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行政院及所屬各機關出國報告提要

出國報告名稱：洽訪龍門計畫 **8749011M041A0** 及 **8749311M041B0** 合約廠商執行進度查核及辦理稽催

頁數____ 含附件：■是□否

出國計畫主辦機關/聯絡人/電話：台灣電力公司/李高雄/（**02**）**2322-9450**

出國人員姓名/服務機關/單位/職稱/電話：

李高雄/台電/核能火力發電工程處/計畫工程師/（**02**）**2322-9450**

出國類別：□1 考察□2 進修□3 研究□4 實習■5 其他（洽公）

出國期間：**97** 年 **11** 月 **8** 日至 **97** 年 **11** 月 **16** 日　　出國地區：法國

報告日期：**98** 年 **1** 月 **10** 日

分類號/目

關鍵詞：

內容摘要：

1. 龍門計畫 **8749011M041A0**（**Emergency Diesel Generator**，**EDG**／緊急柴油發電機）及 **8749311M041B0**（**Stand-by(Swing) EDG**／備用緊急柴油發電機）二件外購設備合約廠商均爲法國 **Man Diesel SA**。其中 **M041A0 Contract Amendment No.1** 係因追加額外工作與成本並展延交期之契約變更；**M041B0** 部分因冷卻器設計變更及工期展延，本公司已於 **96** 年 **4** 月與廠商完成議價修約。**M041A0** 原預定於 **97** 年 **3** 月交運完畢；**M041B0** 原預定於 **97** 年 **6** 月完成交運。
2. 由於本案尚有部分 **Piping and Pipe Support** 及 **Radiators** 迄未如期交運，屢經催辦仍未配合處理。另外，本公司委託台崧公司在美國供料廠商執行品質檢驗之疏失，未及時發現材料屬 **unqualified source material**，在 **Certified Material Test Report**（**CMTR**）未符合 **ASME Sec. Ⅲ**規定要求需先做相關化性與物性檢測的情況下，即簽署 **Product Quality Certificate**（**PQC**）准予交貨，致衍生後續材料必須待補正程序釐清後始得交運情事。茲利用本次出國赴廠商了解有關因應處理狀況，並稽催加速辦理，以配合核四工地安裝時程需求。
3. 上述二合約設備，柴油機（**Diesel Engine**）部分係由 **Man Diesel SA** 自行製造；發電機（**Generator**）部分則分包予 **Alstom Power, France** 承製，均爲本合約之主要設備廠商，本次亦同時洽訪 **Alstom Power, France**，以確保履約順利。

出 國 報 告 內 容

壹、 出國任務

洽訪龍門計畫 8749011M041A0 及 8749311M041B0 合約廠商執行進度查核及辦理稽催。

說明：

一、 龍門計畫 8749011M041A0（Emergency Diesel Generator (EDG)／緊急柴油發電機）及 8749311M041B0（Stand-by(Swing) EDG／備用緊急柴油發電機）係二件外購設備合約廠商均爲法國 Man Diesel SA，其中 M041A0 Contract Amendment No.1 係因追加額外工作、成本並展延交期之契約變更；另外 M041B0 部分因冷卻器設計變更及工期展延，本公司已於 96 年 4 月與廠商完成議價修約。M041A0 原預定於 97 年 3 月交運完畢；M041B0 原預定於 97 年 6 月完成交運。

二、 由於本案尚有部分 Piping and Pipe Support 及 Radiators 迄未如期交運，屢經催辦仍未配合處理。另外，本公司委託台崧公司在美國供料廠商執行品質檢驗之疏失，未及時發現材料屬 unqualified source material，在 Certified Material Test Report（CMTR）未符合 ASME Sec. Ⅲ規定要求需先做相關化性與物性檢測的情況下，即簽署 Product Quality Certificate（PQC）准予交貨，致衍生後續材料必須待補正程序釐清後始得交運情事。茲利用本次出國赴廠商了解有關因應處理狀況，並稽催加速辦理，以配合核四工地安裝時程需求。

三、 上述二合約設備，柴油機（Diesel Engine）部分係由 Man Diesel SA 自行製造；發電機（Generator）部分則分包予 Alstom Power, France 承製，均爲本合約之主要設備廠商廠商，本次亦同時洽訪 Alstom Power, France，以確保履約順利。

四、 基於上述履約情況，本次奉派赴合約廠商洽示下列事項：

(一) 緊急柴油發電機及備用緊急柴油發電機合約廠商履約情形，並洽請有關加速設備交運作業之安排事宜。

(二) 緊急柴油發電機及備用緊急柴油發電機合約分包商承製設備之製造狀況及其與合約廠商之分配情形。

貳、 出國行程

97 年 11 月 8 日 ～ 11 月 9 日	往程（台北 －曼谷 － 阿姆斯特丹 － 巴黎）
11 月 10 日 ～ 11 月 12 日	洽訪龍門計畫合約廠商執行查核履約情形 Man Diesel SA
11 月 13 日 ～ 11 月 15 日	洽訪龍門計畫合約廠商執行查核履約情形 Alstom Power, France
11 月 16 日 ～ 11 月 17 日	返程（巴黎 － 阿姆斯特丹 － 曼谷 － 台北）

全程共計 10 天

參、 洽辦業務辦理情形

一、MAN Diesel S.A.部分：

(一) 按龍門計畫 8749011M041A0 緊急柴油發電機(EDG)及 8749311M041B0 備用緊急柴油發電機（SEDG）兩項合約之承攬商原爲 S.E.M.T.Pielstick，該公司於 2006 年 10 月被 MAN Diesel SE 以股東身分併購，隨於同年 12 月起正式更名爲 Man Diesel SA。係以供應航運、火車及發電廠等大型柴油發電機組著稱，設計及製造包括 2 行程／4 行程馬達、發電機組、氣渦輪機、螺旋推進器及各種動力機組，其發電機容量經 450 至 97,300kw，公司員工約 7,700 人，主要分布於德國、丹麥、法國及捷克等。公司總部位於法國巴黎，其柴油機及相關設備之製造工廠則位於法國西北方之 Saint-Nazaire。有關該公司業務簡介請參見附件一。

(二) 本次出國辦理稽催，洽訪 MAN Diesel SA 先聽取該公司計畫經理 Regis Gadenne 簡報後進行業務討論如下：

１、 按 Alstom 材料供應商 A.I.T.（Amer） 第一批已運抵核四工地管材（Piping Bor Material），由於本公司委託授權台崧公司之檢驗員在工廠執行檢測之疏失，事後發現提送之 CMTR（Certified Material Test Report）不符合 ASME Sec. Ⅲ NCA-3867.6 合格材料規定，衍生屬 unqualified source material 材料須於安裝前先需依法規執行相關化學成分及物理性質等試驗。同時，第二批尚在 Amer 之 Remained Bulk Material 必須俟澄清 CMTR 結案後始得簽署 PQC 交運。

２、 由於雙方對於依法規補作相關試驗方式之解讀存在歧見（參見附件二），務須儘速釐清後據以執行，以利核四工程之進行。

３、 有關 6 部機需委託台灣廠商承製 EDG，基於核四工程進展急需安裝，務請 MAN／Alstom 加速內部流程促使儘早將素材（Raw Material）運至台灣俾 Skid Pipe Spools 得儘速加工預組。

４、 爲配合 EDG／SDG 測試時程，務請將儀裝器材（Instrument Tubing, Fitting & Supports）及 Non-ASME Ⅲ之材料儘速安排簽署 PQC 後，即以空運方式交運該急需設備，以利工程進展。

(三) 針對 Unqualified source material of piping bulk material 有關 NCA-3807.4 之材料檢測方式，MAN 仍維持其對法規有關物性分析（physical testing）與化性分析（chemical analysis）要求之解讀。

(四) MAN 表示 Alstom 供應商 AIT 除欠缺對每一物件（by each piece）作化性分析外，已依 QA manual 遵照 ASME Ser.Ⅲ相關規定辦理，因此對大於 2″Normal Pipe Size（NPS）之 Pipe、Fittings and Flanges，都將依檢測程序進行化性分析及 Positive Material Identification（PMI）。對於小於或等於 2″ 之管材，則以提供 C of C（Certificate of Compliance）爲訴求。

１、 按 AIT 依照其品保計畫（QA program），限定只向合於資格之供料商進購物料，對於每批次材料皆經 CMTR 之檢測，並於每項物件註記管制編號（Material control No.），可謂已建立物件之可追溯機制（Traceability Program）。

２、 爲增取時效，已先就留滯 Amer 工廠部分完成 SDG Bulk 及 Spool，並亦將進行 EDG material 之檢測。

３、 對於先前已運抵核四工地者，將由 AIT 提供必要之檢測設備及指導人員委託台灣當地廠商 SGS 辦理 PMI 檢測。

４、 MAN 表示將如期於 12 月 4、5 日來台出席本公司召開之 Open Issues Meeting，希能就有關 unqualified source material of piping bulk material 之檢驗程序詳予商確，以期雙方儘早達成共識。同時討論有關加速交貨、補送料件以及磋商 T／A Rates 等，俾利履約順利完成。

二、Alstom Power 部分：

(一) 對於 M041A0 及 M041B0 兩項合約，Alstom Power 爲 MAN Diesel S.A.之主要分包商，負責承做發電機（Generator）等相關設備。由於柴油機及發電機均爲本合約之主要設備，故本次亦安排洽訪 Alstom Power，藉以針對合約相關設備製造情形進行了解。Alstom Power 公司位於巴黎市區之西郊，法國捷運設施之機電系統多係由 Alstom 設計承製。

(二) 本次洽訪 Alstom Power，首先由計畫經理 Daniel Chouzennovx 簡報介紹公司有關業務及相關討論，有關履約情形，Alstom 提出之說明及立場大致與 MAN Diesel 一致，Alstom 表示有關 M041A0 及 M041B0 之履約事宜，當與 MAN Diesel 充分配合，以期能盡力配合核四工程需求儘速交運設備完成履約工作。

(三) 會議結束後，在 Chouzennovx 陪同下，參觀 Alstom 研究發展展覽室，並介紹技術部門及業務部門等。有關該公司之簡介請參見附件三。

肆、 國外公務之心得與感想

一、本次奉派赴法國洽訪核四工程重要設備廠商，針對現階段相關議題已向 MAN／Alstom 充分表達我方亟力促處請將延達交運之器材，儘早排除困難及時運送工地，以配合核四工程 EDG／SDG 之檢測時程。

二、隨後仍須持續追蹤廠商實際作爲，並積極督促其依雙方達成之共識逐項完成既定工作目標。

三、法國核能工業發展成效，向來稱著於世界，多年來核能發電占其全國能源供應持續維繫相當高的比重，並成功開拓國際如中國大陸的市場，在現實石化燃料日趨短拙、煤油價格持續攀高，各國都在競相推動節能減碳，以其有效改善地球環境的趨勢下，足資我國慎重考量以適切比率持續發展核能發電淨化能源之參考與借鏡。

伍、 對本公司之具體建議

核四工程之進展固然已近完工階段，但誠如東西方諺語皆有類似「行百里路，半九十」之說法，尤其以龍門計畫如此頭緒萬端的鉅大工程，愈是到最後試俥階段，不啻要加倍努力於個人職掌，更當處心積慮務爲防範各種可能之缺失，以期順利完成核能四廠之興建任務。

陸、 附件

附件一　MAN 公司業務簡介

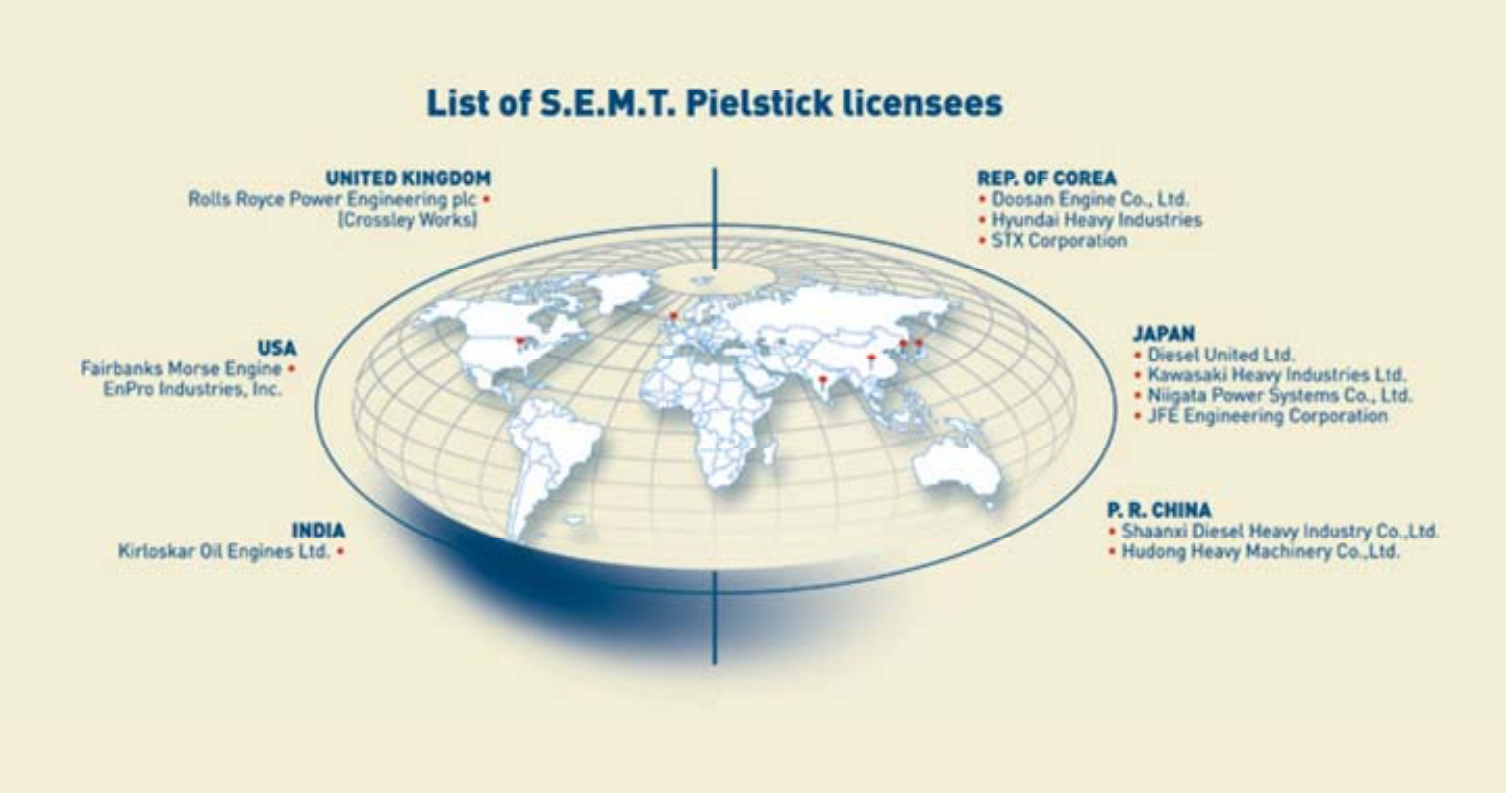
附件二　The required tests of TPC comment is as shown below

附件三　Alstom 公司業務簡介

【附件二】

INTERNATIONAL NETWORK

S.E.M.T. Pielstick's international character is enhanced by a large network of licence holders who are among the world's leading industrial groups.
All these licensees are currently manufacturing a wide range of S.E.M.T. Pielstick engines covering all applications.
For more information about the engine programme, please contact our Licence Department:

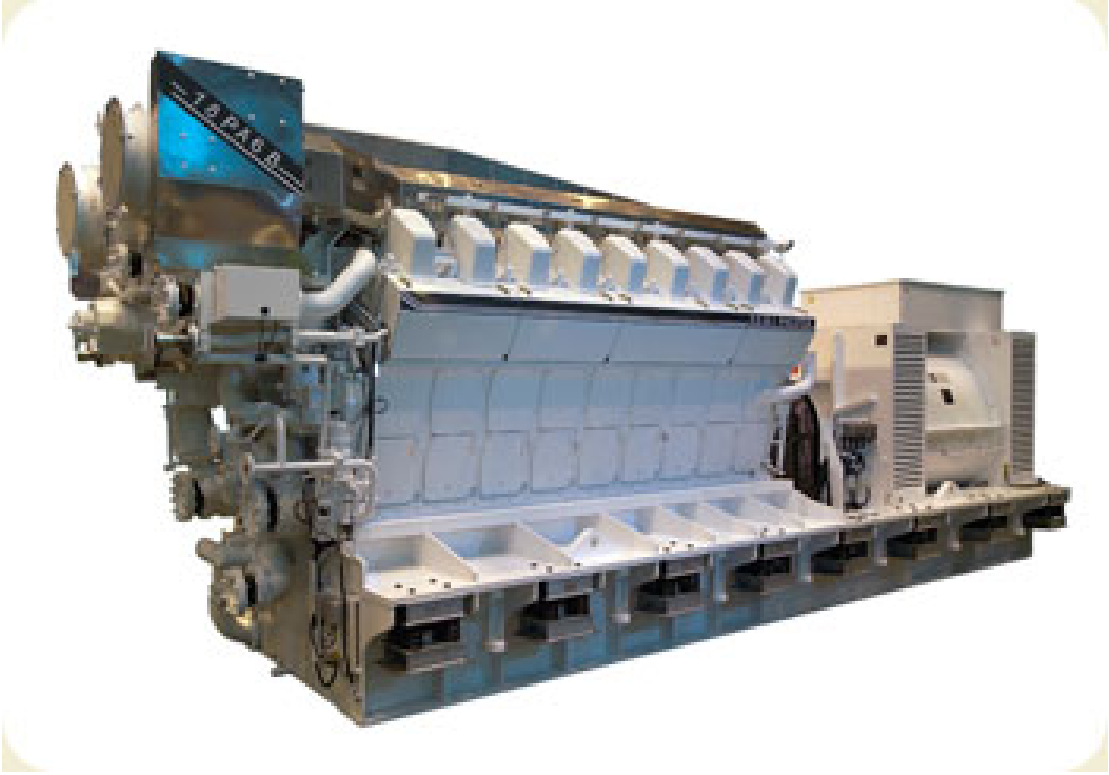


HIGH AND MEDIUM SPEED DIESEL ENGINES FOR EMERGENCY GENERATING SETS IN NUCLEAR POWER PLANTS

Diesel engines are the key components of generating sets for the safety of the whole nuclear power plant.

Our first engines for emergency diesel generators were commissioned in the late sixties for the PA series and early seventies in the USA for the PC2 series.

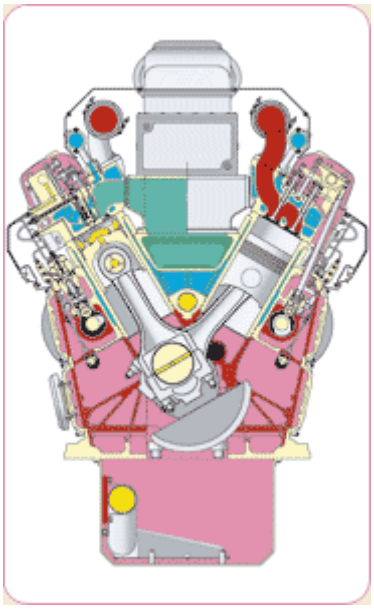
Since then numerous machines were delivered in nuclear power plants all over the world. They have accumulated a huge number of starting and loading up sequences as well as runnning hours providing us with the largest experience in this particular field.



Emergency genset with S.E.M.T. Pielstick
Diesel engine 18 PA6 B

PRODUCTS

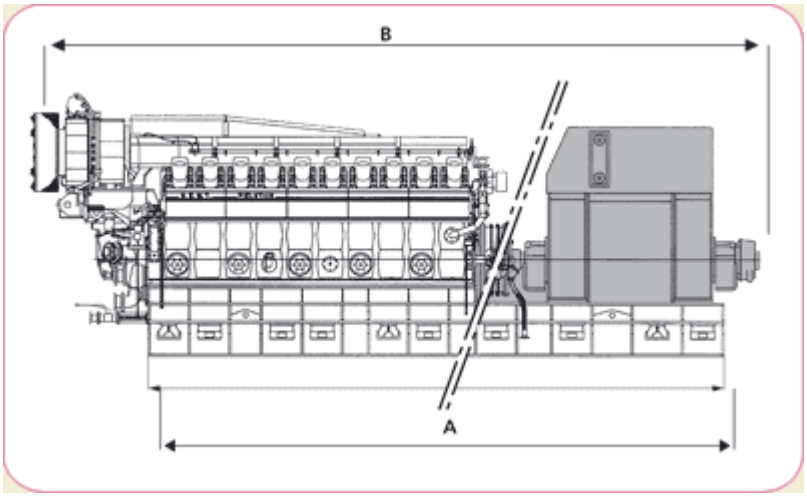
PA6 ENGINE



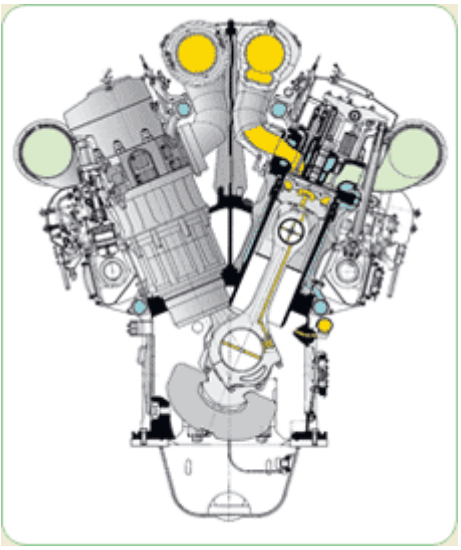
PA 6 engine - Cross section

Generating Set	
Engine type	PA 6
Rated power (kW)	3000 - 7000
Speed (rpm)	720 - 1000
Bore (mm)	280
Stroke (mm)	290 - 350

Dimensions (mm)	
A	6400-8700
B	8400-11000
Width	3000
Height	3870-3915
Mass (t)	50-80*
**including generator*	



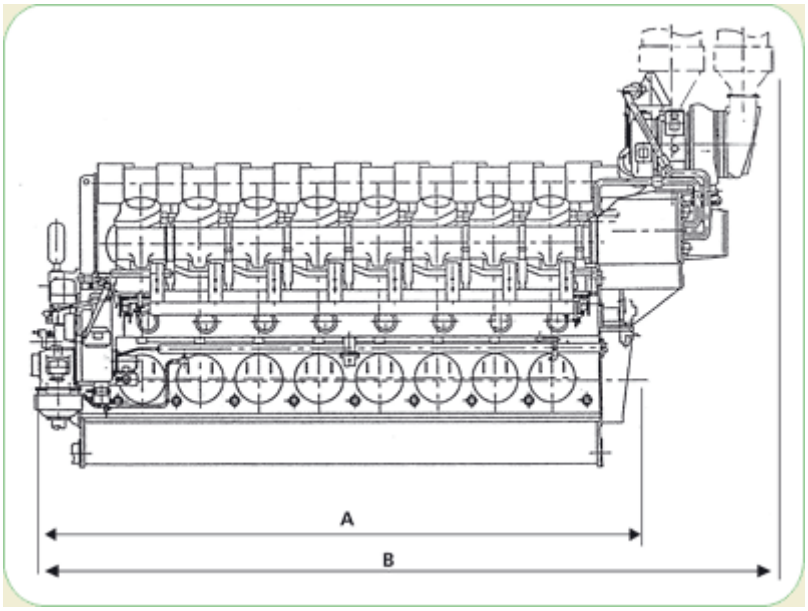
- PC2 ENGINE



PC engine - Cross section

Generating Set	
Engine types - PC 2.5, PC 2.6, PC 2.6 B	
Rated power (kW)	6600 - 9000
Speed (rpm)	500, 514, 600
Bore (mm)	400
Stroke (mm)	460/500
Mass (t)	60-90

Dimensions (mm)	
A	5460-7185
B	7665-8536
Width	3674-3700
Height	3400-4240
Mass (t)	60-90



GLOBAL COMPETENCE

In power generation, we offer a wide range of products covering requirements as different as:

- Base load, emergency and peak-shaving energy supply.
- Cogeneration power plants.

We also have developed extensive experience in

- Engineering, in order to provide global solutions tailored to each customer and project and
    - Engine supporting products such as CoCoS, Computer Controlled Surveilance and INSPECT, a monitoring software, in order to ensure optimum performance of our power plants for our customers.

MERCHANT SHIPS

- Diesel engines rated from 3 880 kW to 26 500 kW for all types of propulsion:
  - Mechanical
    - FPP (Fixed Pitch Propeller),
    - CPP (Controllable Pitch Propeller),
    - Water-jets
  - Diesel-electric
- Gensets from 4 050 kW to 26 500 kW

These engines or gensets are used onboard: Large sailing yachts, fast-ferries, fast monohulls & catamarans, cruise ships, car-ferries, fast freighters, Ro-Ro ships, general cargos, tankers, containers ships, car-carriers, offshore rigs and onshore platforms, cable-laying ships, offshore intervention vessels, dredgers, tugs, etc.

"Ferry Fukuoka 2" (Japan)

The sales of S.E.M.T. Pielstick engines for ship propulsion and on-board gensets are led by the Marine Sales Department.

In order to maintain a close contact with our customers and partners, local representations provide a fast and direct support.

Our experts will study carefully all newbuilding projects with the relevant S.E.M.T. Pielstick engine for propulsion or on-board gensets.

Our experience in complete propulsion systems is available for all customers.

"New Camellia" (Japan)

GLOBAL PERFORMANCES

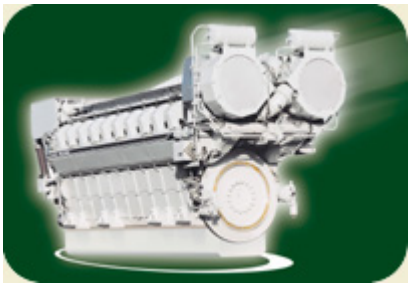
- Performances:
  Reliable performance adapted to the special needs of new ship designs
    - compactness,
    - light weight,
    - long Time Between Overhaul,
    - 55 years' proven experience on Heavy Fuel Oil.
- Simplicity and economy:
    - strongly built for high reliability and low maintenance costs,
    - simple design for easy installation and maintenance,
    - only one stage of turbo-charging (maximum 2 turbo-chargers per engine),
    - all maintenance on-board ship without engine removal including main overhauls,
    - low fuel consumption,
    - low maintenance and operation costs.
- Environment:
    - low smoke emission,
    - exhaust emissions complying with IMO regulations.

Further NOx emissions reduction could be achieved by engine adjustments and up to 80% with additional devices.

16 PC 2.6 B/16 V40/50
S.E.M.T. Pielstick Diesel engine

MAIN FEATURES

- Performances:
  Reliable performance adapted to the special needs of naval ships
    - wide operating envelope, particularly at low speed,
    - low airborne and structure borne noise,
    - shock resistance,
    - compactness,
    - light weight.



20 PA6 B STC
S.E.M.T. Pielstick Diesel engine

- Integration:
  The experience and the know-how of S.E.M.T. Pielstick's engineering department allow it to solve interface and integration matters
    - torsional vibration calculation of the propulsion system,
    - single or double stage resilient mounting,
    - sound insulation,
    - shock resistance calculations,
    - complete propulsion system.
- Simplicity and economy:
    - strongly built for high reliability and low maintenance costs,
    - simple design for easy installation and maintenance,
    - only one stage of turbo-charging (maximum 2 turbo-chargers per engine),
    - a wide power envelope by using a Sequential Turbo-Charging system (STC),
    - all maintenance on-board ship, including main overhauls, without engine removal,
    - low fuel consumption,
    - low maintenance and operation costs.

- Emissions:
    - Excellent stealth features
        - low infrared and visual signature,
        - low smoke emission,
    - exhaust emissions complying with IMO regulations.

      Further NOx emissions reductions could be achieved by engine adjustments and up to 80% with additional devices.

MAINTENANCE

- Designed for long time between overhaul (TBO).
  Major overhaul from 24 000 hours up to 32 000 hours according to engine type, fuel oil type and operating profile.
- Designed for maintenance on-board.
- Designed for easy maintenance
    - Only one or two turbo-chargers.
    - Individual injection pump.
    - Camshaft in several parts.

The required tests of TPC comment is as shown below

Material Type/ Size	Required Test (by TPC)	Required Test (by Alstom)	Alstom clarification/ statement	***TPC comment conclusion***
Pipe, Fittings and Flanges ≤ 2" Nominal Pipe Size.	Chemical Analysis : by each piece. All other requirements of the material specification : by each Heat or Lot. [may be provided C of C or CMTR]	No Chemical Analysis required. Certificate of Compliance (C of C) will be provided.	Chemical tests: We do not agree with TPC position. Please refer to NCA-3867-4.	***Disagree.*** *Chemical Analysis shall be tested by each piece.* ***Disagree.*** *All other requirements test shall be tested by each Heat or Lot.* **[C of C shall be provided]**
Pipe, Fittings and Flanges >2" Nominal Pipe Size.	Chemical Analysis : by each piece. All other requirements of the material specification : 1. By each piece. 2. *Alternativel, by each Heat or Lot. [provided CMTR]	Chemical Analysis on each place. All other requirements of the material specification : By each lot.	Chemical Analysis in progress. All other requirements by each lot. Please refer to traceability as per chapter B of this Letter.	***Agree.*** ***Agree.*** **[CMTR shall be provided]**
Piping Support Structure Material ≤ 2 sq. in. Nominal Cross-Section al Area.	Chemical Analysis : by each piece. All other requirements of the material specification : By each Heat or Lot. [may be provided C of C or CMTR]	No Chemical Analysis required. Please refer to clarifications for NF 2130 and NF 2610. Certificate of Compliance will be provided.	Chemical Analysis: We do not agree with TPC position. Please refer to NF 2130 & NF 2610.	***Disagree.*** *Chemical Analysis shall be tested by each piece.* ***Disagree.*** *All other requirements test shall be tested by each Heat or Lot.* **[C of C shall be provided]**
Piping Support Structure Material > 2 sq. in. Nominal Cross-Section al Area.	Chemical Analysis : by each piece. All other requirements of the material specification : 1. By each piece. 2. *Alternativel, by each Heat or Lot. [provided CMTR]	No Chemical Analysis required. Please refer to clarifications for NF 2130 and NF 2610. Certificate of Compliance will be provided.	Chemical Analysis: We do not agree with TPC position. Please refer to NF 2130 & NF 2610.	***Disagree.*** *Chemical Analysis shall be tested by each piece.* ***Disagree.*** *All other requirements test shall be tested by each Heat or Lot.* **[CMTR shall be provided]**

【附表11】

Excellence in Nuclear Emergency Diesel Generators

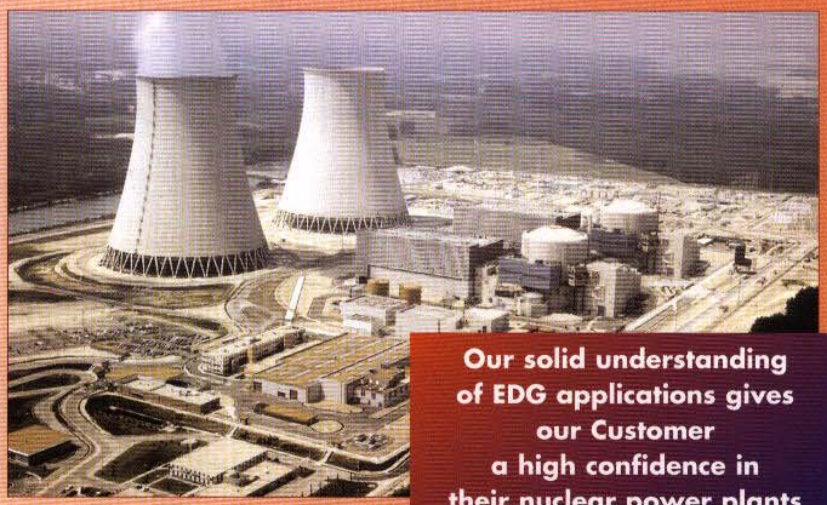
ALSTOM / SEMT Pielstick Consortium

The Emergency Diesel Generators (EDG) projects are managed by the Nuclear Department (ND) of ALSTOM Power.

ALSTOM Power is a worldwide group with a workforce of 40 000 people.

ALSTOM ND in consortium with SEMT Pielstick is the world's leading supplier of EDG for nuclear power plants.

ALSTOM ND is the Consortium leader.



Our solid understanding of EDG applications gives our Customer a high confidence in their nuclear power plants

EDG for global nuclear safety

In nuclear power plants, ALSTOM ND supply :

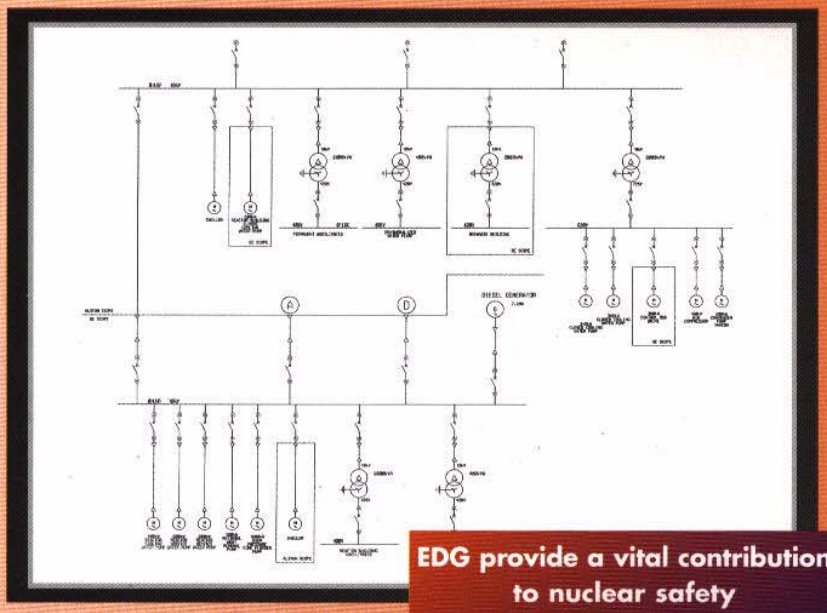
- The engineered safeguard auxiliaries ensuring the barriers integrity and the security of persons in case of failure or accident
- The emergency supplied auxiliaries maintaining the safe shutdown of the reactors.

The EDG can be operated :

- Either as emergency generating units
- Or as stand-by generating units used as back-up of the other EDG (in that case often termed the fifth diesel generator) or the swing diesel generator.

Two types of Pielstick Diesel engines are nuclear and seismic qualified.

	PC2	PA6
Rated power (kW)	6500/8800	3000/7000
Speed (rpm)	500/600	720/1000



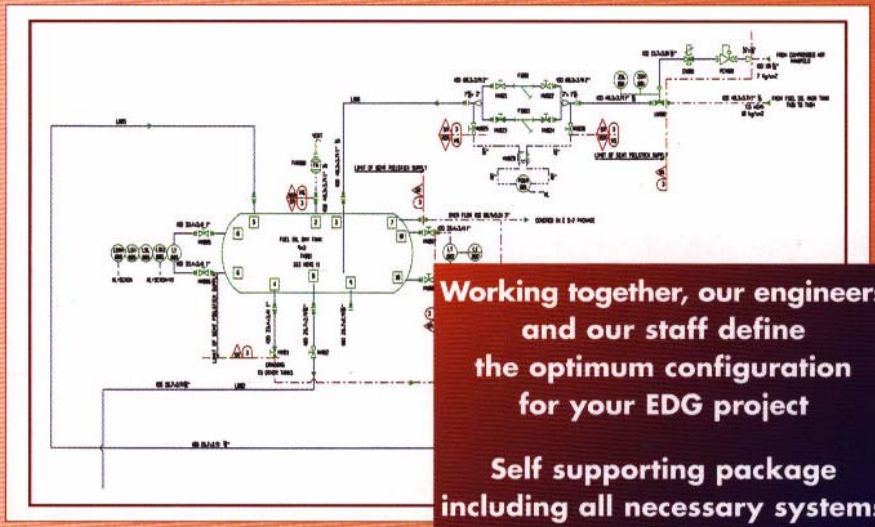
EDG provide a vital contribution to nuclear safety

ALSTOM ND / SEMT Pielstick offer a well proven and highly safe EDG solution

Full and comprehensive package

The Consortium ALSTOM ND/ SEMT Pielstick provides a comprehensive EDG package :

- Diesel engines (manufactured by SEMT Pielstick)
- Generators (ALSTOM or other manufacturers)
- Electrical auxiliaries (protection systems, MV switchgears, LV distribution switchboards)
- Mechanical systems (tanks, valves, pipes) for fuel oil, air supply, lubricating, preheating, water cooling and compressed air start-up systems
- Safety classified control systems.



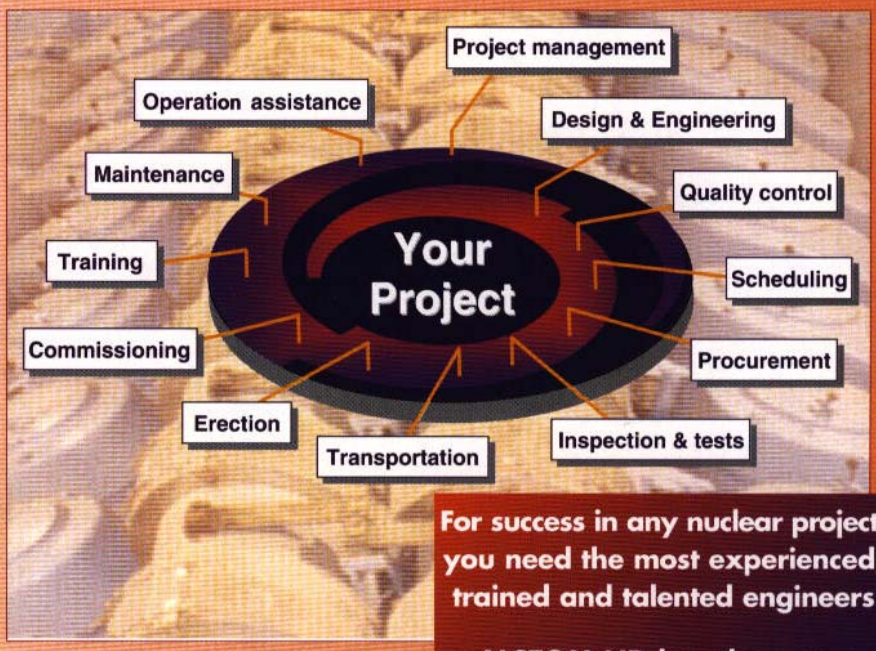
Working together, our engineers and our staff define the optimum configuration for your EDG project

Self supporting package including all necessary systems & components for EDG operation

A complete project management services

ALSTOM ND manages the full line of EDG engineering services :

- Specify generator and engine technical data
- Study the EDG setting-up
- Compute the load sequences, load flow, short-circuit calculation, voltage variation and motor speed recovery, transient stability
- Verify the equipment vibration/ seismic withstand
- Perform inspections and tests
- Ensure civil works interface
- Carry out erection, supervision & commissioning on site
- Provide complete training programs
- Ensure after-sales services.



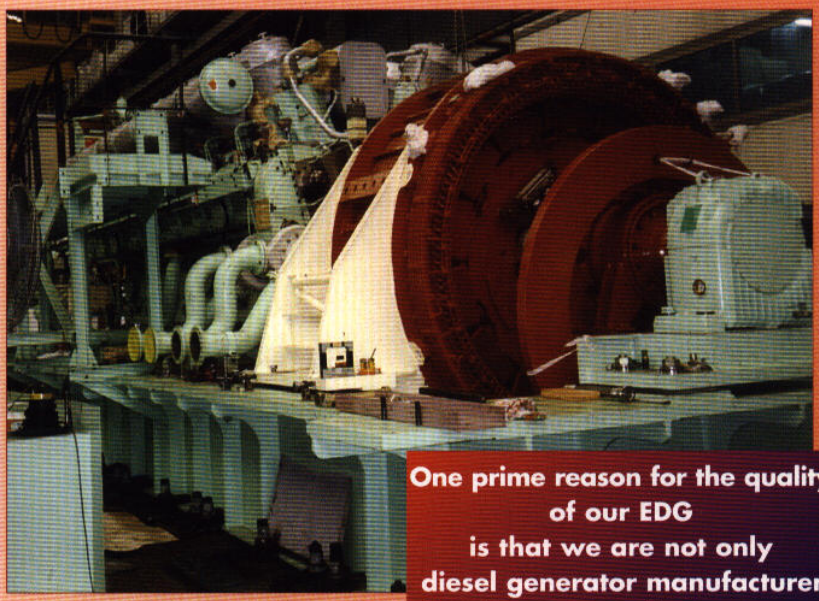
For success in any nuclear project, you need the most experienced, trained and talented engineers

ALSTOM ND has the years of experience and the knowledge in the nuclear field to turn your project into a full success

Major assets of the ALSTOM ND / SEMT Pielstick solution

EDG key features

- A proven and reliable nuclear EDG system
- Rated speed and voltage reached 10 s after the start-up order
- A large experience gained on over 20 projects
- A complete range of EDG
- Applicable to any nuclear plants whatever the type of reactor
- A reference EDG for each project
- Numerous licencees of SEMT Pielstick around the world
- A direct engine/generator coupling
- Redundancy applied on the engine auxiliary systems
- 2 independant air start-up systems
- Excitation based on a permanent magnet generator (PMG)
- Redundant features of the microprocesseur-based DCS with self-checking facilities
- Black start facilities
- A network of worldwide Customer services facilities within ALSTOM Power Services.



One prime reason for the quality of our EDG is that we are not only diesel generator manufacturer, but have a complete mastery of power plant technology and a wealth of experience in plant engineering

An internationally recognised qualification

Our EDG are nuclear safety-related classified and have already proven their superior dependability and durability in nuclear power plants.
They have received certifications for nuclear applications in leading nuclear power production countries (USA, China, France, India, Japan, Korea)
They have been qualified according to IEEE 387 standard involving 300 consecutive hot and cold starts of the DG unit, requiring less than 1% failure rate.
They are also seismically qualified according to IEEE 344 standard.

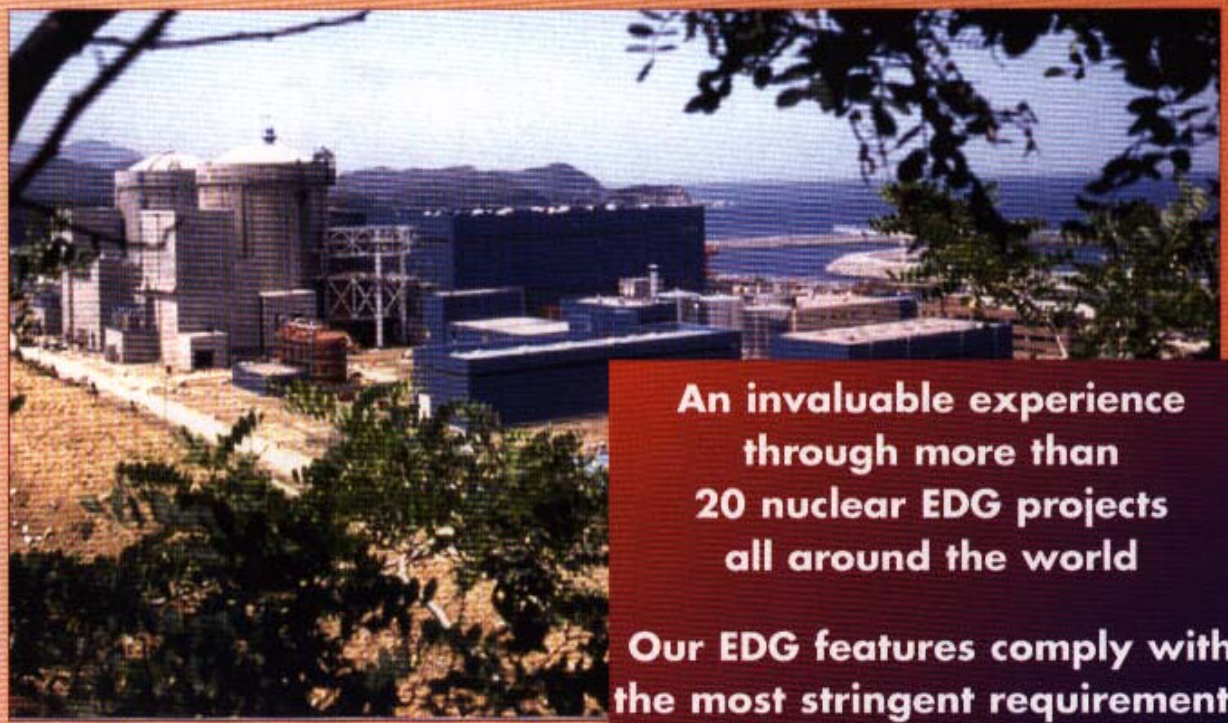
We have qualified specialists with many years of experience to conduct all qualification processes

Fully compliant with international codes and standards

The ALSTOM ND / SEMT Pielstick EDG solution is fully compliant with the regulations applicable for all types of reactors (PWR, BWR, VVER, CANDU, PHWR, etc) :
- IEEE standards
- French RCCE & RCCM codes
- American standards (ASME, ...)
- Canadian standards (CSA)
- German standards (KTA).

ALSTOM ND has been granted certification ISO 9001 : 2000 by Lloyds Registered Quality Assurance.

EDG projects can be managed in accordance with quality requirements such as IAEA 50-C-QA and 10 CFR 50 Appendix B when required.



An invaluable experience through more than 20 nuclear EDG projects all around the world

Our EDG features comply with the most stringent requirements and regulations applicable in the nuclear power plants

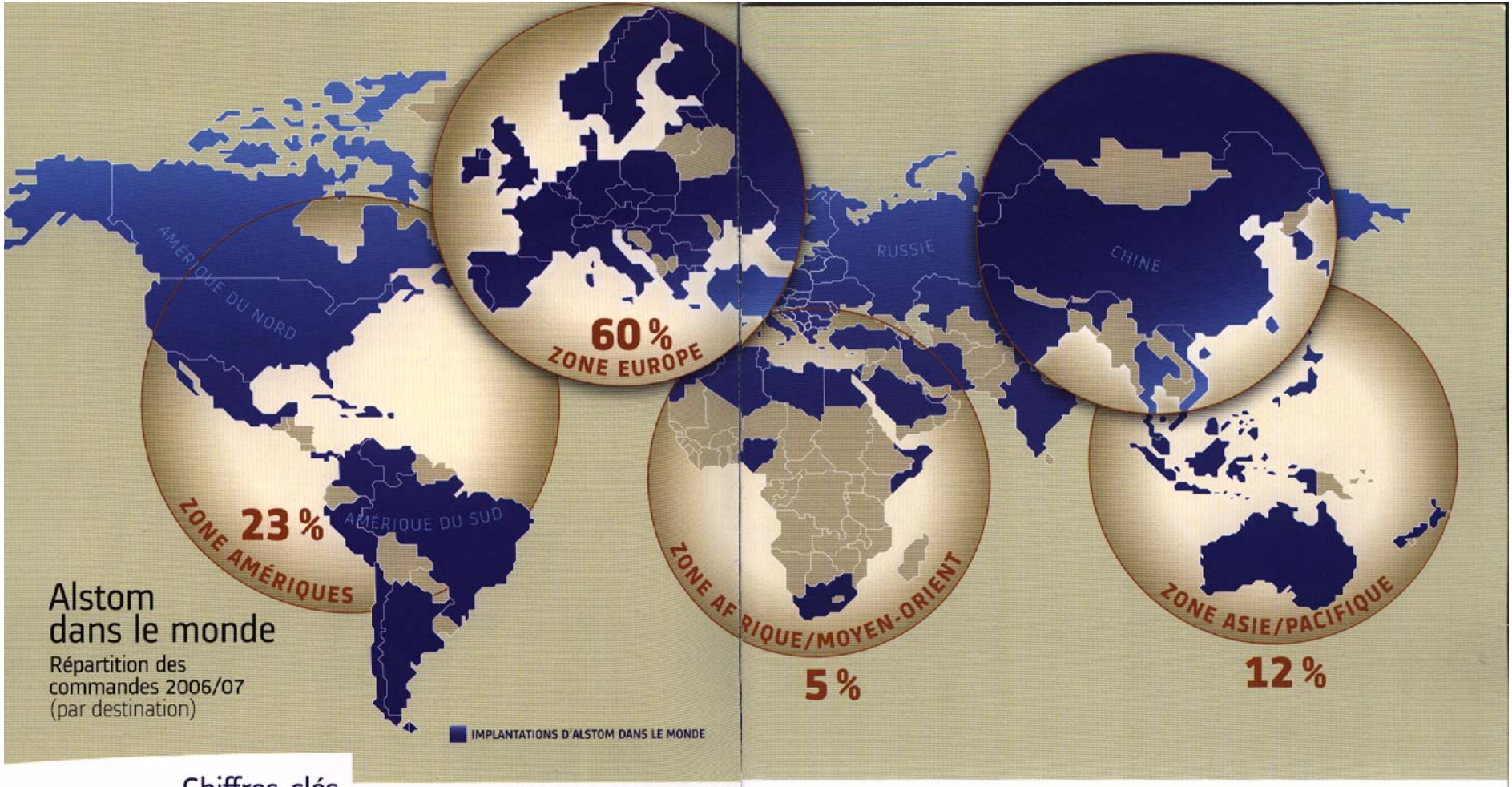
Main worldwide references

ALSTOM ND / SEMT Pielstick nuclear EDG have an excellent reputation worldwide

Country	Customer	Power plant	Type of reactor
South Africa	ESKOM	KOEBERG 1 & 2	PWR
South Africa	ESKOM	KOEBERG 1 & 2 (fifth DG)	PWR
Taiwan	TPC	MAANSHAN (fifth DG)	PWR
Rep. of Korea	KEPCO	WOLSONG 2	CANDU
Rep. of Korea	KEPCO	ULCHIN 3 & 4	PWR
Rep. of Korea	KEPCO	WOLSONG 3 & 4	CANDU
Rep. of Korea	KEPCO	ULCHIN 3 & 4 (fifth DG)	PWR
Rep. of Korea	KEPCO	YONG GWANG 5 & 6	PWR
China	NPQJVC	QINSHAN II - 1 & 2	PWR
China	NPQJVC	QINSHAN III - 1 & 2	CANDU
China	ATOMSTROYEXPORT	TIANWAN	VVER
Rep. of Korea	KEPCO	ULCHIN 5 & 6	PWR
China	NPQJVC	LING AO (fifth DG)	PWR
Taiwan	TPC	LUNGMEN	BWR
India	LARSEN & TOUBRO	TARAPUR	PHWR
Romania	SNN	CERNAVODA	CANDU
China	NPQJVC	QINSHAN 1 & 2 (fifth DG)	PWR
India	ATOMSTROYEXPORT	KUNDANKULAM	VVER
Dem. Rep. of Korea	KEDO	KEDO	PWR

Commissioning date	Engine type	Engine number	DG net output (kW)
1985	18 PA6 V 280	4	4400
1985	18 PA6 V 280	1	4400
1985	16 PC2.5 V 400	1	7000
1997	16 PC2.5 V 400	2	6000
1999	16 PC2.5 V 400	4	7000
1999	16 PC2.5 V 400	4	6000
1999	16 PC2.5 V 400	1	7000
2002	16 PC2.5 V 400	4	7000
2003	16 PC2.5 V 400	4	6000
2003	16 PC2.6 V 400	4	8200
2003	16 PA 6B	4	5000
2004	16 PC2.5 V 400	4	6500
2003	12 PC2.6 V 400	1	5250
2005	16 PC2.5 V 400	6	7500
2005	9 PA 6 V	8	2700
2005	16 PC2.5 V 400	2	6700
2004	16 PC2.5 V 400	1	6000
2006	18 PA 6 B	10	6300
2008	16 PC2.5 V 400	5	7000

ALSTOM ND / SEMT Pielstick is the leading supplier of EDG all around the world.
SEMT Pielstick has licencees in 13 countries and totalises an installed output of over 1 500 000 kW.



Alstom dans le monde

Répartition des commandes 2006/07 (par destination)

Chiffres-clés

au 31 mars 2007

Commandes :
19 Mds €
(+ 34 %*)

Chiffre d'affaires :
14,2 Mds €
(+ 14 %*)

Résultat opérationnel :
957 M€
(+ 40 %*)

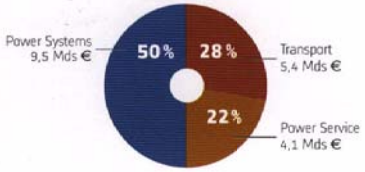
Résultat net :
448 M€
(+ 152 %*)

65 000
collaborateurs

70 pays

*Sur une base comparable.

Total des prises de commandes par Secteur 2006/07 : 19 Mds €



Répartition du capital au 31 mars 2007