

Gas Turbine Plant Optimisation

GTPOM

Project Overview

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The Need

Meeting future power plant technology targets will demand a more sophisticated & rigorous approach to the preliminary design problem than is currently available in existing methods.

We will need to formally bring together and manage multi-disciplinary problems in the design process, bringing together inter-dependent subject areas such as:

- Thermo-Physical Performance
- Capital Cost, Project Finance & Economics
- Environmental Impact
- Resource Consumption
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As our designs may have many conflicting parameters & variables, we will need to make greater use of formal search techniques to better evolve our initial designs, for example:

- Genetic Algorithms
- Multiple Criteria Decision Making Techniques (MCDM)

The Solution - GTPOM



GTPOM

Our Proposal - GTPOM

To provide a comprehensive gas turbine preliminary design tool that will enable the systematic identification of better power generation system designs.

The tool (which will be computational) will:

- Include full 'life cycle cost' optimisation procedures
- Be built on an existing, well proven, software product base (IPSEpro)
- Incorporate advanced plant modelling capabilities (thermodynamic, thermo-chemical, electrical & mechanical capability)
- Incorporate detailed project finance, cost estimation and economic techniques
- Include off-design/part-load scenario assessments
- Exploit formal optimisation techniques
- Be flexible/general enough to cope with many cycle types

GTPOM



Potential Benefits for European Community



GTPOM will be a unique tool:

- It will be used by the GT sector to identify new cycles with improved cost & performance, ensuring that they are:
 - competitive in so far as they are optimised to meet full life cycle requirements of a customers application
 - designed to minimise resource consumption and emissions
- To do this GTPOM will attempt to manage the complex trade-off's that arise during the design process of an advanced system
- Use of GTPOM should make an impact on system designs in the 3-10 year time-frame (and so contribute significantly to the attainment of Kyoto targets and other commitments)
- It should help reduce development time scales for next generation systems (accelerating the discovery of new & improved system concepts)
- It will be applied to identifying improvements for existing systems

GTPOM

The Partners

Rolls-Royce - UK (co-ordinator)



Alstom - UK



Alstom - Sweden



Energi E2 - Denmark



SimTech - Austria



Lund University - Sweden



Genoa University - Italy



Newcastle University - UK



The Partners

Rolls-Royce - UK

Plant Manufacturer & System Integrator

Alstom - UK

Plant Manufacturer & System Integrator

Alstom - Sweden

Plant Manufacturer & System Integrator

Energi E2 - Denmark

Utility/Plant Operator

SimTech - Austria

Process Performance Software Developer

Lund University - Sweden

Advanced Thermo-fluid Expertise

Genoa University - Italy

Power Plant Economics Expertise

Newcastle University - UK

Optimisation Expertise

The Budget

Rolls-Royce - UK	241,000 Euro
Alstom - UK	166,000 Euro
Alstom - Sweden	108,000 Euro
Energi E2 - Denmark	073,000 Euro
SimTech - Austria	231,000 Euro
Lund University - Sweden	163,000 Euro
Genoa University - Italy	147,000 Euro
Newcastle University - UK	151,000 Euro
Total Project Budget	1,280,000 Euro

The Work Programme

- 2 years duration started in January 2001
- 168 person months
- 5 Major Work Packages to Implement Software:
 - WP1 Software Integration
 - WP2 Whole System Performance Modelling
 - WP3 Sub-system Design, Performance & Costing
 - WP4 Life Cycle Cost Scenarios & Economic Modelling
 - WP5 Optimisation Capability Implementation
- 1 Major Work Package to Verify Capabilities
 - WP6 Capability Validation

The Work Programme

In the final phase of the project GTPOM's capabilities will be validated by applying it to a series of novel GT power generation design optimisation studies

- Using GTPOM the team will perform a case study on each of four system types:
 - - A high efficiency CCGT/CHP hybrid
 - A wet recuperated GT cycle
 - A cycle which includes a carbon dioxide capture/removal system
 - A biomass cycle
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 - The team will produce a full public domain report on their findings
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 - The GTPOM software will be 'rolled out' for use in other university and industry projects
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 - Links are already starting to being formed with other potential end-users