Billington
Process Technology

The Simulation Expert and
Digital Production Twin Inventor ...

Using Green Twins to Design Pioneering Green Energy Plants

De-risking investments in complex process plants at early design stage

Utilizing the leading-edge design validation tools combined with in-depth domain knowledge within a wide range of complex green process systems, we address design risks already at early concept stage and find the best mitigation together with our partners.

BPT Green Twins - design, training and online performance monitoring & optimization

Building on the fit-for-purpose simulation tools used in the early de-risking stage, the tools are used further through detailed engineering of the plant, validating control system, enhancing operational procedures, used in efficient training of operators and engineers, assist commissioning and startup, as well as performance monitoring and optimization throughout plant life.

Key-areas of BPT involvement

Green hydrogen production

- Alkaline electrolysis
- Polymer electrolyte membrane cells
- Solid oxide electrolysis cells

Membrane separation

- Micro-, ultra-, nano-filtration and reverse osmosis

Applied reactor modelling

- Fischer-Tropsch (GTL incl. electro fuels)
- Syngas reactor
- Haber-Bosch (ammonia production)

Power generation and CCUS

- CO2 with impurities incl. supercritical CO2 fully dynamic

High temperature heat exchange

- Solid-fluid heat transfer (solar)

Green energy and low-carbon project examples

Carbon-neutral synthetic fuels

High-fidelity steady state and dynamic simulators of electro fuel plant, incl. alkaline electrolysis, syngas- and Fischer-Tropsch reactor systems, covering plant startup, feed-change, etc.

Concentrated solar power (CSP)

Dynamic model of Brayton cycle incl. integrated design of compressors and turbo expanders with supercritical CO2 as energy carrier, validating system startup, shutdown, controllability, etc.

Minimized energy consumption

A field-specific online model-based digital twin solution of compressors reduced energy consumption with 3-4% (~500 MWh per year) and increased regularity with ~2% for a medium size offshore facility.

Eliminated flaring with gas recovery

A mature oil field was modified to a closed flare system incl. changed re-compressor impeller, resulting in gas recovery handling eliminating flaring, valued more than $ 350k per day in saved CO2 taxation.

BPT Lifecycle Simulation Approach

The main vehicle in this approach is the BPT Twins, a full-fledge Digital Engineering and Lifecycle Simulator Framework leading up to an Online Simulator for decision support and production optimization.

Process design and optimization

Control design, validation and improvement

Virtual plant & digital eco-system validation

Operator training simulator

Online digital production twin

1.
We evaluate and improve process and system design for the complete plant by much more detailed and wider analyses than traditional engineering methods.

2.
We test control strategies towards the actual process models, including process control, process & emergency shutdown and compressor protection. We also perform process safety studies complying to API 521 relief scenarios.

3.
To improve performance and interoperability of integrated systems, we build a virtual plant of the entire facility with control system and all main digital applications in ecosystem, hence total performance could be fully validated.

4.
We provide high-fidelity operator training simulators for efficient training of central control room and field operators. Scope of simulator is typically the entire processing facility integrated with control and safety systems as well as replica control system operator stations and instructor station forming a realistic training tool environment.

5.
The lifecycle simulator / digital twin evolves and accumulate increasing rigor throughout the design and commissioning phase - and from plant start-up it forms an operational production twin driven by real-time data with unique performance, accuracy and optimization capabilities.

Lifecycle simulation project examples

Modified compressor configuration

The BPT modified compressor design unlocked increased production valued ~USD 3 billion for the first 5 years and eliminated gas recirculation (energy waste) and minimized re-bundle replacements over field life.

Front-end-loading field development

BPT applied a structured FEL approach to mitigate risks and enhance system design during concept stage of the field development, which improved quality of process and system design assisted by digital workflows and simulators.

Quality of digital production data

Online field-specific model-based reconciling digital twin solution of wells and processing facility, quality-checks the entire dataset for production and equipment, forming essential input to digital apps.

Realistic operational training

Plant-specific simulator with integrated dynamic process model and control & safety systems facilitating highly realistic training in handling of normal operations as well as abnormal situations.

Driving Efficient, Low-Carbon Oil & Gas Production

300+ oil & gas projects

Over decades BPT has executed world-leading studies based on high-fidelity simulators, software extensions and efficient workflows performed by cross-discipline domain experts. The track-record includes more than 300 projects for the global oil & gas industry and an increasing number of low-emission and green energy engagements for energy companies.

BPT-SimApps - tools making the difference

The BPT-SimApps forms an absolute foundation for state-of-the art simulation services – and lifecycle digital production twins, offering unique performance, accuracy and optimization capabilities.

The BPT-SimApps portfolio is under continuous development, innovating unique high-fidelity unit operations and fit-for-purpose thermodynamics - supporting our partners to innovate new low-carbon and green energy solutions.

Front-end-loading - the foundation for success

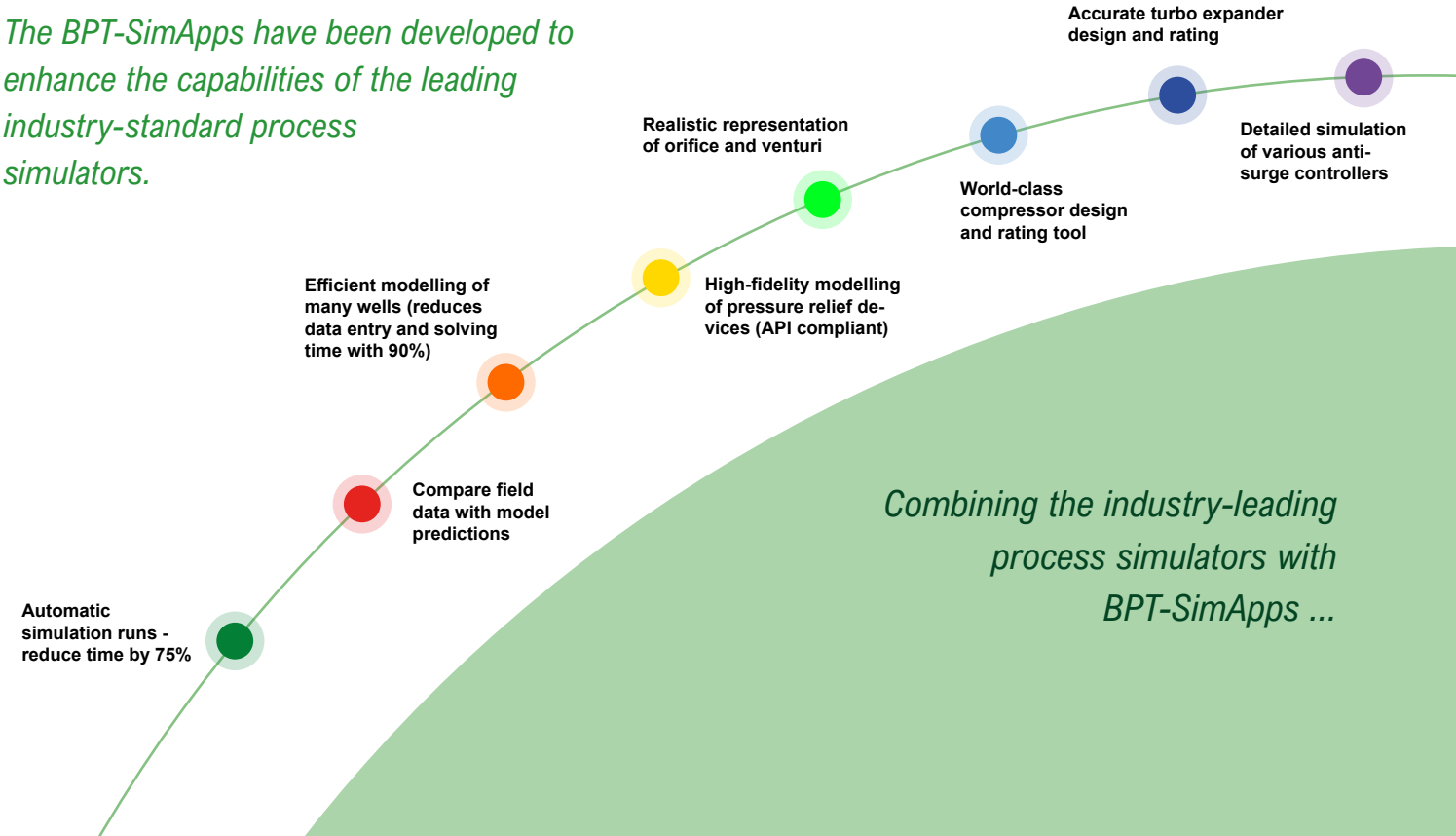
BPT's domain experts are pioneers in applying FEL methodology and tools to discover & mitigate risks and enhance ROI at an early stage.

Lifecycle digital production twins

At BPT we practice a well-proven lifecycle simulator approach. The lifecycle simulator evolves and accumulate increasing rigor throughout the design and commissioning phase - and from first oil it forms an operational production twin driven by real-time data.

The field-wide BPT Digital Production Twins is a key enabler of data driven operations. BPT Twins provides holistic sensor value correction with complete quality-checked datasets as output - and calibrated steady state and dynamic simulator models for efficient and fast decision support and production optimization.

The BPT-SimApps have been developed to enhance the capabilities of the leading industry-standard process simulators.



Combining the industry-leading process simulators with BPT-SimApps ...

BPT-SimApps Software

Accurate and efficient ways of working with process simulators ...

Simulation, design and reporting:

- **BPT-EXT.** Excel-based data processing and reporting

Modelling (flowsheet unit operations):

- **BPT-MWF.** Multi well feeder
- **BPT-PSX.** Relief valve design and rating
- **BPT-ROX.** Orifice and venturi models
- **BPT-CODES.** Centrifugal compressor design and simulation
- **BPT-TEX.** Turbo expander design and rating
- **BPT-ASC.** Custom simulation of compressor anti-surge controller
- **BPT-ECX.** Model framework for electrolysis cell
- **BPT-FRG.** A variety of kinetic reactor models with flexible geometry definition
- **BPT-HTX.** High temperature heat exchange model for solid-fluid heat transfer
- **BPT-MEM.** High-fidelity membranes separation process

Integration:

- **BPT-OLX.** Link between OLGA multiphase flow simulator and process simulator
- **BPT-LLX.** Link between LedaFlow multiphase simulator and process simulator
- **BPT-FSG.** Extraction of flare data from process simulator to flare design tools
- **BPT-TSF.** Transient model data import & export
- **BPT-AMG.** Automatic model generation based on information models
- **BPT-DBX.** Bi-directional communication with engineering databases

Simulation usage management:

- **BPT-SUW.** Simulator usage watchdog.

Seamless integration of multiphase flow and process simulators

Realistic flare system capacity evaluation

Automatic monitoring of simulator usage across company

Detailed modelling of various electrolysis units

High-fidelity representation of various reactor processes

Modelling of high temperature heat transfer

Various membrane separation processes

... enable faster, more detailed, accurate and comprehensive modelling - in all project phases.

Creating Digital Solutions built on world-class Simulation Technology & Competence

BPT is an independent digitalization, software and service company with private owners and HQ in Norway. Over the two last decades we have carried out more than 300 complex simulator-based projects worldwide.

We drive energy companies transforming the existing oil & gas industry to maximized sustainability as well as accelerating the value creation within the wider range of green energy plants.

By teaming up with us, you access a world-leading center-of-excellence when it comes to production domain knowledge, high-fidelity simulation services and simulator-based digital solutions.

BPT Business Areas ...

We drive digital innovation with more efficient ways of working, automating workflows and delivering of value creating digital solutions transforming the energy sector with optimized design of production systems, life of field operations and increased sustainability.

Simulation Services

Over decades BPT has executed world-leading simulation studies based on high-fidelity simulators, software extensions and efficient workflows performed by cross-discipline domain experts.

BPT-SimApps Software

We do innovation on top of the industry-standard process simulators, adding capabilities and fidelity as well as increasing accuracy and user efficiency.

BPT Digital Twins

The main vehicle in our life-cycle simulator approach is the BPT Twins. A full-fledge Digital Engineering and Lifecycle Simulator Framework leading up to an Online Digital Production Twin.

Driving low-carbon production and green energy innovations ...

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