Supply Chain Organization

Anticipating local Industry Participation

GDANSK
April 20th, 2012
J.M DE GUIO
EDF Engineering and Generation Division
VP Industrial Policy

Y. ROBIN
AREVA New Builds
Procurement Development

Gdansk Industry meeting – April 20th, 2012
AGENDA

- Introduction
- Addressing Key Questions
  - AREVA Track Record Experience and Localization Worldwide
  - Components, materials and activities that could be localized
  - How EDF can contribute to create a local nuclear supply chain?
  - Key success factors and lessons learnt
  - Socio-economic benefits
- Conclusion
French Industry (EDF, AREVA) has built reactors since the 1960’s

→ 102 reactors built around the world

- EPR under construction: 4
- PWR in operation: 84
- BWR in operation: 6
- PHWR in operation: 1
- Shutdown Reactors: 7

Total plants: 102

Gdansk Industry meeting – April 20th, 2012
AREVA Track Record Experience and Localization worldwide

Real life experience

- A sustainable nuclear energy future involves an entire nation: its people, its goals, its resources and talents

- No standard models of localization, only specific and tailor-made
Real life experience

- **South Korea**: a relationship that began over 30 years ago
- **China**: a total cooperation for nuclear energy self-reliance
- **Brazil**: Renewing a long-standing partnership for greater self-reliance
- **Japan**: La Hague to Rokkasho-Mura reprocessing plant, “from knowledge to self-confidence”
- **South Africa**: a fuel technology transfer that resulted in indigenous fabrication of fuel reloads for Koeberg NPP
- **USA**: moving the nuclear revival forward with the creation of a heavy equipment JV

*and more to come in India, United Kingdom, South Africa, Czech Republic, Poland, …*
AREVA Track Record Experience and Localization worldwide

Real life experience: South Korea

1975 Fuel cycle related technology transfer
1980-1981 Ulsan 1 and 2 contract, skills development and know-how transfer for erection and commissioning
1982 Localization of heavy components manufacturing at the Changwon plant

Korean standardization program
2007 10-years contract for uranium enrichment

A relationship that began over 30 years ago
AREVA Track Record Experience and Localization worldwide

Real life experience : China

A total cooperation for nuclear energy self-reliance

Gdansk Industry meeting – April 20th, 2012
Illustration of AREVA partnership with China for the development of its nuclear industry
AREVA Track Record Experience and Localization worldwide

Real life experience: Brazil

- **1975**: Fleet program for 8 reactors
  - NUCLEP: Heavy component manufacturing and plant construction
  - Fuel Fabrication Technology Transfer

- **1988**: INB created for Mining, Yellow cake and Fuel production

- **2004**: AREVA along with NUCLEP manufactures 2 replacement steam generators for ANGRA 1

Renewing a long-standing partnership for greater self-reliance

Gdansk Industry meeting – April 20th, 2012
AREVA Track Record in Technology Transfer and Localization worldwide

Real life experience: Japan

- At first (1976), Japan sent 3,000 tons of spent fuel for reprocessing to La Hague.

- Then, beginning in 1987, they engaged in the development of domestic reprocessing capabilities:
  - Technology transfer
  - Technical assistance for start-up and plant operations
  - Tailor-made, hands-on training in the La Hague sister plant
AREVA Track Record Experience and Localization worldwide

Real life experience: South Africa

- 1972, Uranium conversion – Industrial cooperation
- 1980, Fuel Fabrication Technology Transfer
- Services & Maintenance - LESEDI

“A fuel Technology Transfer that resulted in indeginous fabrication of fuel reloads for Koeberd Nuclear Plant”
AREVA Track Record Experience and Localization worldwide

Real life experience: USA

- Fuel Fabrication Plants
- MOX Fuel Fabrication Facility
- Enrichment
- Design & Construction of nuclear reactors
- Pump & Motor maintenance workshop
- Spent Fuel treatment facility development study
- Heavy Equipment JV with Northrop Gruman

“Moving the nuclear revival forward with the construction of a new manufacturing facility”
### Potential scope of localization for Nuclear Power Plant New Builds

**Degree of investment and complexity**

<table>
<thead>
<tr>
<th>Easiest, less demanding for special qualification</th>
<th>Minimum investment or time needed to qualify</th>
<th>Significant investment needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>▶ Earthworks &amp; Foundations</td>
<td>▶ Pumps (non-primary)</td>
<td>▶ Fuel fabrication</td>
</tr>
<tr>
<td>▶ Concrete and rebar supply</td>
<td>▶ Valves</td>
<td>▶ Spent fuel reprocessing</td>
</tr>
<tr>
<td>▶ Intake and outfall construction</td>
<td>▶ Filters</td>
<td>▶ High level waste storage</td>
</tr>
<tr>
<td>▶ Auxiliary buildings</td>
<td>▶ Vessels</td>
<td>▶ Heavy forgings</td>
</tr>
<tr>
<td>▶ Substations</td>
<td>▶ HVAC</td>
<td>▶ Reactor Pressure Vessel</td>
</tr>
<tr>
<td>▶ Transmission lines</td>
<td>▶ Pipe fabrication</td>
<td>▶ Steam Generator</td>
</tr>
<tr>
<td>▶ Cranes</td>
<td>▶ Motors</td>
<td>▶ Polar Crane</td>
</tr>
<tr>
<td>▶ Piping QC3</td>
<td>▶ Transformers</td>
<td>▶ Safety &amp; Operational I&amp;C</td>
</tr>
<tr>
<td>▶ Fire Fighting Equipment</td>
<td>▶ MV &amp; LV Switchgears</td>
<td>▶ Main auxiliaries pumps</td>
</tr>
<tr>
<td>▶ Cable trays</td>
<td>▶ Heat Exchanger</td>
<td>▶ Main Control Room</td>
</tr>
<tr>
<td></td>
<td>▶ Power Cable</td>
<td>▶ Diesel Generators</td>
</tr>
</tbody>
</table>

*Generic list to be tailored to each country/project.*

*The level of localization is proportional to the size of the program*
(1) Total direct jobs related to the fleet build program, including: construction, manufacturing & operating the nuclear power plants. Induced jobs not accounted.

Industry clusters are operational from date providing prerequisites and, where necessary, Government interventions are satisfied.

Example of Nuclear Industry development
Industrial clusters development during fleet construction

Start

Unit #1 connected to grid

Gdansk Industry meeting – April 20th, 2012
Examples of successful AREVA Localisation and technology transfer of components manufacturing in the 1990s when starting the 1000MW Chinese program

- Looking at middle class components ~ 20 suppliers qualified by AREVA for the NI:
  - Part of CI1 piping: SCMP
  - All auxiliary piping prefabrication and erection (Classified and non Classified): Company 23 and CEMR
  - Classified and non Classified Pressure vessels, tanks and heat exchangers manufacturing: SPEC (Shanghai) and DBC
  - All Supports of heavy and others components (Classified and non Classified): CNE (Erzong), Company 23
  - Most of auxiliary handling tools and components including parts of fuel handling: XNE (Xian)
  - HVAC components manufacturing: Jiangsu Shenhai, Jiangsu Huagang
  - Classified Cables manufacturing: SCW (Shanghai),
  - All Cable trays: ZCT (Zhengjiang) and NCT (Ningbo)
Example of successful localization for safety primary components

NSSS Taishan 1

Pressurizer
AREVA

Steam Generator
AREVA

RPV
MHI

Internals
Skoda JS

Control Rod Drive
Mechanisms
AREVA

Reactor Cooling Pumps
AREVA

Primary Lines

NSSS Taishan 2

Pressurizer
DFHM

Steam Generator
SENPEC / DFHM

RPV
DFHM

Internals
Shanghai Number 1

Control Rod Drive
Mechanisms
JSPM/
Shanghai Number one

Reactor Cooling Pumps
JSPM/ADJV
DFEM/SAFAS

Primary Lines

investment set up to be able to deliver the most critical equipments
Sourcing on Local Supplier Market – AREVA has demonstrated already:

- 36 Finnish companies have been validated as Approved Vendor for global Supply Chain for Safety Related Applications up to now for OL3-Project

- In addition, significant number of local companies engaged for Non-Safety Related supplies and services

Even for one unit EPR Project (as in OL3), local suppliers will be involved
Main polish Suppliers already involved for EPR construction in OL3

- **Polimex Mostostal**
  - Manufacturing of Containment Steel Liner
  - Detail manufacturing design of liner
  - Material supply and pre-fabrication in Poland
  - Oversea transportation from Gdynia harbor in Poland to OL3 Site

- **Elektrobudowa SA**
  - Installation of all electrical and I&C equipment at OL3
  - All electrical and I&C Equipment at OL3 EPR™ project
  - Nuclear Installation Contracts from AREVA for other Projects
    - e.g. Project PLEX in Oskarshamn/Sweden

- **KMW Engineering**
  - Engineering, Pre-fabrication and installation
    - HVAC Installation (consortium Broich/P/KMW)
    - all HVAC ducts manufactured in Poland
    - installing all HVAC equipment [dampers, fans, filters, air handling units, etc.]

- **Polbau**
  - Civil Works for OL3 for TI and NL
    - Working as subcontractor of Heitkamp also for TI
    - Several hundred Civil Construction worker from Poland have been involved at OL3 Construction Site

**Huge involvement of Polish personnel on OL3 site:**
- from Finland 29%
- from Poland 20%

Gdansk Industry meeting – April 20th, 2012
AREVA and EDF have started to build a new UK supply chain for a new generation of EPR™ in UK

- Several majors MoUs signed for global partnerships
  - Balfour Beatty Vinci : Civil Construction Work
  - Rolls Royce
    - Manufacturing
    - Collaboration on potential recycling projects in the UK
    - Collaboration on international projects
  - AMEC : Engineering

- Many UK Companies already identified for Engineering, Equipment and Construction either for EPR or maintenance operations:
  - Over 400 UK companies registered on the Areva’s potential supplier list
  - 60 UK suppliers ready to be involved in the next EPR projects
    - 38 companies pre-qualified (Thomson Valves, Ultra electronics, SPX,..)
    - 22 companies qualified, having already business with Areva for New Builds (Weir Group, Darchem,..) and operations (Babcock international, Doosan Power,..)

AREVA relies upon its Global Supply Chain and develops UK Partners
Sourcing & Qualification Process

1. Sourcing
   - Request For Interest
   - Supplier Pre Selection according to RFI’s Feedback analysis

2. Pre-Selection
   - Supplier Pre Assessment (Quality management, design, manufacturing, ...)

3. Pre-Qualification
   - Action Plan definition and follow up
   - Product or process qualification tests as necessary
   - Blank RFQ for detailed technical assessment

4. Qualification
   - Before contract, when the Qualification is satisfactory, approval of the Supplier (Approved Vendor List)

Approved Vendor List

Gdansk Industry meeting – April 20th, 2012
Qualification criteria are referenced in Quality management and Product Specifications

Table of Contents

Introduction
1. Scope
2. Definitions
3. Documentation
4. Design
5. Materials
6. Manufacturing
7. Operability
8. Requirements for Auxiliary Systems, Venting, Drains, Integral Supports

Quality Requirements
With modulation according to Safety Class and National Regulations
- Quality Management
- Documentation
- Inspection

Codes & Standards techniques:
- ASME,
- RCCM,
- KTA,...
- IEEE,... Normes Standards

Contract with Terms and Conditions
- Requisition
- Price
- Schedule...

Gdansk Industry meeting – April 20th, 2012
TheQuality Management requirements are graded according to the safety grade of the product (components or services) to be supplied:

<table>
<thead>
<tr>
<th>Quality grading</th>
<th>Component status</th>
<th>QA requirements</th>
<th>HSE requirements to be considered</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAFETY GRADE (NUC)</td>
<td>Products and services safety related</td>
<td>ISO-9001 complemented by nuclear specific requirements</td>
<td>Environmental program ISO14001, Health &amp; Safety program (OH SAS 18001)</td>
</tr>
<tr>
<td>(Q1, Q2)</td>
<td></td>
<td><a href="http://www.nqsa.org/nsq100-standard/download-nsq100.html">http://www.nqsa.org/nsq100-standard/download-nsq100.html</a></td>
<td></td>
</tr>
<tr>
<td>STANDARD GRADE (ISO)</td>
<td>Products and services non safety related but important for construction and/or operation</td>
<td>ISO-9001</td>
<td></td>
</tr>
<tr>
<td>Q3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NOT CLASSIFIED (NC)</td>
<td>Other products and services</td>
<td>(ISO-9001 recommended)</td>
<td></td>
</tr>
</tbody>
</table>
Established nuclear codes (RCC-M is made by AFCEN: http://www.afcen.com/)

Established nuclear codes or harmonized standards with complements

Industrial codes and standards

Complemented with AREVA NP specific requirements where applicable.
AREVA Sourcing process in Poland

AREVA has been mapping Polish Industry and is now pursuing the pre-selection and pre-qualification phases

- 154 companies registered on the Polish MSL
- 29 assessment visits performed
- 21 companies considered pre-qualified
- 3 companies considered qualified
6 Key success factors for local companies new comers in the nuclear sector:

1. General Management commitment
2. Employees safety culture & mobilization
3. Quality Assurance + Quality Control internal surveillance
4. Management of Sub-contracts
5. Management of non-conformance in trustworthy atmosphere
6. Responsibilities & authority of the Supplier Project manager
How to start the process with AREVA

Learn about nuclear industry
http://nuclear-learning-tour.areva.com

Register your company on our website
http://suppliers.areva.com

If you are interested, start planning for future Qualification
The largest fleet in Europe
- 58 units in operation
- Installed on 19 sites
- 63 GW, in 3 levels of power:
  - 900 MW (34 units)
  - 1,300 MW (20 units)
  - 1,500 MW (4 units)
- Flamanville 3 (EPR, 1,650 MW) under construction
- Penly 3 (EPR, 1,650 MW) under project
- 9 units in dismantling phase

1500 years.unit of nuclear experience feedback
EDF’s industrial strategy is based on several general axis:

- Keep capabilities of the suppliers on long term
- Organize the contracts so that the suppliers can share our objectives
- Give wide fields of responsibility to the contractors: prefer all inclusive contracts, from design to installation, including manufacturing
- Use as far as possible lessons learnt from previous projects (with experienced companies) but also be open to new technologies (with new suppliers)
- For new projects abroad, encourage partnership between nuclear experienced suppliers and new local suppliers
For all the nuclear projects in a newcomer country, the local industry includes companies skilled in standard industry, very aware of the traditional local context (country legislation, industrial uses, purchasing uses,...)

EDF has already several hundred of experienced suppliers in France; they know very well the nuclear requirements but not the local context, and they are not able to build alone a nuclear power plant.

For a common interest, Partnerships between experienced EDF suppliers and local companies are very welcome.
Many factors depending on the country and on the economical environment:

- The industrial capability of the country and the opportunity to localize industry
- The capability of the experienced companies worldwide
- The engineering capability of the global contractor and its competencies in order to specify, evaluate the suppliers, manage the interfaces, and survey the suppliers.
How EDF can contribute to create a local nuclear supply chain for the construction phase?

- **First step**: to organize the scouting of the capabilities of the local companies, then to select the ones that will be able to join the nuclear supply chain. *One or several meetings with the local companies may be useful.*

- **Second step**: to adapt the allotment of the projects to the detected capabilities of the local industry.

- **Third step**: to engage a double qualification process
  - The qualification of the companies (engineering, equipment supplies, erection) ; it may last between 6 months to 2 years for 1 company
  - The qualification or prequalification of the critical (important for safety) components ; it may last up to 4 years for some equipments.
How EDF can contribute to create a local nuclear supply chain for the operation phase?

The contractors are generally not involved in plant operations. EDF use to organize the employee training of the foreign operators by:

- Training of the employees, in their country (mainly by the use of simulators) and in France (training courses in EDF training centers, and among EDF operator teams in nuclear units)
- Sending EDF advisors in the nuclear power plants (EDF has still such advisors in South Africa and in China), both for
  - general management,
  - outage management,
  - operation management.
- Sharing experience with the operator during all the life of the units (Chinese Daya Bay 1 & 2 and South African Koeberg unit are considered like EDF units for EDF challenges for nuclear safety, human security, protection against radiation, cleanliness, innovation,...).
How EDF can contribute to create a local nuclear supply chain for the maintenance phase?

Maintenance must rely on specialized companies, with an effective survey by the operator

- **First step**: to organize the scouting of the capacities of the local companies, then to select the ones that will be able to be involved in the maintenance.

- **Second step**: to organize, inside the owner company, a qualification and survey system of the contractors

- **Third step**: to launch a special training for the workers, mainly about:
  - The safety of the plant
  - The protection against the radiation
  - The professional gestures. For example, the productivity prime have not the same nature (for a welder the length of the welded run in oil/gas, the quality of welding in nuclear).

- **Fourth step**: to launch the qualifications of the maintenance companies, then award the contracts

- **Fifth step**: to get benefits from lessons learnt and share major insights with our partners
Effect on local economy and employment of a standard NPP Project

For 1 unit:

- Increase employment during both construction and operation
- Involvement of very local companies (located near the chosen site) through direct contracts with the general contractor, or through sub-contracts.
Potential major elements of the nuclear value chain

- Equipment Fabrication
- Global Logistics
- Fuel Cycle
- Full Service Package
- Export Markets
- Engineering & Design
- Nuclear PP Contract & Fleet
- Local Government
- Nuclear Regulator
- Local equipment suppliers (valves, equipment)
- Research Reactor
- Nuclear Technology Transfer
- International Training Center
- Artisan Training
- Nuclear Skills Development

Gdansk Industry meeting – April 20th, 2012
Many induced jobs will be created

The welding trade is a key to the construction of the nuclear fleet as well as other projects including the Oil & Gas and Chemical industries.

- This trade provides an example of jobs created in addition to the welder himself. These induced expenditures directly translate into additional manufacturing jobs in the Country

  - Welder training schools
  - Welding Machines
  - Welding electrodes and filler wire
  - Welding electrode holders and guns
  - Electrode storage ovens
  - Welder’s helmet
  - Gloves
  - Protective vest
  - Electrical cable
  - Welding and cutting gases
  - Bottles for shipping and storing the welding gases
  - Gas hoses for welding
  - Fuel for running the diesel generator welding machines
Conclusion

This type of program has a significant socio-economic impact and is an important part of the economic base of several countries including France.

The industrial scheme is flexible and has to be adapted to local situation. The local industrial participation is quite significant even when the program is limited to a few units.

The local industry participation has to be anticipated early enough by the concerned parties in order to be capable to show the appropriate qualification when the selection process starts.

AREVA and EDF look forward to our next discussions regarding your program and how we can add value based on our collective experiences in this challenging industry.
Any reproduction, alteration or transmission of this document or its content to any third party or its publication, in whole or in part, are specifically prohibited, unless AREVA has provided its prior written consent.

This document and any information it contains shall not be used for any other purpose than the one for which they were provided.

Legal action may be taken against any infringer and/or any person breaching the aforementioned obligations.