

Creative Power Solutions

Company profile



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1. Mission

Creative Power Solutions (CPS) is a company that serves the sector of Power generation and Energy utilization.

Our mission is to provide **advanced, efficient** and **customized** technology solutions to clients ranging from Original Equipment Manufacturers (OEMs) to Plant operators and Energy consumers.

We base our services to our customers on:

- Expertise in power generation technology and energy efficiency
- Decades of experience in advanced product development
- A long track-record in technological innovation
- Unique engineering capabilities and state-of-the-art tools



CPS provides customized solutions to its clients.

2. Customer Services - Overview

Product development

- Advanced product development for Turbo-machinery, Steam boilers and power plant components.

Customized solutions

- Customized solutions for operators of power plants targeting cost efficiency and operational flexibility.

Performance improvements

- Engineering for efficiency improvements and emission reductions in existing generation units down to component and part level.

Operation & Maintenance

- Strategies for reduced operation & maintenance costs based on critical part lifetime management and advanced engineering.

Plant Construction

- Site management, project management and quality control with best practice processes.

Technical training

- Technical training courses to strengthen your plant's O&M team for improved availability, reliability, performance and efficiency.

Troubleshooting

- Resolution of plant operational problems based on a systematic methodology.

Consulting Services

- Tendering consulting
- Management consulting
- General engineering consulting

2. Customer Services

Product development

CPS has a senior engineering team of professionals with extensive experience in advanced product development in the field of power generation. The CPS core competence builds upon achievements and successes from key technology development programs within several leading OEM companies such as ABB, Alstom, General Electric and Siemens. CPS is dedicated to innovation as a means to strategic advantage and can help its customers to develop technology in a number of areas:

- Gas turbines
- Steam turbines
- Utility boilers, Packaged boilers, Waste incineration
- Condensers
- Generators
- Auxiliary systems



CPS is specialized in advanced power generation technology.

2. Customer Services

Customized Solutions

Many operators of power plants are forced to compromise when doing business with the large OEM companies in order to fit in with their standard product portfolios. CPS differentiates itself by providing solutions fitted to the customers' particular needs. The advantages for the client are plenty: optimized scope of supply, reduced cost and increased operational flexibility. CPS offers its utility clients alternative solutions at a fraction of the OEM cost in several areas:

- Firing system retrofits and upgrades.
- Fuel flexibility.
- Fuel and ignition system modifications for improved reliability.
- Component redesign for lifetime extension and reduced cost.
- Plant controls, instrumentation and data acquisition.



CPS provides customized solutions to its clients.

2. Customer Services

Performance improvements

The recent decade has seen a strong volatility in fuel prices and an accompanying trend towards higher operational costs. In addition plant operators are continuously confronted with stricter emission limits and CO₂ emission credits. CPS offers engineering for fuel efficiency improvements and emission reductions in existing generation units:

- Optimization of combustion processes for higher exit average temperature and reduced temperature peaks.
- Emission reductions and resolution of challenging combustion problems in all types of power plants and heat processes.
- Redesign of performance limiting components and parts that restrict the plant to reach its full potential.
- Fuel efficiency improvements through the optimization of the thermodynamic cycle.

CPS offers technical training for establishment of efficient plant operation and maintenance procedures to plant O&M teams.



CPS provides solutions for improved plant performance.

2. Customer Services

Operation and Maintenance

Power plant owners are frequently obliged to follow any recommendations regarding O&M issued by the OEM due to the technical complexity of the equipment. CPS has the capability to provide an independent analysis of the technical maintenance required and to suggest alternative procedures. CPS is able assist its clients with different strategies that target cost savings of considerable monetary value:

- Part replacement procedures.
- Refurbishment practices.
- Operation concepts for extended lifetime.
- Component redesign for extended lifetime.
- Negotiations of O&M contracts (commercial & technical).



CPS supports its clients in reducing O&M costs.

2. Customer Services

Plant Construction Services

As an accomplished and multi-faceted partner CPS also provides services related to power plant construction, commissioning and operation. CPS is focused on on-shore activities with full integration towards the back-office and acting as an extended arm of its clients:

- Site management: control and co-ordination of sub-contractor activities according to project plan.
- Project control: consistent and on-time reporting on project progress and budget spending.
- Document control: verification and documentation of logistics and workflow.

Technical Services for Greenfield projects

On-site inspections and validation of contractor work:

- Mechanical construction supervision
- Electrical construction supervision
- Civil construction supervision
- Instrumentation & Controls supervision
- Commissioning supervision
- Operation supervision

2. Customer Services

Technical training

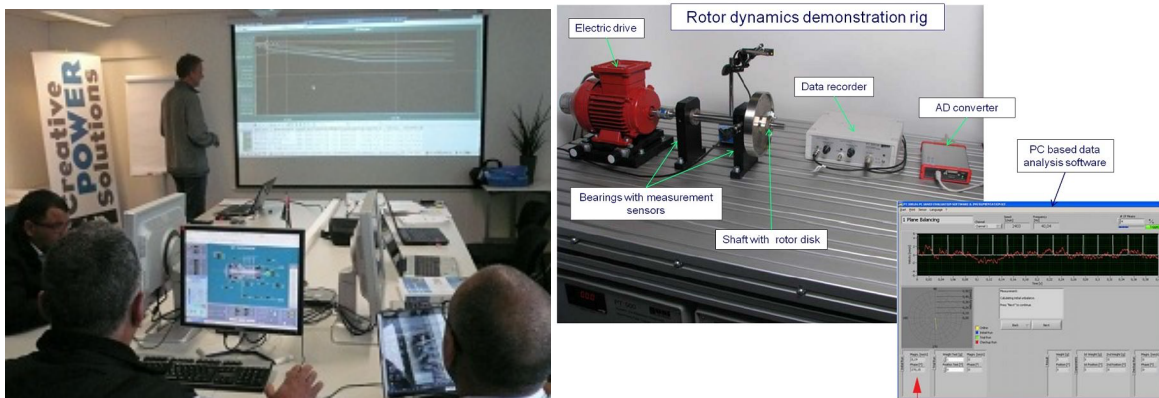
CPS provides technical training courses to strengthen your plant's O&M team for improved reliability, availability, performance and efficiency.

The CPS technical experience and know-how can be used for improved understanding of the equipment design and operation, i.e. the "know-why", which is key to performing root-cause analysis of operational problems and component failures.

The training course contents and duration can be tailored to fit your needs. The CPS training spans from fundamentals (typical duration 4-5 days) to problem solving oriented training (typical duration 2 weeks).

CPS currently offers training in the following areas:

- Gas turbine combustor technology
- Gas turbine operation and controls (incl. simulator)
- Structural vibrations and rotor dynamics (incl. test rig)



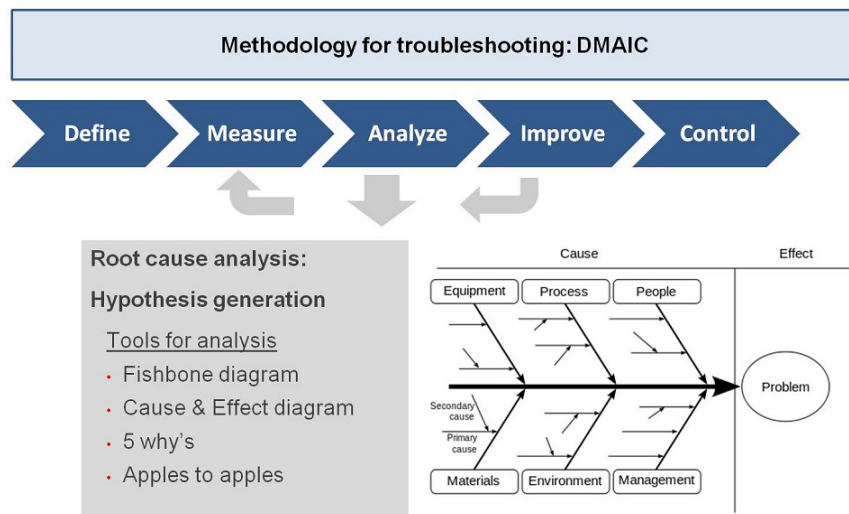
Gas turbine simulation session and vibration test rig equipment.

2. Customer Services

Troubleshooting

CPS is highly qualified to assist power plants with troubleshooting of operational issues. Owing to the significant experience in gas turbine and steam boiler development CPS has the 'know-why' required for analysis of complex problems. The CPS methodology for tackling field issues is based on a systematic approach incorporating root-cause analysis. This can be used in a number of areas:

- Combustion stability issues
- Controls and operational issues
- Emission problems
- Mechanical failures of parts and components
- Start-up failures
- Vibration and rotor dynamics issues



Troubleshooting and problem-solving methodology.

2. Customer Services

Consulting Services

Tendering consulting

CPS can assist you in negotiations with OEM companies and critically analyze technical offers as well as commercial contracts. With the participation of CPS you will be able to argue on a detailed technical level to your advantage.

Management consulting

Benefit from the experience of OEM top managers (ABB, Alstom, General Electric) at a consulting basis. CPS provides support in due diligence processes as well as organizational restructuring programs.

General engineering consulting

CPS has the advanced technical capabilities to develop solutions for a wide range of industries. Our expertise includes combustion and chemical processes, mechanical design, cooling & heat transfer processes as well as energy utilization in buildings and industry.



3. Expert Resources

Know-how

CPS was founded by engineers with leading roles in large organizations such as ABB, Alstom, Rolls-Royce and General Electric. The company is able to form project teams with strong component engineering skills.

Know-why

CPS is specialized in tackling advanced research & product development challenges. The resources include specialists with unique skills and expertise in power generation and energy utilization.

Experience

CPS has senior professionals with an extensive history (more than 40 years) in leading international power generation equipment and energy companies.

Qualifications

To be able to develop leading technologies CPS continuously invests in people with advanced analytical skills. More than a third of the CPS staff is qualified with Ph.D. degrees.



3. Expert Resources

Technology Innovation

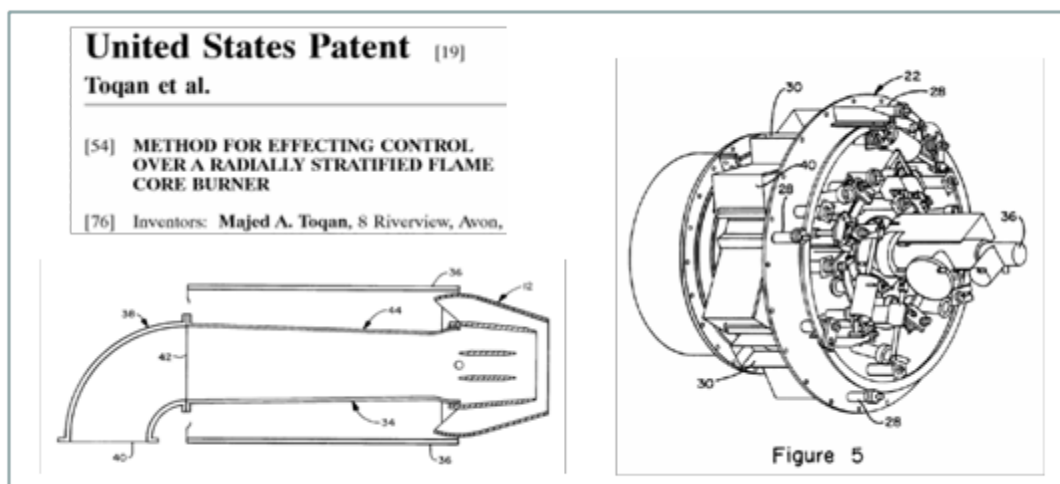
CPS stands for innovation and creativity. To date the staff has been involved in the creation of more than 80 patents related to advanced technology. CPS is continuously developing new ideas for internal as well as external development projects for a wide range of applications:

Turbo-machinery technology:

- Gas turbine design (40 patents)
- Gas turbine operation (11 patents)
- Steam & gas turbine design (10 patents)

Steam boiler technology:

- Steam plant design (5 patents)
- Steam plant operation (5 patents)
- Steam plant processes (10 patents)



CPS has been involved in the creation of more than 80 patents.

4. Technical Areas of Expertise

CPS is able to provide its customers with expertise, know-how and innovative design for a wide range of applications:

Mechanical Engineering

- Combustion engineering
- Fluid mechanics and aerodynamics
- Computational Fluid Dynamics (CFD)
- Cooling and heat transfer
- Mechanical design of components
- Materials for construction
- Finite Element Modeling (FEM)
- Fracture mechanics
- Low and high cycle fatigue assessment (LCF, HCF)
- Strength and lifetime assessments
- Vibration analysis and rotor dynamics

Other Technical & Engineering Skills

- Balance of Plant (BOP) engineering
- Controls and Protection systems
- Fuel conditioning systems
- Instrumentation & Data acquisition
- Plant construction technical management
- Technical training
- Technical troubleshooting & Root-cause analysis
- Energy utilization in buildings & industry

6. References – Projects List

Project references				
Year	Customer Group	Description	Methodology	Location
2018-today	Utility	Overhaul of a 310 MW thermal HFO unit including the steam turbine	Complete service	Egypt
2017-today	Utility	Overhaul of a 300 MW HFO thermal unit including the steam turbine	Complete service	Egypt
2016	OEM Steam Turbine	LP turbine performance improvement study	Flow path and leakage analysis	China
2015	Consulting Engineering	Conversion of a Micro gasturbine to external firing	Conceptual Design CAD	Switzerland
2015	R&D	Auxiliary system development for an advanced GT cycle combustion test rig Phase I: Concept	Systems Design Flow network analysis	USA
2015	OEM Steam Turbine	Strength, lifetime and dynamics assessment of steam turbine blades and rotors.	FEM	China
2015	OEM Hydro Power	Stress and lifetime analysis for generator components	FEM	Switzerland
2014	Industrial manufacturer	Analysis of contaminated air streams in closed environments. Presentation of hardware modification to improve flow behaviour.	System design improvements	Switzerland
2014	OEM Gas Turbine	Lifetime evaluation of a new rotor design	FEM Root Cause Analysis Rotor design	Germany
2014	Steel manufacturer	Root cause analysis of premature failure of radiant DRI furnace coils, redesign of firing system.	CFD FEM Root Cause Analysis	UAE
2014	Plant District Heating	Root cause analysis of boiler nose and assessment of exhaust duct damage. Redesign of exhaust duct	CFD Root Cause Analysis	Russia
2014	Power Utility	Site management and technical supervision of contractors during construction phase of 1400 MW steam power plant	EPC project management	Libya
2014	MRO	Performance and mechanical reconstruction of 4 stage turbine	Reverse Engineer Gas Path	USA
2014	Industrial manufacturer	Failure mechanism evaluation of a lateral compensator	Mechanical integrity	Switzerland
2014	Power Utility	Engineering field support	Outage oversight	USA/Canada
2014	OEM Gas Turbine	Blade root spring	Support Manufacture	USA/Canada
2014	OEM Compressor/Pump	Chief Engineers Design Review & Risk Assessment	Design Review	USA
2014	OEM Gas Turbine	Casing Bolt Failure	Root Cause Assessment	USA
2014	OEM Gas Turbine	Review outage procedures and perform risk assessment if not completed	Outage Procedure Risk Assessment	USA
2014	OEM Gas Turbine	Risk analysis and hardware development	Outage Time Reduction	USA

2014	OEM Gas Turbine	Investigation of loss in performance guarantees and mitigation strategy	Performance Analysis	USA
2013	OEM Gas Turbine	Remaining life assessment of a gas turbine rotor	Mechanical integrity	Germany
2013	OEM Gas Turbine	Full static and transient lifetime assessment of gas generator rotor	FEM simulations	Germany
2013	Power Utility	Techno-economic analysis of rehabilitation of minor gas turbine and steam plant generation units	Techno-economic analysis	Libya
2013	Power Utility	Performance Analysis	Recover performance	USA
2013	OEM Gas Turbine	Basket Spring Clip Wear and Related Flashback Events	Extend life	USA
2013	OEM Gas Turbine	Radial Clearance Investigation	Extend warranty	USA
2013	OEM Compressor/Pump	Rotor Dynamic Modelling and sensitivity study	Design Improvement	USA
2013	OEM Gas Turbine	Casing and rotor service mitigations	Field Solutions	Global
2013	OEM Gas Turbine	Rotor Balance procedure consulting services	Reduce Vibration	USA
2013	Power Utility	Steam Turbine Trailing Edge Erosion Investigation	Extend life	USA
2013	OEM Gas Turbine	Bearing Pivot Pad stiffness mod	Extend warranty	Saudi Arabia
2013	OEM Gas Turbine	Device to eliminate blade rocking during slow roll operation	Remove wear	USA
2013	OEM Gas Turbine	Exhaust Baffle Seal	Extend warranty	USA
2012	Consulting Engineering	Investigation of wind impact on heat exchangers of a waste incineration plant. Presentation of hardware modification to improve flow behaviour.	Aerodynamic Analysis	United Kingdom
2012	OEM Gas Turbine	Evaluation of yellow plume phenomenon in exhaust stack	Combustion engineering	Germany
2012	OEM Gas Turbine	Exhaust bearing housing cover mod	Extend warranty	USA
2012	OEM Gas Turbine	Vibration Investigation and site civil work	Outage Support	USA
2012	OEM Gas Turbine	Investigation of loss in performance guarantees and mitigation strategy	Performance Analysis	USA
2012	OEM Gas Turbine	Identified suppliers for Auxiliary system components including valves and Filter Separators.	Fuel Gas Auxiliary Component Supplier Identification	USA

2012	OEM Gas Turbine	Root Cause Investigation and Recommendations for mitigation of Vibrations reported by End Users in frame.	Vibration RCA	USA
2012	OEM Gas Turbine	Developed and executed mitigation strategy of bearing modification to address excessive rotor vibration.	Vibration RCA	Saudi Arabia
2012	OEM Gas Turbine	Design of Row 4 Blade Retention Device	Mechanical Design	USA
2012	OEM Gas Turbine	Selected by OEM to represent and support the service team in the Western Region of the US	Service Support Regionalization	USA
2012	Power Utility	Evaluation of gas turbine fleet long term service agreements (Phase 1)	Management consulting	Libya
2012	Power Utility	Evaluation and training of gas turbine engineering and O&M personnel (Phase 1), including HW supervision algorithms and equipment condition assessment techniques	Technical training	Libya
2012	Plant Desalination	Steam boiler emission reduction and power output increase for multiple units (Phase 1)	Combustion engineering	Libya
2012	Power Utility	Assessment of instrumentation condition and upgrade of steam plant controls system with improved interfaces (Phase 1)	Controls engineering	Libya
2012	Power Utility	Evaluation and improvement of start-up procedure for a 2000 MW steam plant	Plant Engineering	USA
2012	Industrial manufacturer	Analysis of failure mechanisms of a lateral compensator	Mechanical integrity	Switzerland
2012	Consulting Engineering	Strength and lifetime assessment of a water cooled quencher	Mechanical integrity	Switzerland
2011	OEM Electrical generator	Evaluation of a novel generator cooling concept	Cooling & heat transfer	Switzerland
2011	Consulting Engineering	Investigation of wind impact on air cooled condensers of a power station.	Aerodynamic Analysis	Switzerland
2011	OEM Gas Turbine	Design and Fabrication of testing equipment used to certify Fuel Gas Nozzle refurbishment quality.	Mechanical Design	USA
2011	OEM Gas Turbine	Combustion system re-design with optimization of fuel staging	Combustion engineering	Germany
2011	OEM Gas Turbine	Investigation of a new combustion system concept	Combustion engineering	Germany
2011	OEM Gas Turbine	Analysis of hardware changes of combustion system for reduced part load emissions	Combustion engineering	Germany / USA
2011	OEM Gas Turbine	Root cause analysis of yellow plume in exhaust stack	Combustion engineering	Germany / USA
2011	Power Utility	Evaluation and improvement of generation group organizational structure and processes (Phase 1)	Management consulting	Libya
2011	Power Utility	Assessment of vibration problems in gas turbine exit diffuser	Measurement analysis Root cause analysis	Libya

2011	OEM Gas Turbine	Root cause analysis of gas turbine rotor vibration	Measurement analysis Root cause analysis	Libya
2011	Power Utility	Supply of intake air filters (19'000 units) for generation fleet	Gas turbine parts	Libya
2011	Power Utility	Refurbishment of hot gas path parts for 130 MW gas turbine	Gas turbine parts	Libya
2011	Consulting Engineering	Fracture mechanics analysis of a flywheel	Mechanical integrity	Switzerland
2010	Consulting Engineering	Preparation and execution of professional training over the use of Computational Fluid Dynamics (CFD) for heat exchangers and atmospheric flows.	Professional Training	Switzerland
2010	Consulting Engineering	Steam- and air- side investigation of the fluids behaviour of an air cooled condenser. Presentation of hardware modification to improve flow pattern and reduce vibrations.	Aerodynamic Analysis	Switzerland
2010	Industrial manufacturer	Gas turbine unit conversion to external firing: engineering & design of hardware and controls concept	CAD FEM CFD manufacturing and assembly support	Germany
2010	OEM Gas Turbine	Root cause analysis of premature turbine seal failure	Root Cause Analysis	Germany / USA
2010	OEM Gas Turbine	Investigation of part load emission problem	Combustion engineering	Germany / USA
2010	OEM Gas Turbine	Evaluation of compressor rotor lifetime under various load gradients	FEM	Germany / USA
2010	OEM Gas Turbine	Analysis of turbine stage welded ring (diaphragms)	Turbine design	Germany / USA
2010	OEM Gas Turbine	Investigation of emissions performance of new combustion system	Combustion engineering	Germany / USA
2010	Power Utility	Preparation of business plan for gas turbine refurbishment facility	Management consulting	Libya
2010	Power Utility	Elimination of black stack in 2*65MW steam boiler units for HFO operation	Combustion engineering	Libya
2010	Power Utility	Improvement of steam plant efficiency by optimization of operation concept	Plant operation	Libya
2010	Power Utility	Increased start-up reliability by redesign of gas turbine ignition torches	Plant operation	Libya
2010	Power Utility	Design, supply and implementation of gas scrubbing and heating system, including long-term condition monitoring system integrated into plant's infrastructure	Plant system design	Libya
2010	Power Utility	Evaluation of control system upgrade proposed for a customer by OEM	Controls engineering	Libya
2010	Power Utility	Root cause analysis of gas turbine premature lifetime failures on HFO	Combustor design	Libya
2010	Power Utility	Assessment of steam plant overhaul requirements for turbines, boilers, instrumentation and control system	Plant engineering	Libya

2010	Power Utility	Study of economic advantage of rehabilitation of steam plant	Plant engineering	Libya
2010	Real estate developer	Energy savings analysis and investment cost reduction for a 315'000 m2 building complex	Building energy analysis	United Arab Emirates
2009	OEM Gas Turbine	Lifetime evaluation of casing design for elevated compressor pressure ratio	FEM simulations	Germany / USA
2009	OEM Gas Turbine	Fracture mechanics analysis of rotor disc during transient operation	FEM simulations Fracture mechanics assessment	Germany / USA
2009	OEM Gas Turbine	Evaluation of material temperatures of rotor during engine start-up	Rotor dynamics	Germany / USA
2009	OEM Gas Turbine	Implementation of customized controls and data acquisition system for combined cycle power plant unit	Plant Controls	Russia
2009	Real estate developer	Energy savings analysis and investment cost reduction for a 4000 m2 office building	Building energy analysis	Saudi Arabia
2009	Real estate developer	Energy savings analysis and investment cost reduction for a 105'000 m2 hotel building	Building energy analysis	Saudi Arabia
2008	OEM Electrical generator	CFD simulation for cooling air flow in generator with the target to improve efficiency.	Cooling & heat transfer	Switzerland
2008	Power Utility	Concept for OFA (over fire air) to significantly reduce NOx at a 500 MW pulverized coal power station	Combustion engineering	USA
2007	Power Utility	A root cause engineering study to identify a solution to reduce carbon and NO _x emissions from a 500 MW pulverized coal power station	Combustion engineering	USA
2007	Power Utility	Burner modification concept to solve opacity problem at a 500 MW pulverized coal power station	Combustion engineering	USA
2007	OEM Gas Turbine	Conceptual design for an improved sealing system for a combustion chamber	Combustor design	Germany / USA
2007	OEM Gas Turbine	Vibration analysis of a can annular combustor assembly	FEM and CFD simulations	Germany / USA
2007	OEM Gas Turbine	Investigation of part load emission problem	Combustion engineering	Germany / USA
2007	OEM Gas Turbine	Stress analysis of a new compressor bearing casing including simulation of contacts and bolt pre-tensioning	FEM simulations	Germany
2007	OEM Gas Turbine	Mechanical design of fuel injection system.	Mechanical design	Germany / USA
2007	OEM Steam Turbine	Benchmarking and improvement of an analysis method for steam turbine inlet vanes.	FEM simulations	Germany
2007	OEM Gas Turbine	Design concept to solve combustion instability problem	Combustion engineering	Germany / USA
2007	Power plant construction consortium	Systems engineering, procurement and construction management for a 200 MW gas turbine plant. Delivery of balance of plant equipment and Distributed Control System.	Plant engineering and construction	Kuwait

2006	OEM Steam Turbine	Modelling of windings heating in turbine seals.	Cooling & heat transfer	Germany
2006	OEM Gas Turbine	Lifetime and fracture mechanics assessment for a new rotor disk	FEM simulations Fracture mechanics assessment	Germany
2006	Industrial manufacturer	Engineering study for the replacement of natural gas with coal for drying and calcinations applications	Plant engineering	USA

5. References - Testimonials

CPS has executed a large number of challenging projects in power generation and energy efficiency services. We dedicate ourselves to deliver high quality and innovative solutions based on our advanced technical skills and capabilities. Meeting and exceeding the expectations of our customers is a top priority as illustrated by a recent testament from one of our clients:

“We are impressed with your team’s collective knowledge, analysis tools, and capabilities in applying fundamentals as a foundation for a solution, regardless of the complexity. We have challenged CPS with projects involving very fluid scope and schedule, i.e. significant changes in objectives and milestones. CPS met this challenge on every occasion with great professionalism, expediency and understanding. We were able to maintain a very open level of communication with the CPS team, from both a project management and a technical level. This provided opportunity for learning and resulted in a more refined understanding of the technical challenges we face. This level of open communication is rare in the industry, if not unique, and is truly refreshing.” – Dennis del Grosso, Arizona Public Services - Electricity, Power, Energy Services, USA.



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