Pelamis Wave Energy Converter

Pelamis sea trial

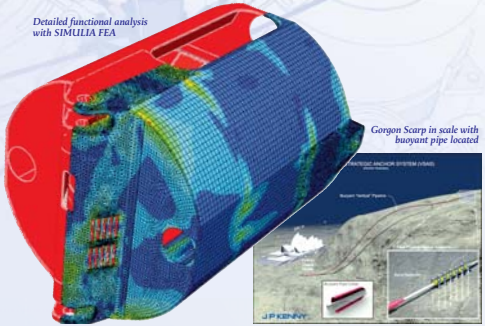
Pelamis offshore Wave Farm

Designs on Energy with Dassault Systèmes Technology

CATIA, ENOVIA and SIMULIA are being deployed in many sectors of the energy business including fusion, oil exploration and wave power to maximise capital investment returns.

The world's leading fusion research programme is being carried out at the Culham Science Centre in Oxfordshire, where developers use Dassault Systèmes' CATIA V5 and ENOVIA SmarTeam provided by Applied, to create and maintain the vast amount of engineering data required to ensure that future generations can benefit from the work carried out today.

"CATIA V5 is used to model the Joint European Torus project (JET) – (the flagship of Europe's integrated fusion programme), and the buildings and facilities which house it," explains Paul Carman, CATIA Manager at Culham. "This is a huge digital mock-up of JET, which consists of over a million parts built."



Detailed functional analysis with SIMULIA FEA

Gorgon Scarp in scale with buoyant pipe located

FUTURE PROOF AT JET

In conjunction with CATIA V5, the UKAEA* has also invested in ENOVIA SmarTeam, creating an extended enterprise level system that enables the effective storage, sharing, maintenance and retrieval of engineering data between researchers and different agencies now and into the future.

"Until ITER is built, JET will remain the only machine of its level of sophistication in the world," says Carman, "and it's important that we retain our world-class status ready for the transition to ITER. Effective PLM is a vital part of that process."

JP KENNY – PIPELINE DESIGN CHALLENGES

JP Kenny is applying state-of-the-art technologies to the design of the sea-bed pipeline, its route mapping and the proposed carbon dioxide sequestration project.

Key elements of the project are:

- Construction of a network of seabed manifolds and pipelines from the gas fields to an offshore island.
- The sub sea structures will be large and require specialized installation technology.
- A gas processing facility on the island.
- Gas sequestration in formations deep below the island.
- LNG shipping facilities to transport products to international markets.

The deepwater location of part of the gas field presents challenges for the design and installation of large diameter pipeline. The pipeline requirements include 260km of large gas delivery line and 520km of small diameter pipe connecting the wellheads, manifolds and other equipment.

Other issues to be considered in the design of the pipeline are the effects of the local marine environment, which features steep escarpments at the continental shelf, the annual cyclone season, large tidal movements, and strong currents, which impact on the seabed and the pipeline itself.

MEETING THE CHALLENGES WITH FEA SOFTWARE

JP Kenny deploys Abaqus, a complete suite of unified finite element analysis software from SIMULIA, the Dassault Systèmes brand for realistic simulation.
Abaqus is helping engineers to develop and test designs to withstand the pipeline dynamics and the forces operating at the continental shelf crossing.

Detailed lateral buckling analyses are conducted to assess forces and strains across the full range of behaviours, and to investigate the potential for pipeline creep or walking.

PIPELINE SEABED INTERACTION

Pipeline and pipeline-to-seabed interaction are modelled using the Abaqus contact surface option, which helps to define appropriate locations for built in buckle points. It is also helping to identify expansion spool sizes and Abaqus is used to predict bending and ovalization of the pipeline.

Abaqus is also used to confirm locations where the pipeline should span the sea floor escarpment at the continental shelf, which drops from 200m to 800m water depth. Crossing the escarpment at the optimum point will reduce the pipe lay for the project by up to 40km – a significant cost saving. The team is also exploring deepwater trenching to reduce this span.

Dassault Systèmes PLM is helping to make these huge energy assets commercially viable.

The state-of-the-art technologies being applied to the design and development of these gas fields are helping to make these huge energy assets commercially viable. In addition to identifying the potential to reduce the pipeline length by 40km, the software is also helping to make this asset safer and more environmentally responsible as it supplies vital energy and earns valuable income.

WAVE POWER

Pelamis Wave Power Ltd (PWP), creators of an innovative wave energy converter, is performing rapid design evaluation and optimisation of power generators with Abaqus Unified Finite Element Analysis (FEA) software from SIMULIA.

To generate electric power, Pelamis Wave Energy Converters (PWEC) are linked together into a "wave farm" on the ocean's surface. Hydraulic rams resist the motion of the waves and pump hydraulic fluid through electricity-producing generators. A wave farm of 40 Pelamis machines, covering a square kilometre of ocean surface, is capable of generating electric power for 20,000 homes.

Pelamis Wave Power uses Abaqus FEA software for initial concept analysis, general design work, and detailed functional analysis of its Wave Energy Converters. Engineers use the software's material modeling capabilities and incorporate data from hydraulic systems tests, electrical layouts and production assembly requirements, to make their Wave Energy Converters efficient, cost-effective and environmentally sound •)

Undersea well heads

* United Kingdom Atomic Energy Authority

For more information:
www.jet.efda.org
www.jpkenny.com
www.pelamiswave.com