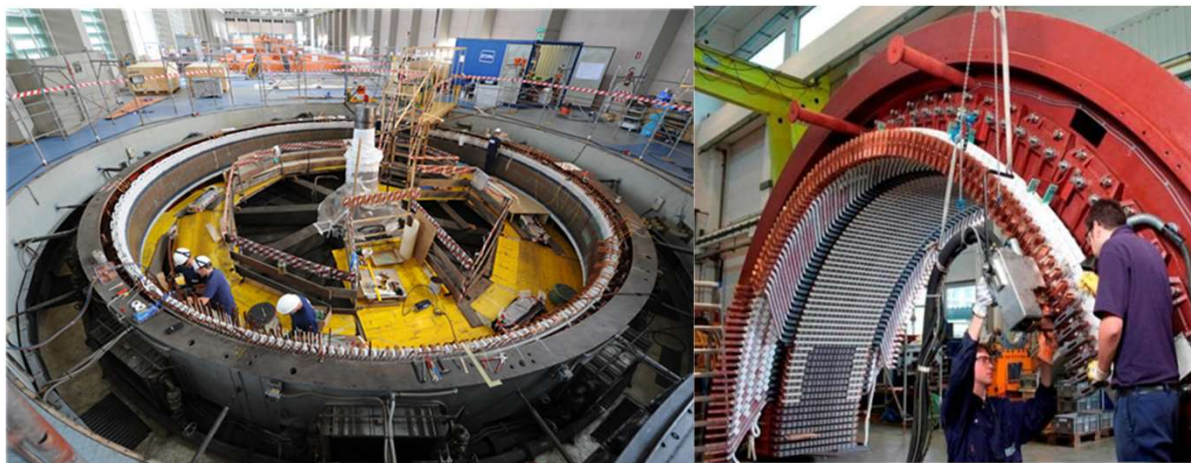


Generators & E-Motors

第四部分：发电机 & 电动机

- 维修及改造世界主要品牌
- 典型案例



典型案例：（1）德国水电：水轮发电机的翻新改造

Verbund Innkraftwerke GmbH - Neuötting, Renewal of three hydro generators

Challenge 项目描述

- In the existing run-of-the-river power plant with 149,400 MWh per year were installed 3 old generator units with a significant aged weakened insulation system. The customer expected a concept for an operating time of further 30 years.
年发电量1.494亿度河床式水电站, **3台发电机组绝缘老化, 客户需要一个延长30年使用寿命的解决方案.**

Solution 方案&执行

- Delivery/prefabricating of 3 new stators active parts, existing of: stator frame, - core and - winding. Also the rotor winding has been completely renewed and modified.
预制三个新的定子部件, 含: 定子架, 定子芯和焊接. 同时彻底翻新和改造转子绕组.

Benefits 优势

- Shortest outage time of the generators regarding pre manufacturing the components
通过部件预制使发电机的停机时间缩到最短
- Decreased losses of the generator
降低了发电机的损失
- Competitive price, experienced and good craftsmanship
价格合理, 经验丰富, 技艺高.
- Delivery was on time.
按时完工
- Highly positive Customer feedback
获得客户极高的评价

Key Figures 关键数据

3 hydro powered
generators
3台水力发电机
SVFL760/30-88, 10000
kVA

Time Frame 项目周期:
March 2012 - March 2015



(2) 德国炼厂：长期维修保养合同（5,000台电动机和800台机泵）

MIRO Karlsruhe, Maintenance contract of 5000 motors & 800 pumps 客户：德国

2000-ongoing

Challenge 项目描述

- The customer is operating one of the biggest Refineries in Germany.
客户是德国最大的炼油运营商
- According to the global competition the customer was interested in cost- and calculation optimization.
因为全球竞争性,客户注重成本和量化优化

Solution 方案&执行

- Stork offered the customer a complete service package for several years for the entire electrical machinery and pumps in operation (more than 5,000 Motors and 800 pumps).
施托克提供全部运行电机和机泵(超过5000台电机和800台泵)的多年服务合同。
- Stork performs a continuous condition monitoring and diagnostics.
施托克负责连续的运行监测和诊断。
- We created an optimized overhaul concept for many years.
施托克创造了一个多年优化检修概念。

Benefits 优势

- The concept was created on a base of more than 60 years of repair experience.
基于60多年的检修经验, 创造优化检修方案。
- Customer has highly qualified Stork personnel on site.
客户对施托克的现场员工非常满意。
- Stork can realise a very short reaction time.
施托克能够快速响应
- Stork is responsible for the complete handling and organization.
施托克全权负责组织和实施。
- Stork guarantees MIRO a performance reliability.
施托克保证MIRO的可靠性
- Stork delivers a complete monthly and yearly maintenance forecast.
施托克提交所有的月度和年度维护计划。
- MIRO can realize a calculable cost planning for a long term period.
MIRO可以实现长期的成本量化。

Key Figures 关键数据

Frame contract since 2000
框架协议始于2000年

Complete ongoing service package for the entire electrical machinery and pumps
所有电机和机泵的服务合同



(3) 利比亚电厂：13台电动机维护检修和改造

GECOL - Libya, Corrective maintenance 13 motors Libya

Challenge 项目描述

- Maintenance/Overhaul/Rewinding project for 13 Motors from power stations Tobruk and Tripoli west.
Tobruk and Tripoli 电站13台电动机的维护, 检修和绕线

Solution 方案&执行

- Depending on the findings we have repaired the motors.
修复电动机
- Most of the motors have been rewound and restacked.
大部分电动机需要重新绕线和组装

Benefits 优势

- The customer could re-use the original motors with the same parameters (mechanical and electrical parameters)
客户可以按原参数(电气和机械)重新使用原电动机
- The reliability of all motors has been fully recovered
恢复所有电动机的可靠性

Key Figures 关键数据

13 Motors from Power stations Tobruk and Tripoli West.
Tobruk and Tripoli West 电站13台电动机

Dec 2010 -Feb 2013
(due to civil war 因为内战延期)



(4) 德国水电：水轮发电机的改造和提效升级

Vattenfall Wasserkraft GmbH, Power Plant Hohenwarte, Large efficiency increase of hydro motor- generator

Challenge 项目描述

- 4 pieces of hydro motor-Generators each with high magnetic losses and inefficiency
4台水利发电机, 磁损大, 效率低

Solution 方案&执行

- Disassembly of generator rotor and middle-part of the stator
解体转子, 定子部件
- Renewal of stator core and winding
翻修定子芯和绕组
- Refurbishment of rotor coils with renewal of the inter-turn insulations
更新内转接头绝缘, 翻修转子绕组

Benefits 优势

- Competitive price, experience, good craftsmanship
价格合理, 经验丰富, 技术高超
- Reduction of electric and magnetic losses = enhanced efficiency = reduced costs for the customer
降低电损耗和磁损, 提高了效率, 客户因此获得收益
- Reduction of copper and magnetic losses
降低铜损和磁损
- Increase of efficiency
提高效率

Key Figures 关键数据

Retrofit & Upgrade
改造和升级

Hydro motor-Generators,
Type DWHV255/14,
50 MVA
水力发电机 50MW

Time Frame 项目周期:
2005 - 2009



(5) 德国RWE：西门子850MVA发电机的翻修改造

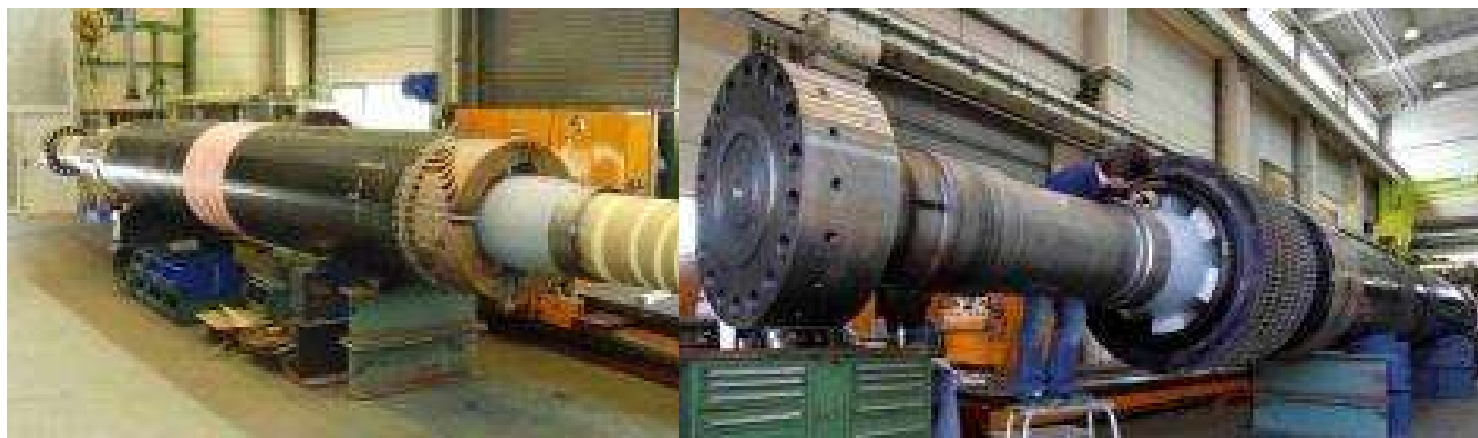
RWE Power - Germany, Generator refurbishment

Challenge 项目描述

- Diagnostics of Siemens-KWU 850 MVA Turbo Generator and refurbishment of the generator
Siemens-KWU 850 MVA发电机组诊断和发电机翻修

Solution 方案&执行

- Replacement of old generator stator with new rewinded stator (365 tons)
更换发电机定子(重量365吨)
- Overhaul of compressor rotor in Stork workshop
在施托克车间检修压缩机转子
- Analysis of insulation system of rotor and stator windings
分析转子和定子绕组绝缘系统
- High speed balancing of the Generator rotor
发电机转子高速动平衡试验



Key Figures 关键数据

Siemens KWU 850 MVA
Turbo Generator
Refurbishment
西门子KWU 850 MVA涡轮
发电机组翻修

(6) 德国电厂：汽轮发电机组的改造 (AEG 150MW)

Vattenfall Europe Wärme AG, Lichterfelde - Germany, Revision Turbine Generator set

2008

Challenge 项目描述

- Planned regular revision of turbine and generator, tendered by the customer via public tendering procedure
公开招标项目, 汽轮发电机组定期检修

Solution 方案&执行

- Major overhaul with the following scope:
大检修范围包括:
 - Dis- and reassembly of 3-casing turbine and generator
拆解和安装3缸汽轮机, 发电机
 - Revision of axial balance piston and stuffing boxes and guide vane carrier
调校轴向平衡盘, 密封函和导叶架
 - Revision of the 3 rotors
转子调校
 - Balancing of rotors on operating speed
转子调平

Benefits 优势

- We offered shorter delivery times than our competitors and we delivered on time and budget
施托克的工期比竞争者短, 按期完工
- Spare parts could be offered 15 % under the OEM prices
配件价格低于OEM产品价格15%
- During the overhaul, an unforeseen crack was found at the HP inner casing, that would normally caused the entire turboset to be abandoned due to too high repair costs (need for new casing, delivery time >12 months). Stork managed to find a workaround within the overhaul time and thus the customer could proceed to operate the turboset up to it's full load range
检修期间, 高压内缸发现裂纹, 一般这会因为价格太高而导致整个透平报废(新壳体, 超过12个月的交货期), 施托克在检修期内找到了解决办法, 客户可以继续满负荷运行该机组
- The customer was very satisfied with our performance and solution that has proved our strength
客户非常满意施托克的表现, 解决方案指明了施托克的实力

Key Figures 关键数据

AEG Turbine
EAK III/150222a/Zü MA3
150 MW and generator
AEG 150MW 汽轮发电机组

Period of execution:
项目周期:
17 weeks (周)



(7) 德国EVN: 西门子260KVA汽轮发电机维修和改造

EVN AG - Theiß, Turbo generator Repair 汽轮发电机组维修

Challenge 项目描述

- The generator had an unexpected earth fault in the rotor winding
发电机转子绕组接地
- Stork has been ordered for a root cause analysis and provided the best repair concept.
施托克做原因分析并提供解决方案

Solution 方案&执行

- Dis- and Reassembly of the generator on-site
现场拆装发电机
- Rewinding of the rotor with improved and modified design of the rotor winding and modified shrink fit area in our workshop
修改和提高转子绕组设计, 并在工厂修改过盈配合区域.

Benefits 优势

- The risks of similar failure has been reduced to a minimum
最大程度的降低类似故障的发生
- The rate of reliability has been increased
设备可靠率得到提高
- Delivery on time and positive customer feedback
按时完工, 得到客户的好评

Key Figures 关键数据

Turbo-generator,
Siemens, TLRI115/46,
260000 kVA
西门子涡轮发电机

Time frame 项目周期:
Nov 2015 - Jun 2016



(8) 德国RWE: 820MVA汽轮发电机组的改造

RWE Generation SE - Gersteinwerk, Major revision of large Turbo Generator (modification) 用户: 德国RWE

Challenge 项目描述

- Major Revision of Turbo Generator and rewinding of the rotor
涡轮发动机大修, 转子线圈绕制

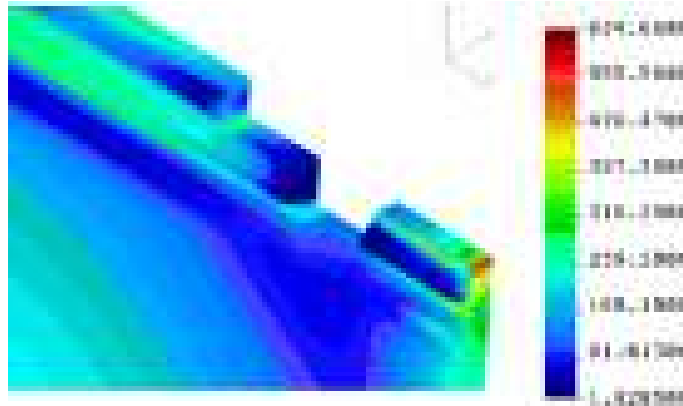
Solution 方案&执行

- Disassembly and assembly at site
现场拆解和安装
- Rotor rewinding in Stork workshop Regensburg
转子线圈在施托克Regensburg工厂绕制
- Short Ring Modification of rotor body
转子短路环改造
- High speed balancing of the Generator rotor
发电机转子高速动平衡



Benefits 优势

- Best Cost-Benefit Ratio for the scope
在竞争者中性价比最好
- Stork could prevail against OEM
施托克胜过OEM厂商
- Delivery on time
按时完工



Key Figures 关键数据

Ds-Generator
DS发电机
THDD115/67,
820 MVA

Time Frame 项目周期:
March 2010 - June 2011

(9) 德国抽水蓄能电站：水轮发电机的改造和升级 (AEG发电机)

GDF Suez -Germany , Retrofit and Upgrade of a Pumped Storage Power Plant

Challenge 项目描述

- Rewinding and restacking of 2 stators of 2 18-pole hydro motor-generators
2台水轮发电机18极定子线圈的绕制和组装

Solution 方案&执行

- Manufacturing of new stator frames and stator cores.
制造新的定子框架和定子芯
- Rewinding of the stators in our workshop.
在施托克的工厂绕制定子
- Disassembly of the “old” stators on site, reassembly of the new ones and commissioning.
现场拆除旧定子, 安装新定子并调试

Benefits 优势

- Reduction of electric and magnetic losses = enhanced efficiency = reduced costs for the customer
降低电损耗和磁损, 提高了效率, 客户因此获得收益
- Increase of efficiency
提高效率
- Competitive price, experienced and good craftsmanship
价格合理, 经验丰富, 技术高超
- Delivery on time with no HSEQ incidents
按期, 安全完工

Key Figures 关键数据

Ds-Synchron-Motor-Generator, AEG
AEG, DS同步发电机
S 8980/18 35 MVA,
333 1/min

Time frame 项目周期:

Machine 1:

设备1:

Sept. 2010 - April 2011

Machine 3:

设备3

March - August 2015



(10) 意大利E.ON: 西门子296MVA汽轮发电机组的改造

Italy, E.ON Produzione - Centrale di Livorno Ferraris S.p.A. 用户: E.ON 意大利 Dec. 2012 - Febr. 2013

Challenge 项目描述

- The Customer operated an Generator with a known weak point in the original rotor winding design.
客户的发电机转子线圈存在设计缺陷
- The rotor winding has to be checked in detail and modified by a service supplier.
转子绕组必须检查和维修

Solution 方案&执行

- Dis- and reassembly of the generator on site.
现场拆卸和安装发电机
- Repairing of the rotor in our workshop Regensburg with optimized rotor winding design.
优化转子绕组设计, 在施托克Regensburg的工厂维修

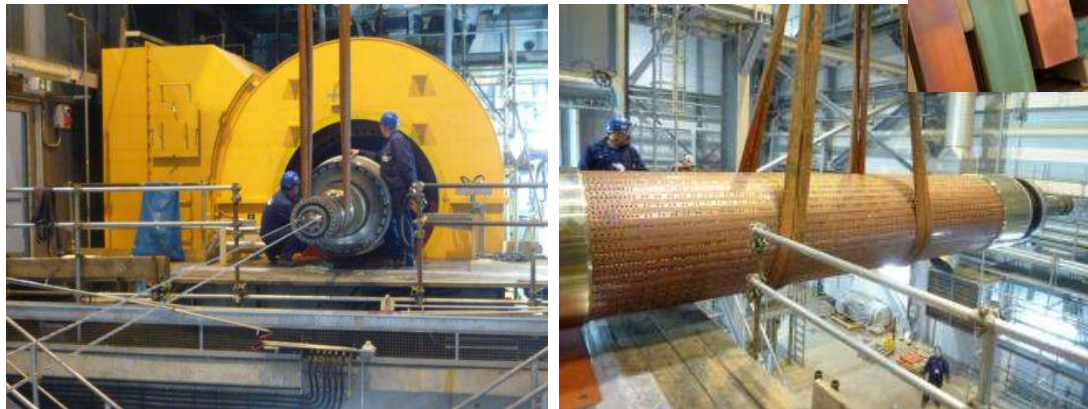
Benefits 优势

- The old rotor winding could be reused
旧转子绕组可继续使用
- Customer was absolutely satisfied!
客户非常满意
- We provided the fastest and most cost saving solution
施托克的方案是最快和最经济的
- We delivered on time and budget with no HSEQ incidents
按期,安全完工

Key Figures 关键数据

Steam turbine generator,
Siemens, TLRI115/52,
296 MVA, 15750 V, 10851
A,
3000 1/min

西门子蒸汽轮机发电机组



(11) 意大利ENEL: ABB水轮发电机的改造 (Ansaldo-ABB, 23MVA)

Italy, ENEL Green Power - Centrale di Isola Serafini 用户: 意大利ENEL May 2016 - apr. October 2016

Challenge 项目描述

- Customer had two Hydro Generators with a significant aged stator winding insulation and asbestos inside.
客户2台水力发电机的定子绕组绝缘老化 并含石棉
- Repair time and removal of asbestos should be reduced to a minimum.
维修时间短, 并将石棉降低到最低

Solution 方案&执行

- Pre-manufacturing of the stator coils in our workshop.
定子线圈在车间预制
- Rewinding of the stator on site including removal of asbestos in the original winding.
现场绕制定子, 并清除原绕组的石棉,



Benefits 优势

- Best Cost-Benefit Ratio for the scope
性价比最好
- It is a running project with expected delivery on time.
Till now there are no HSEQ incidents.
项目正在进行, 预期按时完工. 目前无任何HSEQ事故



Key Figures 关键数据

Generator 3:
发电机:

Ansaldo-ABB
ATBW-112-23000

Baujahr: 1989
23000 kVA
53,6 1/Min.

50 Hz, 10 kV,
1328 A,

Erregung:
314 V, 458 A

(12) 德国EVN: 400MVA发电机定子绕组维修及改造

EVN AG - 400MVA Power Plant Dürnrohr

2016

Challenge 项目描述

- Developing a most practicable and price competitive repair concept for a thermal aged and mechanical stressed stator-winding
针对一个热老化和应力老化的定子绕组提出最可行和经济的维修方案

Solution 方案&执行

- Disassembling of the generator rotor
拆解发电机转子
- Repair and improvement of the stator winding design.

定子绕组的设计和修复

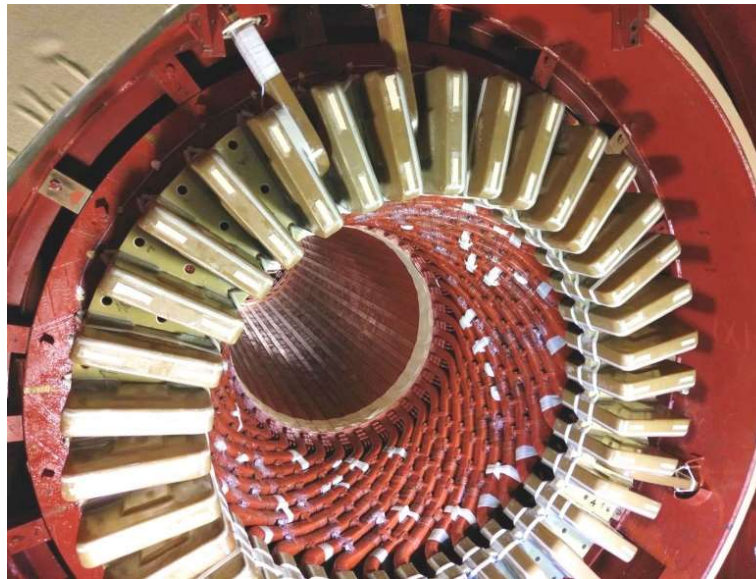
- Final verifying of work with a Bump test.
冲击试验验证
- Revision of the rotor in our workshop incl. short ring modification.

工厂检修转子, 包括短路环改造



Benefits 优势

- We created the most convincing repair concept for the stator winding
施托克提供最可行的定子绕组维修方案
- We succeeded against Sensoplan & Andritz
施托克战胜Sensoplan & Andritz获得合同



Key Figures 关键数据

发电机数据:
Ds-Generator Elin,
HDTGDD 225/2-485,

Nr. 1,638,972, 21 000 V
Stern \pm 5 %, 10 997 A,

400 MVA,

3000 1/min,
cos j 0,92, 50 Hz, Isol.-
Kl. „F“

(13) 荷兰NUON: 西门子550MVA发电机改造 (辅助系统更新)

Nuon Power Generation B.V. - Power Plant Velsen, Renewal Generator Auxiliary Power Plant 2013

Challenge 项目描述

- Obsolete status of the Generator auxiliary systems on Generator 24 & 25.
24,25号发电机辅助系统处于淘汰状态
- Bring the Generator auxiliary systems according to the actual ATEX directive.
按ATEX标准提升发电机辅助系统

按ATEX标准提升发电机辅助系统

Solution 方案&执行

- Modification of the seal oil system. 改造油密封系统
- Renewal of the water detection skid 更新水检模块
- Renewal of the H2 supply skid 更新制氢模块
- Renewal of the H2 skid 更新氢气模块
- Renewal of the CO2 evaporator 更新二氧化碳蒸发器
- Renewal of the gas dryer 更新干燥器
- Renewal of the blowout pipes 更新排空管
- Renewal of the measurement 更新测量系统
- New piping of the Generator auxiliary systems 辅助系统管道更新

Benefits 优势

- Best Cost-Benefit Ratio for the scope
性价比好
- No HSEQ incidents.
无HSEQ事故



Key Figures 关键数据

Auxiliary system of:
辅助系统

24# 发电机:
Generator 24 KWU/Smit,
THDD115/59,
550 MVA,
3000 1/min

25# 发电机:
Generator 25
Siemens, THDD108/53,
450 MVA,
3000 1/min



(14) 定子绕组制造 Stator winding manufacturing in Coil shop

Various Clients national and international 国内外各种客户

Challenge 项目描述

- In case of an Stator winding damages the complete bar set and coil set have to be renewed.
一旦定子损坏, 所有的集线排和型圈必须更换

Solution 方案&执行

- Delivery and manufacturing of different roebel bars with a voltage range from 6 kV up to 18 kV.
6kv至18kv换位棒的制造和供应
- Delivery and manufacturing of coils for motors.
线圈的制造和供应

Benefits 优势

- The customer is not anymore dependent from the OEM.
客户不再只能依赖OEM供应商
- Cost Saving and high qualitative partly automated manufacturing process.
半自动制造工艺, 成本低, 质量高
- Stork has more the 50 Years experience in manufacturing bars and coils.
施托克拥有超过50年的汇流排和线圈制造经验

Key Figures 关键数据

Coil Shop
Roebel Bars
Diamond Coils
Closed Slot coils
DC armature and field coils
Strip on edge field coils

绕线工厂:
换位棒
棱形线圈
气隙线圈
直流电枢和励磁线圈
励磁护边带



Others & Nuclear Power Plan

其他及核电

典型案例：（1）德国RWE：核电发电机组维修（世界最大发电机之一，西门子1530MVA）

RWE Power AG - Nuclear Power Plant Biblis, One of the largest Generator world-wide repair 1530 MVA 德国核电2015

Challenge 项目描述

- Complete disassembling and preparing the stator middle section for transport to the power plant Lingen.
定子完全拆解，并将制造的部件运往Lingen电厂
- First Generator for Stork with water cooled rotor winding.
施托克第一台水冷转子绕组
- Generator type is one of the biggest world wide
世界上最大的发电机之一

Solution 方案&执行

- Disassembling of rotor and stator at the nuclear power plant.
在核电厂拆卸转子和定子
- Loading of the stator for shipment to the nuclear power plant Lingen.
定子装运

Benefits 优势

- Significant cost savings because the customer could involve STORK as a competitor during the negotiation process.
洽谈阶段施托克的介入和竞争,显著地**为客户节省了投资**
- Works were in the past always performed by OEM's
以往的工作都是由OEM厂商完成
- 1st time that such an order was placed to a NON-OEM in the nuclear business.
德国核电领域第一次非OEM原厂商获得合同

Key Figures 关键数据

四极半速发电机
4-pole Generator,
Siemens/KWU,
THFF180/76-15, 1530
MVA,
1500 1/min



(2) 德国RWE：核电站现场技术支持（1个核电+4个联合循环，RWE）

RWE Power AG, Lingen, Germany, Site Support for 1 Nuclear (Convoy) and 4 Combined-Cycle Power Plants 2002-ongoing

Challenge 项目描述

- Providing qualified specialists for specific tasks
提供具体任务的专家服务

Solution 方案&执行

- Administration 管理
 - Revision of technical documentation 更新技术文档
 - Inventory control and materials management 清查控制盒材料管理
 - Chemical measurements and analyses 化学测量和分析
 - Quality management 质量管理
- Supervision of electrical facilities 电气设备监护
- Periodic inspections, repair and maintenance of fire alarm installations 消防设施的定期检查, 维修和保养

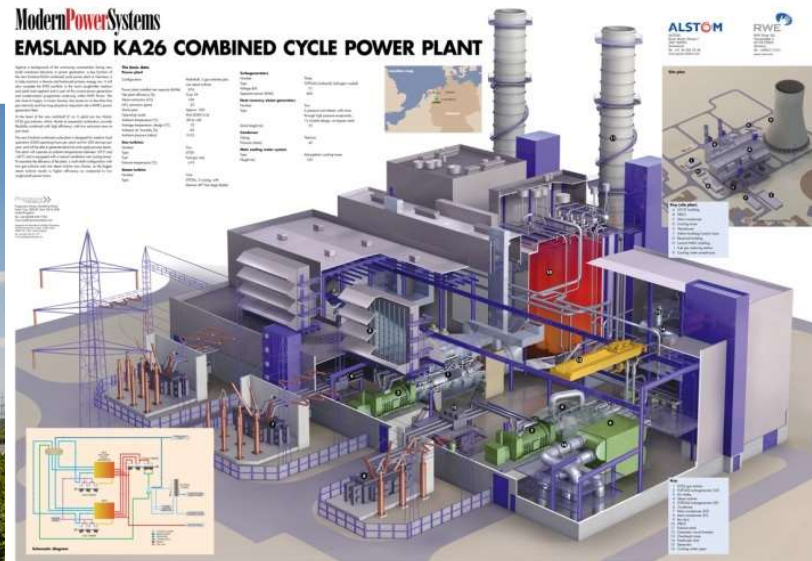
Benefits 优势

- Know-how transfer with regard to operation, maintenance and repair of a nuclear power plant 核电厂运行, 维护和检修技术转让
- No personnel risk for the customer 客户没有人身事故

Key Figures 关键数据

Manpower Service Contract
人力资源合同

Time Frame 期限:
2002 - ongoing



(3) 德国核电：核电机组退役 - 技术服务支持

RWE Power AG, Power Plant Mülheim-Kärlich, Germany, Dismantling of a Nuclear Power Plant

2002-ongoing

Challenge 项目描述

- Providing qualified specialists for specific tasks
提供具体任务的专家服务

Solution 方案&执行

- Dismantling coordinator for the primary circuit and nuclear auxiliary systems
核电一回路和辅助系统的拆解
- Support of the remaining operation
剩余运行的支持
 - Planning of rebuilding measures 重建措施计划
 - Removing of interfering edges 相干边界的消除
 - Work preparation for maintenance and periodic inspections 维保和定检工作的准备
 - Measuring program for nuclear ventilation 通风测量程序

Benefits 优势

- Know-how transfer with regard to the dismantling of nuclear facilities
核电设备拆解技术转让
- No personnel risk for the customer
客户没有人身事故

Key Figures 关键数据

Providing Nuclear Plants with qualified staff
提供合格的人力资源

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