When planning a transportation system, customers are challenged to select the appropriate technology and mode of operation that will provide peak performance, lowest operating costs and the smallest environmental footprint while minimizing energy consumption.

EnerGplan Simulation Tool

EnerGplan is a graphical-based simulation tool that provides the transit system designer with the ability to analyze and optimize the power system configuration and minimize the energy consumption of the complete transportation system.

EnerGplan conducts an overall analysis of transit system performance to predetermine the optimal mode of transit system operation. The analysis includes:

- Fleet performance
- Train speed profiles
- Power distribution system load flows
- Effects of onboard and wayside energy storage devices
- Train schedules
- Train routing

The Solution

The BOMBARDIER® EnerGplan® is Bombardier's newest tool to help optimize the design of power distribution systems and reduce energy consumption during operations.
EnerGplan also provides an analysis of the optimal power system configuration, such as location, rating and setting of energy storage devices that minimize energy consumption.

The flexibility of this software allows the user to model virtually any transit system of any complexity.

Operating cost reduction and power system design optimization

Now more than ever, transit authorities and system operators are compelled to find ways to reduce transit system capital and operating costs. Many technologies available on the market today claim to achieve significant energy reductions, but can be very expensive and largely ineffective if used inappropriately. In certain applications such devices may even lead to degradation of transit system performance. EnerGplan provides the means to evaluate these technologies to determine their effectiveness and their impact on system operation.

EnerGplan has the capability to simulate different power distribution system configurations with various energy-saving scenarios to determine the optimum solution. For example, it clarifies whether the onboard energy storage or wayside energy storage offers the optimum energy saving for a specific system, by simulating both configurations to determine the optimum solution from a system performance, capital cost and energy reduction perspective. It can also calculate the CO2 reduction for different scenarios.

EnerGplan Main Features

Graphical environment

EnerGplan employs an easy-to-use graphical environment to:
• Construct any track plan using the available basic track building blocks
• Construct any power system using the basic power distribution building blocks

The graphical environment provides the ability to:
• Superimpose a guideway on an aerial or other map
• Edit parameters of any object using a double click
• Zoom in/out, pan, add grid lines, mouse lines and curve features
• Flip, rotate or delete any object

Guideway editor

EnerGplan is capable of simulating multiple train routes operated at different headways for the same studied case. The chainage equality feature allows the user to easily input guideway data as it is received from civil engineers without manual pre-processing.
Electrical network editor

EnerGplan is capable of modelling:

- Traction power substations (TPS)
  - DC TPS: rectifier, controlled rectifier, controlled rectifier with inverter
  - AC TPS: normal transformer, autotransformer, booster transformer (future)
- Wayside energy storage – used to reduce energy consumption and for voltage regulation applications
- Wayside resistor banks – used to dissipate regenerated energy if the power system is non-receptive
- Power rail, catenary and running rail to distribute electrical power to the vehicles (with local and global resistance/impedance editing)
- Utility substations
- Feeder cables (including length, size of cable/feeder, resistance/km for both positive and return)
- Busbars and feeder cables (allows interconnection of any number of feeder cables)
- Power rail gaps (gaps can be in either positive, negative or both power rails)

EnerGplan Capability

Dynamic load flow modelling

Interactions among multiple trains are included in the load flow analysis, thus allowing simulation of actual system performance and providing an accurate power supply and distribution design. Traditional load flow models employ a model where trains are simulated independently of the power system. EnerGplan models both the train and power system simultaneously and interactively so that the effect of power system voltage drops on train performance can be determined.

Rolling stock editor

EnerGplan is not limited to any specific type of train or transit technology. The generic input feature allows the flexibility to simulate multiple train types operating simultaneously on one or more user-definable routes. EnerGplan can be used to simulate everything from the largest metro system to the smallest people-mover application.

The rolling stock editor consists of train editor, car editor, and propulsion editor. It is capable of modelling onboard energy storage as well as onboard resistors.
EnerGplan Simulation Tool

Graphical visualization

The dynamic train display allows monitoring of any chosen train operating on the guideway, displaying its location and other pertinent operational data. The graphical visualization tool is a unique and informative way to demonstrate fleet operation with the option of demonstrating power supply and distribution system behaviour. The instantaneous current and voltage of selected traction power substations, busses or feeders can be displayed, as well as the current stored or released from any energy storage unit.

EnerGplan outputs and results

Operation analysis and load flow results are generated as text files and visualized using a graphical utility add-on. The text outputs are divided into summary and detailed reports for both train performance and load flow analysis.

The flexibility of the graphical utility allows the user to generate any kind of graph needed to illustrate train performance and/or power system design.

ECO4 – Energy, Efficiency, Economy and Ecology

EnerGplan forms part of Bombardier's ECO4* environmentally friendly technologies. Addressing the growing challenges among operators to reduce Energy consumption, improve Efficiency, protect the Ecology while making sense Economically, ECO4 is the concrete validation of Bombardier's declaration – The Climate is Right for Trains*.

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