities and related items.

News from Sister Societies and International News

- **Canadian Nuclear Society (CNS) (http://www.cns-snc.ca)**

Within the past month before the ANS Washington meeting, the CNS held 3 events:

- 18-20 October: 7th International Conference on Simulation Methods in Nuclear Engineering, Ottawa, Ontario, http://www.cns-snc.ca/events/7icsmne/
- 1-4 November: International Nuclear Components Conference 2015 (INCC-2015), Mississauga, Ontario http://www.incc2015.org/INCC2015_html/INCC2015_home.html
- 5-6 October: CANDU Fuel Technology Course, Whitby, Ontario, http://www.cns-snc.ca

And the CNS conference and course schedule continues to be very busy in the next 12 months:

- 2016 June 19-22: 36th Annual Conference of the CNS and 40th Annual CNS/CNA Student Conference, Toronto, Ontario, Canada, http://www.cns2016conference.org
- 2016 August 15-18, 13th International CANDU Fuel Conference, Kingston, Ontario, Canada, http://www.cns-snc.ca
- 2016 September 11-14, 3rd Canadian Nuclear Waste Management, Decommissioning and Environmental Conference, Ottawa, Ontario, Canada http://www.cns-snc.ca
- 2016 March 7-9, CNS CANDU Technology and Safety Course, Toronto, Ontario, Canada, http://www.cns-snc.ca
- 2016, Nuclear-101 Course, location to be determined.

- **China**

Minglu Wang, Assistant to **Dr. Zheng** of China's State Nuclear Power Technology Corporation (SNPTC), sent the following article on the CAP1400.

Advanced Large Passive PWR CAP1400 Ready for Construction

The CAP1400 is an advanced large passive nuclear power plant with independent

Intellectual Property (IP) rights, developed by State Nuclear Power Technology Corporation (SNPTC) on the basis of China's nuclear R&D system and equipment manufacture industry as well as AP1000 introduction and assimilation, and realized by the National Key Science and Technology (S&T) projects in a whole-nation system. Over 100 domestic organizations including R&D institution, manufacturers, and universities have participated in research, development and demonstration (RD&D) of CAP1400.

In 2008, the State Council approved the Large Advanced Pressurized Water Reactor and High Temperature Gas-Cooled Reactor, which indicated the CAP1400 RD&D program was launched, and simultaneously the conceptual design got started. At the end of 2010, the conceptual design was reviewed and approved officially by National Energy Administration (NEA). In July 2010, the preliminary design was carried out, and approved by National NEA at the beginning of 2014. In Oct, 2014, the regulator-National Nuclear Safety Administration (NNSA) finished the CAP1400 PSAR review. Up to now, over 80% of the CAP1400 detailed design has been achieved. The demonstration site is ready for first concrete pouring, as shown in Fig. 1.

Fig.1 CAP1400 demonstration project site

Due to a series of design innovation of CAP1400, including the safety systems to prevent and mitigate design-basis events and severe accidents, and the self-developed equipment, the rationality should be validated through experiments. After PIRT assessment and applicability analysis of AP600/AP1000 safety experiments results, three critical experiments for passive core cooling tests, in-vessel retention test, passive containment cooling test were laid out. For key equipment performance validation, the other three experiments including hydraulic test for reactor vessel and core, flow induced vibration tests for reactor vessel internals and steam generator performance tests were set up. Twelve experiment facilities were constructed and ten experiment rigs were reconstructed. The six critical experiment facilities are shown in Fig. 2.

ACME for PXS | In-vessel retention | CERT for PCS

Hydraulic test | SG hot performance | Flow induced vibration

Fig. 2 Six critical experiment facilities for CAP1400

In total, 887 test conditions were carried out, among which the key test conditions were 357 whose successful fulfillment are the prerequisites for issuing the CAP1400 construction permit. The NNSA witnessed 27 of them. Furthermore, during the progress of the critical experiments implementation, the chief designer of CAP1400 instructed the experiment team on site very often, as shown in Fig.3.

Fig.3 Chief Designer of CAP1400 visiting PCS facility

By August 2014 the experiments related to the CAP1400 license application were completed. As the last milestone, the experiment of steam-generator-performance validation was completed in July 2015, which means the all the experiments dispensable for CAP1400 safety system and key component-performance validation have been accomplished. In order to make full use of the experiment facilities, other extended test cases are being conducted by SNPTC.

In summary, all the preparation for CAP1400 demonstration project construction is ready. We believe that the CAP1400, as a typical Gen III NPP with advanced passive safety features and excellent performance, will be the prioritized option not only for Chinese utilities but also for utilities overseas. Turkey and South Africa have paid high attention to the CAP1400.

- **India**

R.K. Singh, Secretary, Indian Nuclear Society & Head, Media Relations & Public Awareness Section, BARC, sent the following notice.

International Workshops CANSAS-2015 and New Horizons on in Nuclear Reactor Thermal Hydraulics and Safety (IW-NRTHS) are being organized for December 8-11, 2015 at Mumbai by Atomic Energy Regulatory Board (AERB) & supported by Indian Nuclear Society.

- **Italy**

Dr. Prof. Mauro Bonardi, Professor of Chemistry, Radiochemistry, Radiopharmaceutical Chemistry, Health Physics; Expert in Radiation Protection and Dosimetry at the Universitá Degli Studi di Milano & National Institute of Nuclear Physics, Co-Editor of the *ANS Globe*, submits this piece about the situation in Italy:

It seems that the political situation in Italy will stabilize before the end of 2015. We hope to have a “Real Government” with a "democratically elected new Premier”.

At the moment, the cost of electricity in Italy (in kW.h) is the “highest in the World”, and the percentage of electro-nuclear power imported from abroad cannot increase much more at the moment it varies from 14% to 18 % of the total consumption, and is imported from France, Switzerland, Austria, and Slovenia. It is imported annually mainly by night to pump water in the hydro PPs and used later during the day).

In case of success in the new elections, the “nuclear option” would become very much more promising with GEN-III+ and GEN-IV reactors, because at present many Italian industries are still involved in designing and manufacturing many nuclear components (Ansaldo Nucleare, Genova is the leader) and some big industries are strongly involved in the maintenance and building of new NPPSs (in Europe, India, China, Eastern Europe, South America and east Asia).

Finally, an already existing public society named “SOGIN, ROMA” started a pressing publicity in the media, regarding the construction of the “National Nuclear Repository”. This is excellent news, because this would be the first step in passing seriously to the nuclear option.

- **Japan**

Kiyoshi Yamauchi, AESJ International Committee, sent the Japan Country Report as of 2015 September 15.

Energy Basic Plan

The revised "Energy Basic Plan" was approved by the Cabinet on April 11, 2014, where it is emphasized that restoration and reconstruction of Fukushima is the starting point of nuclear energy and it is expressed that use of nuclear energy should place first priority on the pursuit of safety enhancement.

It is also stated that nuclear energy is one of the important baseload power contributing to ensure the stability of the energy supply and demand structure and dependency on nuclear power generation will be reduced as much as reasonably possible by energy saving, introduction of renewable energy as well as improvement in thermal efficiency of fossil power.

Concerning nuclear fuel cycle issues, it was stated that the Government will take leadership to find a solution for High Level Radioactive Waste final disposal, will maintain reprocessing and LWR-MOX project in order to assure firm future outlook on energy security and HLRW management, while obtaining understanding and cooperation of municipalities hosting nuclear facilities and international community.

The Ministry of Economy, Trade and Industry (METI), started to discuss how to realize the above energy basic plan, forming two working groups under the Nuclear Subcommittee. One is "the Rad-waste Working Group", where the final disposal of high-level waste and TRU is to be discussed. The other is "the Safety enhancement / technology/ human resources Working Group". Further, "the Energy demand/supply prospectus Subcommittee" was also formulated.

In July 2015, METI decided "The Long Term Energy Demand/Supply Prospectus" based on "The Energy Basic Plan", receiving the result of the above Subcommittee. The desirable power "best mix" in 2,030 features 20 ~ 22 % of nuclear, down from about 30 % before "the Great earthquake disaster" of 2011, and 22~24% renewable energy, as electric power base, in order to contribute to CO2 reduction of about 26% from 2013.

Nuclear Regulatory Authority

Two of the five current NRA commissioners, Commissioner Kunihiko Shimazaki (seismologist) and Commissioner Kenzo Oshima (former ambassador to the United Nations), expired their tenure of two years in the end of September 2014. The Diet approved two new commissioners in June 2014. The new commissioners are; Professor Satoru Tanaka of nuclear engineering at Tokyo University, the former Chairman of the Atomic Energy Society of Japan, and Professor Akira Ishiwatari at Tohoku University, the former chairman of the geological society of Japan. They have their term of 5 years. The term of the other NRA commissioners is 5 years for Chairman Shunichi Tanaka (physicist) (till September 2017) and 3 years for Commissioner Toyoshi Fuketa (nuclear engineering) and Commissioner Kayoko.

News on Nuclear Facilities

The new safety regulation for commercial LWRs was enforced in July 2013, and applications for NRA review on conformity with new safety standard for restart were started. Applications as of September 2015 are; 15 sites 25reactors (15 PWR, 4ABWR, 6 BWR).

Sendai NPP unit 1 & 2, Takahama NPP Unit 3&4, and Ikata NPP unit 3 obtained design safety approval on conformity with new safety standard from NRA. Kyushu, Kansai and Shikoku Electric Power Company started necessary procedures for restart such as application for operation license, application for construction plan for restart and communication with local government/local communities etc. In September 2015, Sendai unit 1 started commercial operation. This is the first unit to be restarted after the "Great Earthquake" in 2011.

Stakeholder Dialogue

(1) Media has been splitted. One group is still anti-nuclear or deliberate against nuclear, but other group is more positive to keep nuclear from the view point of energy security, macro economics and global warming as far as the safety is assured.

(2) Fukui District Court issued provisional disposition to prevent the restart of Takahama Unit3&4 on April 14, 2015, stating that the current NRA requirement is not enough and the safety of Takahama Unit 3&4 is not fully assured.Kansai Electric Power Company stated strong objection to this disposition. Chairman Tanaka of NRA also stated that this disposition is based on errors in finding fact. The Cabinet stated that they do not change their policy to proceed to restart the plants as far as the safety is assured.

On April 22, 2015, Kagoshima District Court rejected a request by a group of local anti-nuclear residents for a temporary injunction prohibiting the restart of the Sendai 1&2 of Kyushu Electric Power Company, located in southwestern Japan, due to "no irrationalities" in the NRA new regulatory standards, in the context of the latest scientific findings.

(3) The Nuclear Risk Reserch Center(NRRC) was formed in the Central Research Institute of Electric Power Industry in October 1, 2014.

In light of the Fukushima Daiichi Nuclear Power Station Accident, it is vital to continually strive for even higher levels of safety and it will be necessary for nuclear utilities to go further than simply meeting regulatory requirements and to pursue sustained committment to ruduce nuclear risk. To reduce risk, it is necessary to implemant appropriate measures to counter disasters and mitigate the results. It is also important to predict the progression and behavior of accidents. The NRRC is aimed for research and development of the comprehensive risk assessment utilizing PRA and other probabilistic approach. Ikata unit 3 of Shikoku Electric Power Company has been selected as a pilot plant.

Dr. George Apostolakis, the former NRC Commissioner is the Head and Dr.Richard A. Meserve, the former NRC Chairman is the Executive Advisor. Dr. Apostolakis started to see CEOs of Electric Power Companies and visited plant sites in order to convince them of the importance of Risk Informed Management.

On September 2, 2015, the first Symposium by NRRC was held. “What is Risk Informed Management“, “What is expected for the NRRC“ were discussed. Presenters were from the NRA, Local Government, Masmedia, Julist ans so forth.

AESJ issued a position paper on “the necessity of the safety review of the nuclear plants based on the scientific and rational perspectives and information sharing“ on November 11, 2014. This position paper is coming from the concern that the current regulatory review process requires too much resources and time.

Recent status of Fukushima Daiichi NPP on-site restoration (topics in 2014-2015)

(1) Fukushima Daiichi D&D Engineering Company

The Fukushima Daiichi Decontamination and Decommissioning (D&D) Engineering Company was established in April 2014 by Tokyo Electric Power Company. The company has responsibility for the decommissioning and cleanup of Fukushima Daiichi NPS. The mission is to decontaminate, decommission and cleanup the Fukushima Daiichi NPS with the greatest degree of expertise, safety, and efficiency; with the greatest possible regard for the environment and those who live in it.

(2) Nuclear Damage Compensation and Decommissioning Facilitation Corporation (NDF)
Nuclear Damage Compensation Facilitation Corporation was reformulated as NDF in August 2014 to include national supporting function for decommission and contaminated water removal.

It is expected that technical strategy making and judgement by NDF, site operation by TEPCO, and technology development by International Research Institute for Nuclear Decommissioning (IRID) should work together. IRID was established in August 2013.

(3) “The Intermediate and Long Term Road Map for Fukushima Decommissioning and Contaminated Water Removal” originally issued on December 2011, revised on June 2013, was revised again on June 2015, reflecting the progress of the recovery work at the site, comments from the Fukushima Council, and the strategic study of NDF.

Major points are as follows;
- Emphasis on risk reduction rather than speed
- Explicit schedule of near time frame
- Transparency
- Strengthen the command chain
- Final target of decommissioning (30-40 years later) is kept the same.

(4) Groundwater Bypass

Fukushima Daiichi D&D Engineering Company started the groundwater bypass operation at Fukushima Daiichi NPS. Pump up of groundwater started in April 2014 and water drain operation started May 2014. Groundwater is pumped up before entering the site, is stored in storage tanks for detection of radioactivity, and will be drained to the sea if radioactivity is below the operation target level. The target

radioactivity level of groundwater to be drained is under 1 Bq/l for ^{134}Cs and ^{137}Cs, under 5 Bq/l for beta emitters, under 1500 Bq/l for tritium.

Concerning the water in the buildings, the amount of radioactive materials will be reduced to half in 2018 and treatment of the water will be completed in 2020.

(5) Unit 1-3: cleanup operation

Preparation work such as decontamination and investigation of leaked portion in the core region has been started using robots in order to be prepared for the removal of fuel debris.

Earliest time to start to remove fuel debris is expected in 2021.

(6) Unit 1-4: fuel assembly removal form spent fuel pool

At the time of the earthquake disaster, unit 4 was in periodic inspection, and all the assemblies were discharged from the core and stored in the spent fuel pool. The operation of fuel assembly removal from the spent fuel pool was started in November 2013 in preparation for unit 4 decommissioning and was already completed.

AS for unit 1-3, preparation work such as decontamination and removal of demolition waste in the spent fuel pits has been started in order to remove spent fuel in the pool. In unit 1, dismantling of building cover has been started and spent fuel assembly removal is expected to start early in 2021. In unit 2, fuel assembly removal is expected to start in 2020.

In unit 3, demolition waste has almost removed and spent fuel assembly is expected to start early in 2018.

- **Mexico**

Prof. Juan Luis Francois, of the Universidad Nacional Autónoma de México, sent the following very interesting news:

The Ministry of Energy of Mexico (SENER) published on June 30 a document called "Development Program of the National Electric System 2015-2029 (PRODESEN)", which includes the construction of three nuclear power units, additional to the two already in operation in Laguna Verde, Veracruz. These three new units are scheduled to start operation in 2026, 2027, and 2028, respectively.

- **OECD Nuclear Energy Agency (http://www.nea.fr)**

The following articles are gleaned from OECD NEA monthly reports.

International Framework for Nuclear Energy Cooperation (IFNEC)

IFNEC is a forum for co-operation among participating countries to explore mutually beneficial approaches to ensure that the development of nuclear energy for peaceful purposes proceeds in a manner that is efficient and meets the highest standards of safety, security and non-proliferation. Following the approval of the NEA Steering Committee on 23 April 2015, the NEA has accepted the invitation of the Executive Committee of the International Framework for Nuclear Energy Cooperation (IFNEC) to become the Technical Secretariat for this initiative, in a similar role that the NEA has in the Generation IV International Forum (GIF) and the Multinational Design Evaluation Programme (MDEP). The current secretariat functions, supported by the US Department of Energy (DOE), will be gradually handed over in the coming months, in the run up to the preparation of the 2015 Executive Committee meeting, which will take place in Romania on 23 October 2015.

Generation IV International Forum (GIF) 2014 Annual Report

This eighth edition of the Generation IV International Forum (GIF) Annual Report highlights the main achievements of the Forum in 2014, and in particular progress made in the collaborative R&D activities of the eleven existing project arrangements for four of the six GIF systems: the gas-cooled fast reactor, the sodium-cooled fast reactor, the supercritical-water-cooled reactor and the very-high-temperature reactor. Progress made under the memoranda of understanding for the lead-cooled fast reactor and the molten salt reactor is also reported. In May 2014, China joined the supercritical-water-cooled reactor system arrangement. In October 2014, the project arrangement on system integration and assessment for the sodium-cooled fast reactor became effective. GIF also continued to develop safety design criteria and guidelines for the sodium-cooled fast reactor, and to engage with regulators on safety approaches for generation IV systems. Finally, GIF initiated an internal discussion on sustainability approaches to complement ongoing work on economics, safety, proliferation resistance and physical protection.

Benchmark Study of the Accident at the Fukushima Daiichi Nuclear Power Plant (BSAF)

The initial meeting for Phase 2 of the **NEA BSAF Project** was held in Japan from 22 to 27 June 2015 and was attended by over 50 representatives from 10 countries. he BSAF aims at improving the understanding and modelling of accident progression at the Fukushima Daiichi plant. In its second phase, the time frame under consideration is being extended to about one month from the start of the accident and the behaviour of fission products is being added to the scope. Participants at the meeting discussed the lessons learnt from Phase 1, as well as the challenges regarding the availability of data and uncertainties with boundary conditions. Participants were also given a summary of recent findings from on-site investigations at the plant and provided with an opportunity to visit one of the undamaged reactors (unit 5) and to gain first-hand knowledge of the reactor configuration. The meetings closed with a consensus on the next steps for the participants and the operating agent and on the time frame and expected scope for future meetings.

South Africa signs Generation IV International Forum (GIF) Agreement

On 15 September 2015, South Africa signed the ten-year extension of the Framework Agreement for International Collaboration on Research and Development of Generation IV Nuclear Energy Systems, paving the way for its continued collaboration among participating countries in this important area of Gen IV R&D. A signing ceremony was held in the presence of the Honourable Tina Joemat-Pettersson, Minister of Energy of South Africa, and Mr William D. Magwood, IV, NEA Director-General. The **Generation IV International Forum (GIF)** is a co-operative international endeavour which was set up in 2005 to carry out the research and development needed to establish the feasibility and performance capabilities of the next generation of nuclear energy systems.

Safety of Advanced Nuclear Reactors

The Joint CNRA and CSNI Ad hoc Group on the Safety of Advanced Reactors (GSAR) held its second meeting on 22-24 September 2015 with representatives from the regulatory bodies of France, Germany, Italy, Japan, Korea, the Russian Federation and the United States, Generation IV International Forum (GIF) experts, and representatives from the International Atomic Energy Agency (IAEA) and the European Commission (EC). The GSAR was established jointly by the **NEA Committee on Nuclear Regulatory Activities (CNRA)** and the **NEA Committee on the Safety of Nuclear Installations (CSNI)** to ensure improvements in nuclear safety through appropriate regulation and research for advanced reactors, and to provide input to GIF on regulatory and safety issues. The main goal of the September meeting was to discuss priorities related to the safety of nuclear systems and the group's activities, including selection of a pilot study and technical areas. The GSAR members agreed to select a sodium fast reactor for their pilot study due to availability of information and its sufficient design maturity. The participants also developed a work proposal including specific technical areas to be approved by the CNRA and the CSNI in December 2015.

- **United States**

Jessica Bishop and **Mark Massie**, students of **Prof. Sama Bilbao y León** at Virginia Commonwealth University, sent the following contribution to the *ANS Globe*.

VCU Summer Practicum in Dresden, Germany

During the period of June 15 through June 28, Virginia Commonwealth University Professor Dr. Sama Bilbao led 8 students abroad to complete a study at the Technical University of Dresden. The trip included not only a 3-credit hands-on course in Nuclear Reactor Physics, but also an intensive course in the German language. The group also delved into German culture through multiple historic visits, experiencing local cuisine and sight-seeing within the beautiful state of Saxony. Students conducted a total of 7 experiments utilizing the university's zero-power training reactor, AKR-2. This included reactor start-up, control-rod calibration, identification of unknown radionuclides, exploration of neutron flux distribution, gamma dosimetry, the adjoint flux function, and

Morning lecture in the reactor lab

VCU student Nathan Kirby inserts a sample to be activated into the reactor core.

the activation and decay of radioactive nuclides. This experience provided the students with the opportunity to manually control the reactor - something that is not allowed at many other institutions without proper certification. When manipulating the control rods, students could monitor the dynamics of the reactor characteristics and ultimately gain insight on the mechanics and operations at a full-scale nuclear power plant. Along with the reactor experiments, students were granted a tour of the thermal hydraulics lab where they observed investigations in natural convection, determining steam-flow characteristics and the potential hazards of steam generation - experiments that were geared toward the analysis of BWR systems. These studies were supplemented by truly enriching lectures in advanced topics such as reactor physics and thermal hydraulics given by the team of remarkable TUD professors **Dr. Wolfgang Hansen, Dr. Tilo Wolf, Dr. Carsten Lange, and Dr. Christoph Schuster**. This programme also allowed students to experience another culture and learn about the history of Germany through guided tours in Dresden and weekend excursions to Saxonian Switzerland and Meissen, Germany. Throughout the two-week period students were able to put their growing knowledge of the German language to use through ordering food and conversation with locals, which made the experience not only increase the students' technical knowledge, but also challenge their minds in social aspects as well. The course was the first of its kind for both universities and will hopefully serve as a star model for future study abroad programmes in Nuclear Engineering.

Group of VCU students and TUD staff hiking in Saxonian Switzerland.

Highlights from the 2015 June Meeting in San Antonio, TX

Dr. Wei-Wu Chao, of the Science and Technology Division, Taipei Economical and Cultural Representative Office, reviewed the Status of the Nuclear Power Program in Taiwan. It is reproduced in Appendix 1.

Dr. Fiona Rayment, Director Fuel Cycle Solutions, National Nuclear Laboratory, UK, gave a presentation on UK Nuclear, Current Capacity, New Build and Beyond. This is reproduced in Appendix 2.

Dr. Frank Akstulewicz, Director, Division of New Reactor Licensing, Office of New Reactors, US Nuclear Regulatory Commission, made a presentation on New Nuclear Plant Construction and Licensing Activities Worldwide. This is reproduced in Appendix 3.

Societies with Collaboration Agreements with ANS

The following is a list of nuclear societies with collaboration agreements with the ANS, along with the corresponding website addresses. The Table contains also a few other entries of interest to ANS International Committee members.

Society	Website or E-Mail Address
Asociación Argentina de Tecnología Nuclear	www.aatn.org.ar
Associação Brasileira de Energia Nuclear	www.aben.com.br
Association des Ingénieurs en génie atomique du Maroc	-
Atomic Energy Society of Japan	wwwsoc.nii.ac.jp/aesj/index-e.html
Australian Nuclear Association	www.nuclearaustralia.org.au
Bangladesh Nuclear Society	-
Bulgarian Nuclear Society	www.bgns.bg
Canadian Nuclear Society	www.cns-snc.ca
Chinese Nuclear Society	www.ns.org.cn
Croatian Nuclear Society	www.nuklearno-drustvo.hr/en/home.html
Czech Nuclear Society	www.csvts.cz/cns
European Nuclear Society	www.euronuclear.org
Hungarian Nuclear Society	www.kfki.hu/~hnucsoc/hns.htm
Indian Nuclear Society	www.indian-nuclear-society.org.in
Israel Nuclear Society	meins@tx.technion.ac.il
Korean Nuclear Society	www.nuclear.or.kr/e_introduce.php
Lithuanian Energy Institute	www.lei.lt
Malaysian Nuclear Society	www.nuklearmalaysia.org/index.php?id=18mnu=1
Nuclear Energy Society of Kazakhstan	www.nuclear.kz
Nuclear Energy Society of Russia	ns@kiae.ru
Nuclear Energy Society of Slovenia	www.drustvo-js.si
Nuclear Energy Society of Thailand	www.nst.or.th
OECD/Nuclear Energy Agency	www.nea.fr
Polish Nuclear Society	www.ptn.nuclear.pl
Romanian Nuclear Energy Association	www.aren.ro
Romanian Society for Radiological Protection	www.srrp.ro

Slovak Nuclear Society	www.snus.sk
Sociedad Nuclear Española (SNE)	www.sne.es
Sociedad Nuclear Mexicana	www.sociedadnuclear.org.mx
Ukrainian Nuclear Society	www.ukrns.odessa.net
United Kingdom Nuclear Institute	www.nuclearinst.com/ibis/Nuclear %20Institute/Home
Women in Nuclear – Global	www.win-global.org
Affiliated National Societies	**Website or E-Mail Address**
Belgian Nuclear Society	www.bns-org.be
Associated Nuclear Organizations	**Website or E-Mail Address**
International Nuclear Societies Council	http://insc.ans.org
Pacific Nuclear Council	http://www.pacificnuclear.net/pnc/
Non-U.S. Local Sections	**Website or E-Mail Address**
Austrian Section	
French Section	http://local.ans.org/france/
India Section	http://local.ans.org/india/
Italian Section	
Japanese Section	
Latin American Section	www.las-ans.org.br
Korean Section	
Swiss Section	
Taiwan Section	u805301@taipower.com.tw

Calendar of Events

Some Upcoming International Conferences on Nuclear and Related Topics

(Please send us information about your upcoming conferences, for inclusion in this space.)

Legend:

✹ **ANS Event**

□ **Non-ANS event co-sponsored by ANS**

o **For all other conferences, ANS is NOT a sponsor, nor are these conferences endorsed by ANS.**

2015

- 1-4 November: International Nuclear Components Conference (INCC-2015), Mississauga, Ontario, Canada, http://www.incc2015.org/INCC2015_html/INCC2015_home.html

- 4-5 November: Nuclear Power Plant Life Management & Extension 2015**,** Paris, France - http://www.wplgroup.com/aci/conferences/eu-enl1.asp

- 8-12 November: ANS Winter Meeting, Washington, DC, USA – http://www.ans.org/meetings ✸

- 8-11 December: CANDU Safety Association for Sustainability Workshop CANSAS-2015, and New Horizons in Nuclear Reactor Thermal-Hydraulics and Safety, Mumbai, India.

2016

- 17-20 April, 2016 International Congress on Advances in Nuclear Power Plants (ICAPP-2016), San Francisco, CA, USA - http://icapp.ans.org/

- 17-22 April, 11th International Conference on Tritium Science & Technology (TRITIUM 2016), Charleston, SC, USA - http://tritium2016.org

- 1-5 May, PHYSOR-2016, Sun Valley, ID, USA- http://www.physor2016.org ✸

- 12-16 June: ANS Annual Meeting, New Orleans, LA, USA – http://www.ans.org/meetings ✸

- 11-15 September, Top Fuel 2016, Boise, Idaho, USA - http://www5vip.inl.gov/topfuel2016/

- 6-10 November: ANS Winter Meeting, Las Vegas, NV, USA – http://www.ans.org/meetings ✸

2017

- 5-8 February, Conference on Nuclear Training and Education, CONTE-2017, Jacksonville, FL, USA - http://www.ans.org/meetings

- 11-15 June: ANS Annual Meeting, San Francisco, CA, USA – http://www.ans.org/meetings ✸

- 31 July-4 August, 13th International Topical Meeting on Nuclear Applications of Accelerators (AccApp '17), Québec City, QC, Canada – Organised jointly by ANS and CNS - http://www.ans.org/meetings

- 29 October -2 November: ANS Winter Meeting, Washington, DC, USA – http://www.ans.org/meetings ✸

2018

- 17-21 June: ANS Annual Meeting, Philadelphia, PA, USA – http://www.ans.org/meetings ✸

- 11-15 November: ANS Winter Meeting, Orlando, FL, USA – http://www.ans.org/meetings ✸

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*Co-Editors of the *ANS Globe*

Appendix 1

Presentation by Dr. Wei-Wu Chao

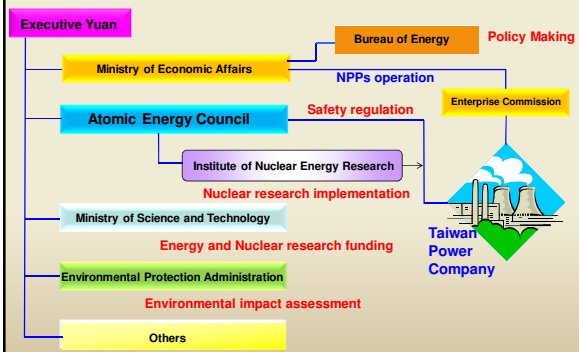
Status of Nuclear Power Program in Taiwan

Status of Nuclear Power Program in Taiwan

Dr. Wei-Wu Chao
Science and Technology Division
Taipei Economical & Cultural Representative Office
June 9, 2015

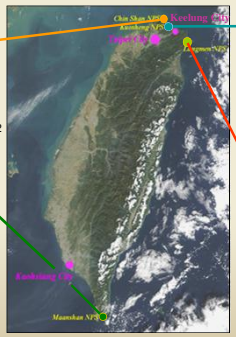
Contents

Government Agencies (Energy and Nuclear)



Nuclear Power Plants in Taiwan

Chinshan NPS
GE BWR-4 636 MWe x 2
Commercial Dec-1978 Unit1
Jul-1979 Unit2



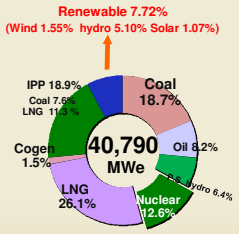
Kuosheng NPS
GE BWR-6 985 MWe x 2
Commercial Dec-1981 Unit1
Mar-1983 Unit2

Maanshan NPS
Westinghouse PWR
951 MWe x 2
Commercial Jul-1984 Unit1
May-1985 Unit2

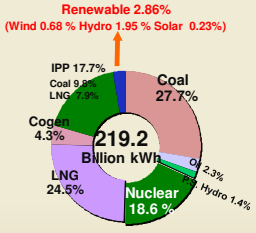
Lungmen NPP
GE ABWR
1,350 MWe x 2
Deferred (mothballed)

Nuclear Installed Capacity: 5 GWe (not includes ABWR)

Power Generation in 2014 (1/2)

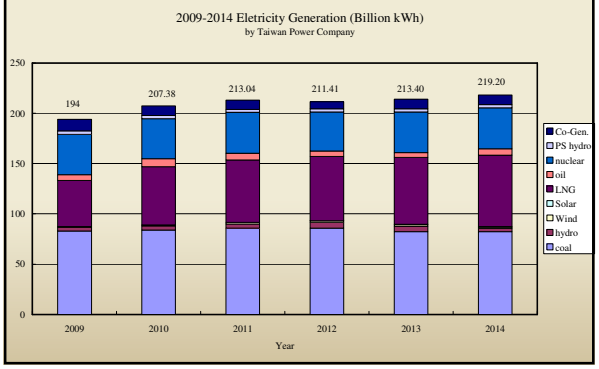


Installed Capacity in 2014

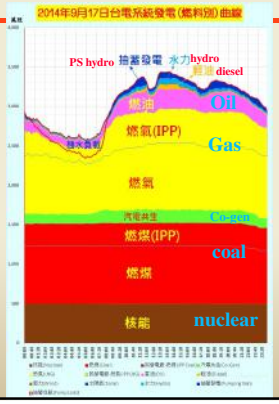


Electricity Generation in 2014

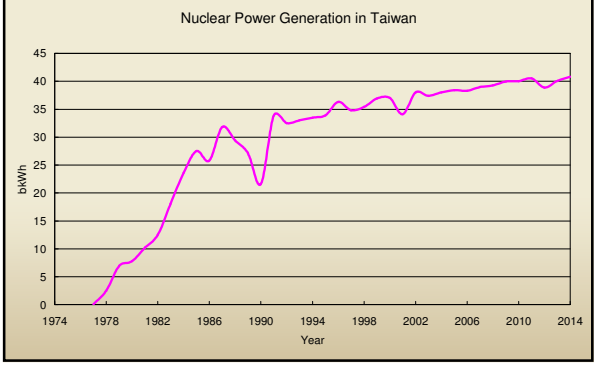
2009-2014 Power Generation



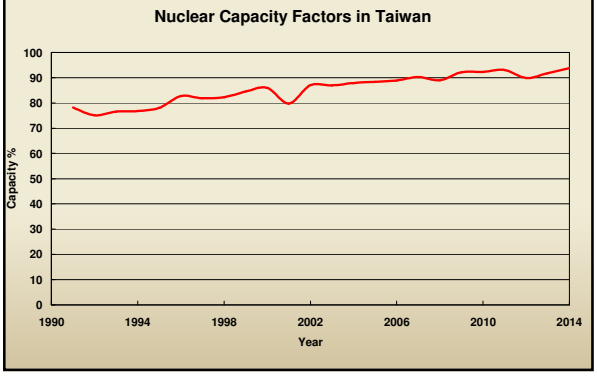
Typical Summer Daily Load



Nuclear Performance in 2014 (1/2)



Nuclear Performance in 2014 (2/2)



Safety Re-evaluation of NPPs (1/2)

- After Japan's Fukushima Daiichi accident occurred in March, 2011, Atomic Energy Council (AEC) asked Taiwan's Nuclear Power Plant operator (TPC) to re-evaluate its capability to copy with extreme natural disasters, including earthquake, tsunami.
- The re-evaluation comprises following parts
  - Nuclear Safety
  - Radiation Protection
  - Emergency Response Preparedness

Safety Re-evaluation of NPPs (2/2)

- The evaluation results show no imminent concerns for plant continuous safe operation, while some areas need improvement, such as water tightness of emergency cooling building, backup mobile diesel engine and air compressor, seismic re-assessment, revising emergency operation procedure, etc.
- Atomic Energy Council, closely cooperates with USNRC on Japan lessons learned and taskforce's recommendations

Stress Test (1/2)

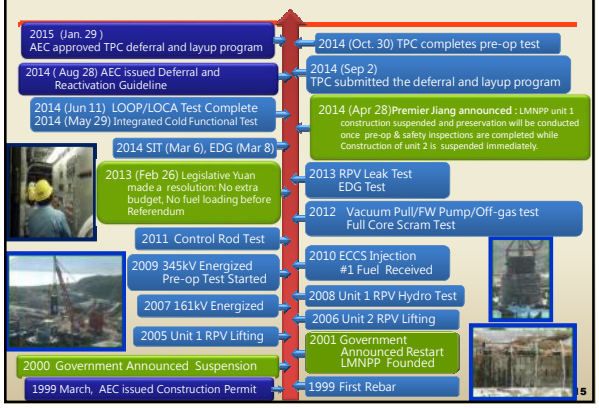
- Invite domestic and international experts to review stress test report prepared by TPC.
- A six-member OECD/NEA team conducted a two-week peer review in March 2013.
- The team concludes that Taiwan's national report is consistent with the process according to the European Nuclear Safety Regulators Group (ENSREG) Criteria used in the EU.

Stress Test (2/2)

- A nine-member EU team visited Taiwan and nuclear plants Sep. 23 to Oct. 3, 2013 for conducting on-site evaluation. They reviewed stress reports before visit.
- The conclusion is that the stress tests in Taiwan were carried out by essentially following the specifications of the 2011/12 European stress tests and can thus be considered comparable with regard to the relevance of their results.
- *the standards of safety applied to Taiwanese NPPs seem to be generally high and to conform in most areas to international state-of-the-art practices.*

Overlook of Lungmen site

Lungmen Project Chronicle of Events

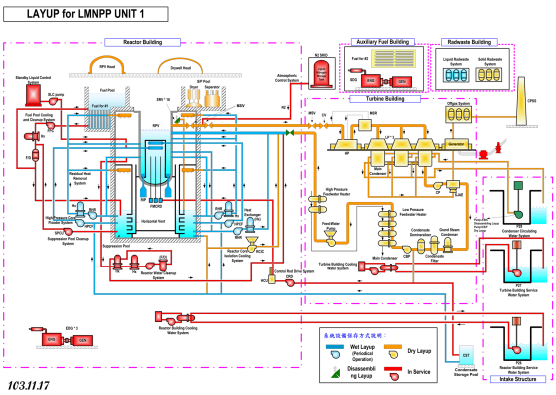


Status of Lungmen (1/2)

- Construction of the Lungmen ABWR Plant started in 1999. The project has encountered numerous difficulties as led by suspension in 2000, and followed by subsequent restart in 2001 and associated problems with rising price of construction materials, rehiring and interface of subcontractors, resulting in extended delays and requests for additional budget allocation.
- As of end of 2014, Unit 1 was 95.82% and Unit 2 was 91.53% complete on construction.

Status of Lungmen (2/2)

- A national referendum was proposed in 2013 by executive administration to decide the fate of the Lungmen plant.
- The proposal has been debated at the Legislative Yuan, but without conclusion.
- Under the shadow of a hunger strike by a powerful political figure and massive protest, on April 28 2014, the government decided to suspend the construction of Lungmen nuclear power plant until completing a national referendum, which has no clear timeline for now.
- Lungmen plant staff started to place systems to deferred status since 2014.



Unit 1 Reactor Bldg. Operating Floor

Unit 1 Main Generator

Unit 1 Main Turbine

Unit 1 Main Control Room
(during LOOP/LOCA Testing)

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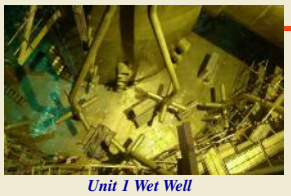

Unit 1 Wet Well

Unit 1 RPV with Dryer/Separator

Unit 1 Spent Fuel Pool
(Fuel for Initial Cycle submersed)

Unit 1 Control Rod Drives

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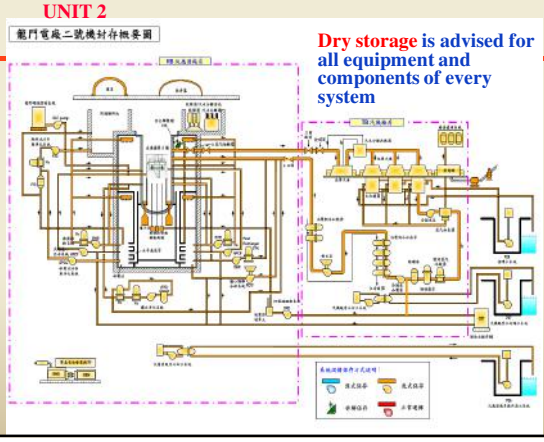
UNIT 2



Dry storage is advised for all equipment and components of every system

Unit 2 Refueling Machine (covered)

Unit 2 Main Generator

Unit 2 Main Turbine

Unit 2 Main Control Room

Onsite Wet Storage of Spent Nuclear Fuel

Unit		Capacity (Assembly)	Storage Inventory	Refuel per cycle	Estimated date for full-capacity shutdown	Effective Operating License
Chinshan	1	3,083	2,982	~120	April 19 ,2016	Dec., 2018
	2	3,083	2,972	~120	March 27 ,2017	July, 2019
Kuosheng	1	4,398	4,180	~180	November 30 ,2016	Dec., 2021
	2	4,398	4,252	~180	March 30 ,2017	Mar., 2023
Maanshan	1	2,160	1,311	~70	2024	July, 2024
	2	2,160	1,339	~70	2025	May, 2025

As of December 2014

Current Status of Dry Storage Facility in Chinshan NPP

Concrete Storage Casks

SNF Dry Storage Facility

- Taiwan Power Company (TPC) submitted the construction license application in March, 2007.
- AEC issued the Construction License in December, 2008.
- TPC started the construction in Nov., 2010.
- Dry run of pre-operational tests was completed in Jan. 2013 and AEC approved the test result report in Sep., 2013.
- TPC would carry out the second stage pre-operational test (i.e. hot test) only after New Taipei City Government (local government) issues the Water and Soil Conservation Permit.

Current Status of Dry Storage Facility in Kuosheng NPP

Storage system of Kuosheng ISFSI

The illustration of Kuosheng ISFSI

- TPC entrusted the CTCI Machinery Corporation (Taiwan) and NAC International (USA) to construct the ISFSI system in Nov., 2010
- 27 MAGNASTOR concrete casks will be used, each one is capable of storing 87 BWR assemblies each (Total 2349)
- Licensing application was submitted in March, 2012
- AEC organized a review team with 10 technical subgroups for detailed technical review
- AEC completed the SAR reviews in Feb., 2015

Current Status of abroad reprocessing project (1/2)

- On Feb.17, 2015, TPC opened a bid regarding abroad reprocessing services of spent nuclear fuel of Chinshan and Kuosheng Nuclear Power Stations.
- Contract Quantities of Spent Nuclear Fuel (SNF)
  - 1200 Bundles (480 Bundles for Chinshan Power Station and 720 Bundles for Kuosheng Power Station) of SNF
  - Delivery: 300 Bundles/yr
  - 1200 Bundles Delivery Completion: before Dec. 31, 2018
  - Supplier should optimize the quantity of residues produced to be returned to Taiwan, with a maximum of 60,000 liter which is based on 1200 Bundles SNF to be reprocessed
    - Compacted Residues should be equal to or less than 37,500 liters
    - Vitrified Residues should be equal to or less than 22,500 liters

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Current Status of abroad reprocessing project (2/2)

- In March 2015, the biding of abroad reprocessing services was modified by the TPC
  - The Supplier shall not ship back the Reprocessed Plutonium and Uranium to Taiwan.
  - The final solution for this material usage in a third party civilian reactors shall be in compliance with the "Agreement for Cooperation between the TECRO (Taiwan) and the AIT (US) Concerning Peaceful Uses of Nuclear Energy".
- On April 2, 2015, the abroad reprocessing project was suspended due to the budget rule controversy by congress.

AEC's Regulatory Position on SNF Reprocessing (1/2)

- **SNF reprocessing :**
  - compliance with the "Radioactive Waste Management Policy"
- **Reprocessed uranium and plutonium :**
  - agreement for abroad reprocessing services.
- **HLW storage facility:**
  - TPC is required to prepare a Preliminary Plan of Storage for Reprocessed Waste.
  - The storage facility shall be constructed prior to 2 years of transported back of reprocessed waste.

AEC's Regulatory Position on SNF Reprocessing (2/2)

- **Abroad reprocessing shall meet :**
  - Joint Convention on the Safety of Spent Fuel Management on the Safety of Radioactive Waste Management
  - Regulations for the Safe Transport of Radioactive Material
  - the domestic laws and regulations
- **The safeguards shall meet:**
  - "Agreement between the IAEA, the Government of the ROC and the Government of the USA for the Application of Safeguards"
  - "Agreement for Cooperation between the TECRO and the AIT Concerning Peaceful Uses of Nuclear Energy".

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Concluding Remarks

- Nuclear power has played an important role in Taiwan's energy portfolio
- Japan's Fukushima Dai-ichi accident has a great impact on Taiwan's nuclear energy policy, even though both safety evaluation and stress test results demonstrate no adverse effect
- The decision on deferring new plant construction might greatly affect the energy security in decades
- Spent nuclear fuel storage and/or reprocessing would be become a pressing issue within next few years
- Challenges remain as diverse public opinions on nuclear safety, energy mix, and radwaste management

Thank You for Your Attention

Appendix 2

Presentation by Dr. Fiona Rayment

UK Nuclear Current Capacity, New Build and Beyond

APPENDIX 2

NATIONAL NUCLEAR LABORATORY

UK Nuclear
Current Capacity, New Build and Beyond

Fiona Rayment
Director Fuel Cycle Solutions

ANS Annual Meeting 2015

Agenda

NATIONAL NUCLEAR LABORATORY

- UK History
- New Build – 16 GWe Capacity
- Future scenarios
- Summary and Conclusions

Agenda

NATIONAL NUCLEAR LABORATORY

- UK History
- New Build – 16 GWe Capacity
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Calder Hall
Magnox Station 1956

NATIONAL NUCLEAR LABORATORY

- UK civil nuclear programme evolved from weapons
- Design to operation over 4 year period
- Uranium metal fuel with CO_2 cooling
- Classified as Generation I
- Capacity 200MWe

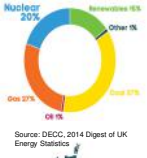
UK Current Nuclear Generation
16 Units ~ 10 GWe

NATIONAL NUCLEAR LABORATORY

- Magnox Reactor
- Total ~ 500MWe
- Wylfa - Closure 2015

- Advanced Gas Reactor
- Total ~ 7.6GWe
- Pursuing Plant Life Extensions
- Hartlepool, Dungeness B and Hinkley Point B already extended
- Expected closures following extensions from 2019 to 2028

- Pressurised Water Reactor
- Total ~ 1.2GWe
- Sizewell B
- Planned closure in 2035, but plant life extension expected to 2055



Source: DECC, 2014 Digest of UK Energy Statistics

Agenda

NATIONAL NUCLEAR LABORATORY

- UK History
- New Build – 16 GWe Capacity
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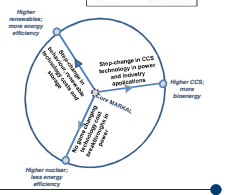
The Carbon Plan

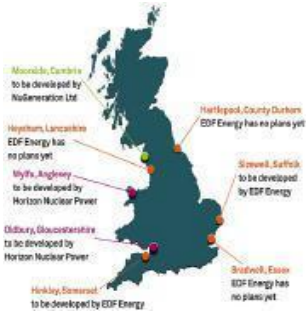
NATIONAL NUCLEAR LABORATORY

- Legally binding 80% emission reduction by 2050
- Low carbon generation needed for:
  - Electricity
  - All transportation
  - Domestic and Industrial Heat, Light & Power
- Electricity grid grows from ~85 GWe to ~300GWe
- Generation sources ~ 33% renewables, CCS and nuclear



UK 'Designated' Nuclear Sites – New Build (16 GWe)

NATIONAL NUCLEAR LABORATORY



EDF Energy UK
Areva EPR's
Hinkley Point, Somerset
Sizewell, Suffolk
Additional options for siting at Bradwell, Hartlepool, and Heysham

Horizon Nuclear Power Ltd
(Owned by Hitachi)
Hitachi GE ABWRs
Wylfa, Anglesey
Oldbury, Gloucestershire

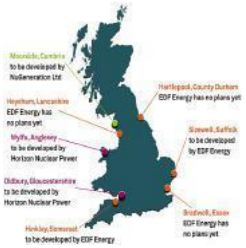
HORIZON NUCLEAR POWER

NuGeneration Ltd
(Toshiba Westinghouse / GDF Suez Joint Venture)
Moorside, Cumbria

EDF Energy – Hinkley Point C (HPC) - 2 EPRs (3260MWe)
Sizewell – 2 EPRs (3260MWe)

NATIONAL NUCLEAR LABORATORY

EDF Energy UK
Areva EPR's
Hinkley Point, Somerset
Sizewell, Suffolk
Additional options for siting at Bradwell, Hartlepool, and Heysham



Source: WNA 2015

- October 2011
  - Application - consent to construct and operate
  - Initial date start up was end 2017 (now 2023)
- By September 2010
  - £50M contracts with supply chain
- By February 2013
  - Pre-development costs had reached £1Bn
- By October 2013
  - Terms for £16bn investment contract agreed
  - 35 year CfD with strike price
    - £89.5/MWh (Sizewell proceeding)
    - £92.5/MWh
- By October 2014
  - EC decides that UK plans supporting construction meet state aid rules
- By October 2014
  - New Project Investment
    - EDF retains 45 – 50% share
    - CGN / CNNC takes up 30 – 40% share
    - Areva takes up 10% share
    - Options for further take up
- Supply Chain
  - EDF – architect engineer
  - Areva - reactor system, fuel, control and instrumentation (>£1.7 billion)
  - Bouygues / Laing O'Rourke - civil engineering (>£2 billion)
  - Costain - cooling water intake tunnels
  - Alstom - two steam turbines of about 1700 MWe
  - Rolls-Royce - manufacturing of nuclear components.
  - Workers on project
    - 25,000 total
    - 5600 on site at any one time
    - 900 permanent jobs when operational

Horizon – Wylfa – 2 ABWRs (2760MWe)
Oldbury – 2 ABWRs (2760MWe)

NATIONAL NUCLEAR LABORATORY

Horizon Nuclear Power Ltd
(Owned by Hitachi)
Hitachi GE ABWRs
Wylfa, Anglesey
Oldbury, Gloucestershire

HORIZON NUCLEAR POWER

Source: WNA 2015

- In 2009
  - Horizon Nuclear Power established
  - 50:50 joint venture - RWE npower / E.ON UK
  - Horizon bids for and successful - Oldbury and Wylfa sites
- Initial plan was by 2025;
  - ~6000 MWe of new nuclear capacity
  - Wylfa - 4 AP1000 reactors or 3 EPR units.
  - Oldbury – 3 AP1000 reactors or 2 EPRs
- By early 2012
  - German-based RWE and E.ON announced withdrawal from Horizon JV
- By October 2012
  - Hitachi bid successful for Horizon (~£700M)
  - 2 x 1380 MWe ABWR units per site
- By April 2013
  - Applied to ONR for GDA
  - Expected to complete end 2017
- By May 2013
  - Hitachi-GE Nuclear Energy Ltd (HGNE) - engineering and design contract signed
  - Babcock International has expressed some interest in taking equity in the two Horizon projects.
- By December 2013
  - UK Government signed a cooperation agreement with Hitachi and Horizon "to promote external financing"
  - Expectation to have a similar guarantee to HPC by end 2016
- By 2019
  - Full construction expected to begin

NUGEN – Moorside – 3 AP1000s (3405MWe)

NATIONAL NUCLEAR LABORATORY

NuGeneration Ltd
(Toshiba Westinghouse / GDF Suez Joint Venture)
Moorside, Cumbria

Source: WNA 2015

- Early 2009
  - NUGEn established
  - 50:50 joint venture - Iberdrola / GDF Suez
- October 2009
  - Moorside site purchased
- December 2013
  - Iberdrola agreed to sell 50% share to Toshiba
- June 2014
  - Toshiba buy one – fifth of GDF Suez's stake to give it majority (60%) ownership
  - Intention given to build 3 AP1000 reactors at Moorside
- December 2014
  - Cooperation Agreement signed with UK government to gain access to the 2012 UK guarantee scheme for infrastructure
  - Discussions with UK Government regarding terms for the contracts for difference (CfD)
- Early 2017
  - Site licence application is expected following GDA approval for AP1000
- 2024
  - First unit expected to be on line

National Grid will need to build 400 kV lines

- October 2023 - grid connection agreement for 1600MWe
- October 2025 - grid connection agreement for a further 1600MWe

UK Supply Chain is…..

NATIONAL NUCLEAR LABORATORY

- Making a major contribution to UK new build programme
- Investing in facilities and skills
- Bringing together Sheffield and Manchester universities and 30 industrial companies through Nuclear Advanced Manufacturing Research Centre
- Creating an NIA Nuclear Supply Chain development programme
- Delivering through an NIA programme management board
- Supported by utilities and reactor vendors

the nuclear institute

nuclear delta™

nuclear delta™

- Separates a nuclear professional from other professional scientists, engineers, technologists, and business specialists.
- Demonstrates a personal commitment on the part of each member to an enhanced level of professionalism, security and safety standards.

Agenda

NATIONAL NUCLEAR LABORATORY

- UK History
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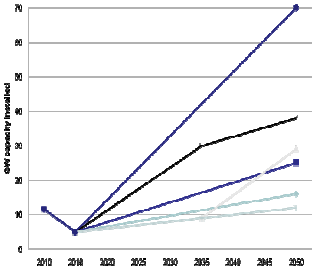
Scenarios for deployment of Nuclear Energy in UK

NATIONAL NUCLEAR LABORATORY



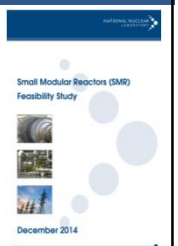
By 2050;
- Legally binding 80% emission reduction
- Grid grows from ~85GWe to ~300GWe
- Generation sources – Renewables / CCS / Nuclear

Deliver long term secure energy on the way to a low carbon energy future

Example : UK SMR Study Overview

NATIONAL NUCLEAR LABORATORY

- Government-commissioned industry-led feasibility study into Small Modular Reactors (SMRs)
- Delivered by a consortium of experts from the UK nuclear industry
- NNL led the study
- Six Down-selected Technologies;
  - mPower – B&W and Bechtel
  - NuScale – Fluor
  - Westinghouse SMR – Westinghouse
  - ACP 100+ - CNNC
  - Plus;
  - ANTARES - AREVA (removed from study)
  - U-Battery – Urenco (evaluated separately)



www.nnl.co.uk/media/1627/smr-feasibility-study-december-2014.pdf

Agenda

NATIONAL NUCLEAR LABORATORY

- UK History
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Summary and Conclusions

NATIONAL NUCLEAR LABORATORY

- UK Nuclear Industry pioneer in nuclear generation
- Lifetime extensions being pursued for AGR and PWR stations
- UK Government pursuing nuclear as a key part of energy mix
- New Build programme proceeding across a number of existing licenced sites with EPR, ABWR and AP1000 technology
- Significant supply chain contracts already in place with UK having a mature and flexible supply chain
- Further phases on nuclear as an energy source being evaluated beyond existing New Build Programme

NATIONAL NUCLEAR LABORATORY

NATIONAL NUCLEAR
LABORATORY

Appendix 3

Presentation by Dr. Frank Akstulewicz

New Nuclear Plant Construction and Licensing Activities Worldwide

New Nuclear Plant Construction and Licensing Activities Worldwide

Frank Akstulewicz, Director
Division of New Reactor Licensing
Office of New Reactors
U.S. Nuclear Regulatory Commission

June 9, 2015

U.S.NRC

New Reactor Licensing Activities

- The NRC is an independent U.S. government agency that was established in 1974 to regulate the Nation's civilian commercial, industrial, academic and medical uses of nuclear materials.
- The agency's mission is to protect public health and safety, promote the common defense and security, and protect the environment.
- The NRC does not promote or endorse the use of nuclear power but regulates its safe operation, when used.
- The NRC, upon submission and review of an acceptable application and completion of appropriate regulatory processes, is responsible for issuing licenses to construct and operate new nuclear power plants in the U.S.
- Focus is on Light Water Reactors

U.S.NRC 2

Proposed Agenda

- Snapshot of construction/licensing of new nuclear power plants worldwide – focus is on Large Light Water Reactors (LLWRs)
- New reactor trends from a regulator's perspective
- Multinational Design Evaluation Program (MDEP)
- New nuclear power plants in the United States
  - Licensing Process
  - Status of Licensing
  - Construction Activities and Oversight

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Major Construction Activities throughout the World

- There are 65 LLWRs under construction in 14 countries (various designs being considered) (WNA)
- China – 24 reactors under construction (AP1000, EPR, others)
- Finland – 1 (EPR)
- France – 1 (EPR)
- India – 6 (various)
- Japan – 2 (ABWR)
- Republic of Korea - 4 (APR1400) and other designs
- Russian Federation – 9 (VVER designs & various)
- Slovakia – 2 (V-213+)
- United Arab Emirates – 3 (APR1400)
- United States – 5 (AP1000 and Westinghouse 4 Loop)
- *Several other countries considering construction*

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New Reactor Licensing Activities

- Canada – site licensing and design reviews*
- China – licensing and design reviews
- Czech Republic – siting and tendering *
- Finland – 2 new sites approved and design reviews
- France – possible second new EPR
- India – siting and design reviews
- Republic of Korea – licensing and design reviews
- Russian Federation – licensing and design reviews
- South Africa – licensing processes
- United Kingdom – site licensing and design reviews
- U.S.A – combined license and standard design reviews
- Bulgaria, Turkey, Vietnam, etc.

** These countries are in the early stages of licensing.*

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New Small Modular Reactor Trends

- Regulatory Initiatives such as MDEP and Nuclear Energy Agency (NEA) – Committee on Nuclear Regulatory Activities (CNRA)/Working Group on the Regulation of New Reactors (WGRNR)
- Small Modular Reactors (SMRs)
  - NRC reviewed readiness and assessed key policy and infrastructure Issues (SECY-14-0095, ML14073A710)
  - Key SMR issues:
    - Emergency Planning
    - Mechanistic Source Term
    - Multi-Module Control Room Staffing
    - SMR Insurance and Liability
- GEN IV Reactors (non-LWRs)

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Regulator Initiatives – MDEP and WGRNR

- Multinational Design Evaluation Program
  - Started in 2006
  - Cooperate and exchange information on design reviews
  - Explore opportunities for harmonization of licensing and safety review approaches in specific areas
- Members – regulators from
  - Canada, China, Finland, France, India, Japan, Russia, South Africa, South Korea, Sweden, Turkey, U.A.E, U.K., and U.S.A
  - Regulators retain sovereign rights and responsibilities for licensing new reactors in their countries
- IAEA involved in all generic activities
- OECD Nuclear Energy Agency acts as technical secretariat (www.oecd-nea.org/mdep)

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MDEP Organizational Structure

MDEP members interact with industry to include: operators, licensees, applicants, vendors, standards development orgs, other regulatory authorities, GIF, INPRO, etc.

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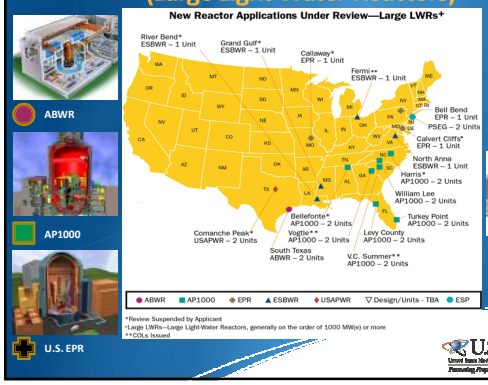
New Reactor Applications in the U.S. Under Review (Large Light Water Reactors)



ABWR

AP1000

U.S. EPR

ESBWR

US-APWR

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New Reactor Licensing in the U.S.A. (1/3)

- Most new reactor licensing activities are occurring under 10 CFR Part 52
  - These regulations have been in place for over 20 years and were a result of lessons learned from the hundreds of licensing reviews that were undertaken in the 1970s and 80s
- Licensing under 10 CFR Part 50 still available
  - Construction Permit and then Operating License
  - Watts Bar 2 constructing under Part 50
- Standard Design Certifications
  - ABWR (GE) - certified
  - AP1000 (WEC) – certified
  - ESBWR (GE-H) – certified
  - *AP600 (WEC) – certification expired*
  - *System 80+ (CE) – certification expired*

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New Reactor Licensing in the U.S.A. (2/3)

- Standard Designs under review
  - US APWR *(Mitsubishi)*
  - APR1400 *(KHNP)*
- Early Site Permits issued
  - Clinton *(IL – Exelon)*
  - Grand Gulf *(LA – SERI)*
  - North Anna *(VA - Dominion)*
  - Vogtle *(GA – Southern Nuclear)*
- ESPs under review
  - PSEG *(Salem County, NJ)*
- Combined Licenses issued
  - Vogtle Units 3 and 4 *(AP1000 – Southern Nuclear)*
  - V.C. Summer Units 2 and 3 *(AP1000 – SCANA/SCE&G)*
  - Fermi Unit 3 *(ESBWR – DTE Electric)*

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New Reactor Licensing in the U.S.A. (3/3)

18 Combined License Applications submitted, 5 of which are actively under review:

- ABWR
  - STP (TX – NRG Energy)
- AP1000
  - Levy (FL – Duke)
  - Lee (SC – Duke)
  - Turkey Pt (FL – FPL)
- ESBWR
  - North Anna (VA – Dominion)
- ***US EPR****
  - ***Calvert Cliffs (MD – UniStar)****
  - ***Bell Bend (PA – PPL)****
- **US APWR**
  - ***Comanche Peak (TX – Luminant)****

****Suspended applications***

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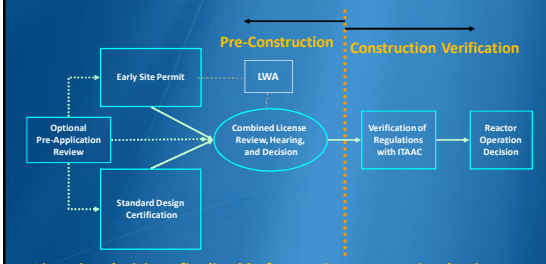
Part 52 - Fitting the Pieces Together



- Licensing decisions finalized before major construction begins
- Inspections w/ITAAC to verify construction
- Limited work may be authorized before COL issuance

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Vogtle and Summer Construction (AP1000)

- COLs issued in Feb and Mar 2012, respectively
- First concrete pours in March 2013
- Operation currently planned for 2019 for first Vogtle or Summer unit
- Regulatory processes in place to handle necessary changes to design/licensing basis during construction
  - Change process as identified in the regulations
  - License amendment/exemption request process
- Licensee responsible for building plant as designed and licensed

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Significant Vogtle Construction Activity

The auxiliary area of the Vogtle Unit 3 nuclear island

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Significant V.C. Summer Construction Activity

Aerial photograph of V.C. Summer Units 2 and 3 nuclear construction project

December 2014 Photo provided by SCE&G

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Some Key U.S. New Reactor Issues

- Construction Efforts
- Building to the approved design
- Simulator Qualification
- Digital I&C
- Supply Chain Quality
- Modular Construction

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NRC Oversight

- NRC Resident Inspectors onsite at Vogtle and Summer (supported by Region II)
  - Construction and operational programs inspections
  - ITAAC verification procedures
- NRC inspecting vendors supplying key components for construction
  - Quality Assurance, etc.
- Upon acceptable submission of notification by licensee, oversight will provide input into Commission's decision allowing fuel loading and initial operation

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Other New Reactor Activities

- Active SMR Designs
  - NuScale Design Certification
    - Application expected in December 2016
    - Draft DSRS to be published for comment in July 2015
- Potential NuScale COL Applicants:
  - TVA (Clinch River Site)
  - Utah Associated Municipal Power Systems (UAMPS)
- As with LLWRS, addressing key SMR issues early is vital in supporting docketing decisions and establishing review schedules
- Advanced Reactors
  - High temperature gas cooled
  - Liquid metal cooled

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Summary

- There is high level of activity in the area of new nuclear plant construction and licensing worldwide
- Many more plants being licensed and designs being reviewed by safety regulators
- Vogtle and Summer construction ongoing with NRC construction oversight (this is the first exercising of the Part 52 post COL process)

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Thank You

For additional information on the NRC or new reactors please visit us at:

www.nrc.gov/reactors/new-reactors.html

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Acronyms/Abbreviations

10 CFR	Title 10 of the *Code of Federal Regulations*	LA	Louisiana
ABWR	Advanced Boiling Water Reactor	LLWR	Large Light Water Reactor
ADAMS	Agencywide Documents Access & Management System	LWA	Limited Work Authorization
ANS	American Nuclear Society	LWR	Light Water Reactor
AP1000	Advanced Pressurized 1000	MD	Maryland
AP600	Advance Pressurized 600	MDEP	Multinational Design Evaluation Program
APR1400	Advanced Power Reactor 1400	MI	Michigan
B&W	Babcock & Wilcox	NEA	Nuclear Energy Agency
CE	Combustion Engineering	NJ	New Jersey
CNRA	Committee on Nuclear Regulatory Activities	NRC	Nuclear Regulatory Commission
COL	Combined License	OECD	Organisation for Economic Co-operating and Development
COLA	Combined License Application	PA	Pennsylvania
DC	Design Certification	PPL	Pennsylvania Power and Light
DTE	formerly Detroit Edison	SC	South Carolina
EPR	Evolutionary Power Reactor	SCE&G	South Carolina Electric & Gas Company
ESBWR	Economic Simplified Boiling Water Reactor	SMR	Small Modular Reactor
ESP	Early Site Permit	STP	South Texas Project
FL	Florida	TX	Texas
FPL	Florida Power & Light	U.A.E.	United Arab Emirates
GA	Georgia	U.K.	United Kingdom
GE	General Electric	U.S.	United States
GEH	General Electric-Hitachi	U.S.A.	United States of America
GEN IV	Generation IV	US-APWR	United States Advanced Pressurized Water Reactor
GIF	Generation IV International Forum	VA	Virginia
IAEA	International Atomic Energy Agency	VVER	Voda Voda Energo Reactor
IL	Illinois	WEC	Westinghouse Electric Company
INPRO	International Project on Innovative Nuclear Reactors and Fuel Cycles	WGRNR	Working Group on the Regulation of New Reactors
ITAAC	Inspections, Tests, Analyses, and Acceptance Criteria	WNA	World Nuclear Association
KHNP	Korea Hydro & Nuclear Power		

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Background Slides

NRO Organizational Chart
NRC Lessons Learned Reports

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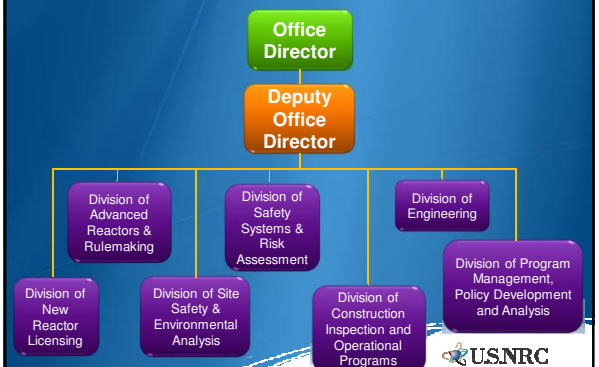
Office of New Reactors Organizational Chart



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Lessons Learned – USA (1/2)

- Part 52 Licensing Lessons Learned Report
  (April 2013 – ADAMS Accession Number ML13059A239)
  - High quality applications with sufficient detail
  - Timely development and maintenance of regulatory guidance
  - Strong design standardization
  - Early identification and timely resolution of complex issues
  - Improve system of requests for additional information
  - Concurrent reviews of design certifications and combined license applications
  - Update to regulations incorporating lessons learned

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Lessons Learned – USA (2/2)

- Part 52 Post-COL Self Assessment Report
  (July 2013 – ADAMS Accession Number ML13196A403)
  - Timely and good quality inspections
  - Effective training, preparation, and program support of inspectors
  - Prompt, accurate, and well-documented licensing and technical support of Region II by the Office of New Reactors and the Office of General Counsel
  - Well-documented bases for both the 10 CFR Part 52 Construction and Vendor Inspection Programs
  - Timely processing of preliminary amendment requests and license amendment requests
  - Effective feedback processes within the implementation guidance that promote self-correction of the program

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