Wind Diesel 2004 Workshop

Girdwood, Alaska,

28-29 september 2002

Engineering of Wind-Diesel Systems using Matlab / SPS Tools*

**SimPower Systems*

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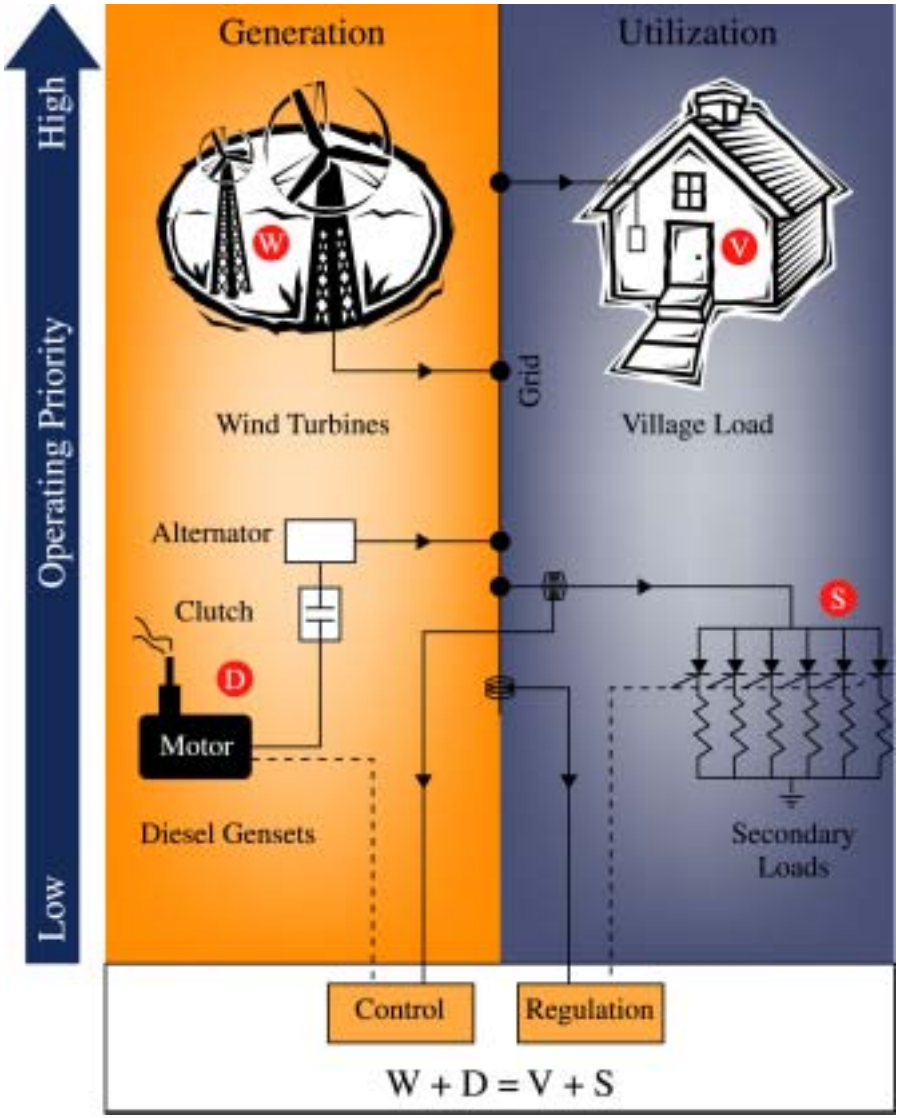
The High Penetration No-Storage Wind Diesel Concept



- **Priority to Wind Energy Free Fuel**
  - Optimal Penetration Dictated by Economics: Cost of Fuel, Wind Resource
  - Diesels Are Shut When Wind Exceeds Demand
  - Energy Surplus Used in Secondary Loads (heating fuel savings)
- **No Power Quality Reduction**
- **A Regulator Maintains Balance Between Generation and Load**
- **A PLC Manages the Transitions Between the Operating Modes: All-Diesel, All-Wind and Wind-Diesel**
- **Savings**
  - Fuel: 50-70% Depending on Wind Resource
  - Increased Diesel Life
  - Diesel Maintenance
- **Electricity ->Energy planning**

New modelling tools

- Need of flexible tools
  - Stability Protection and Control issues
  - System Optimization
- Previous Simulations of the HPNSWD were carried out with EMTP (Electro-Magnetic Transient Program), EMTDC
- Other tools in Transient analysis…

+ Simulink

++ Power System Blockset

  - Comparison for Validation
  - User « friendly »
  - Control tools analysis

Power System Blockset

Power System

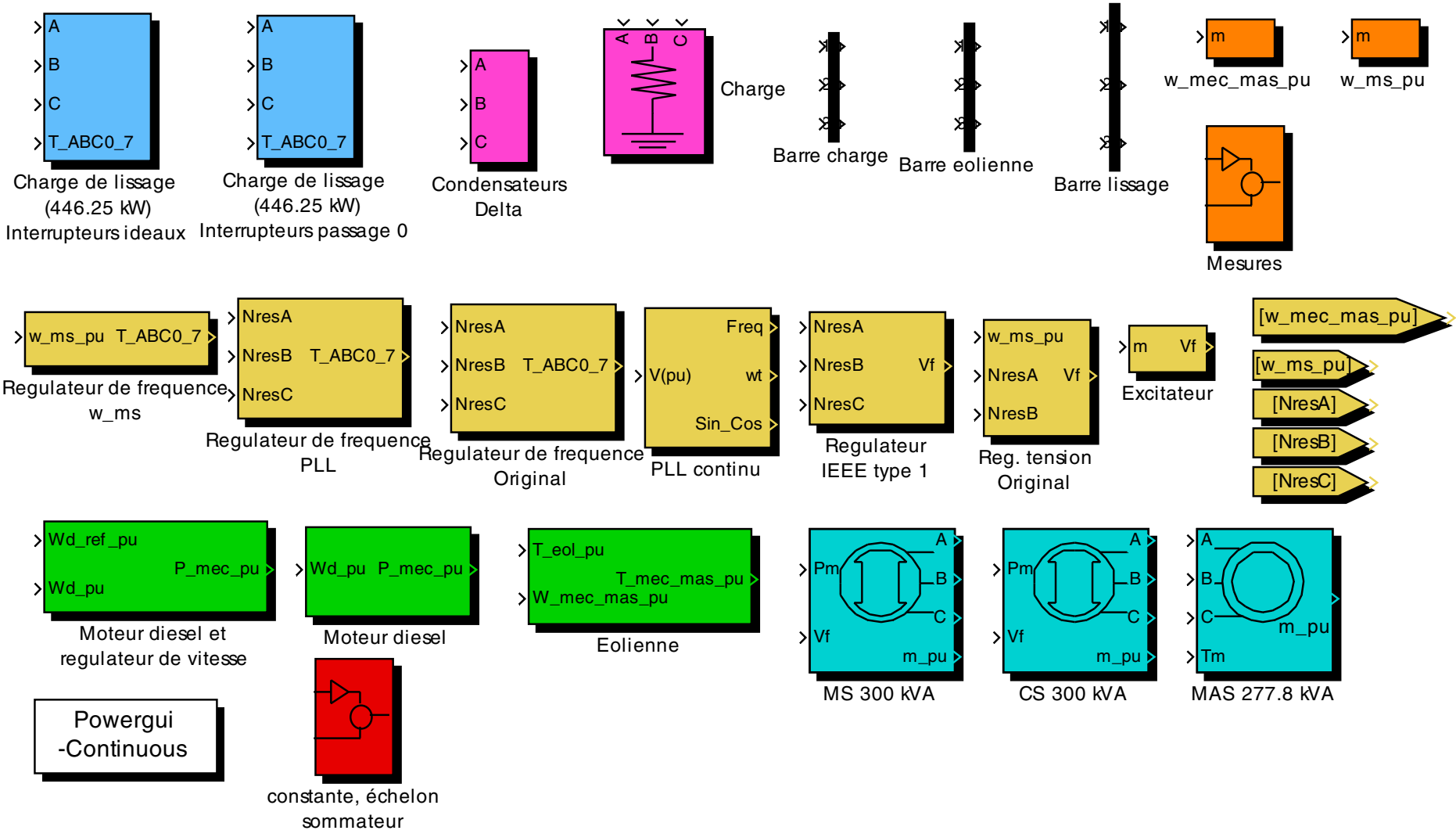
The Power System Blockset provides the ability to model and simulate electrical power systems and drives within the Simulink Environment. Applications of the Blockset include analysis and modeling of power utility distribution networks and self-contained power systems such as those for ships, aircraft and spacecraft. …And remote networks

The blockset covers the following areas:

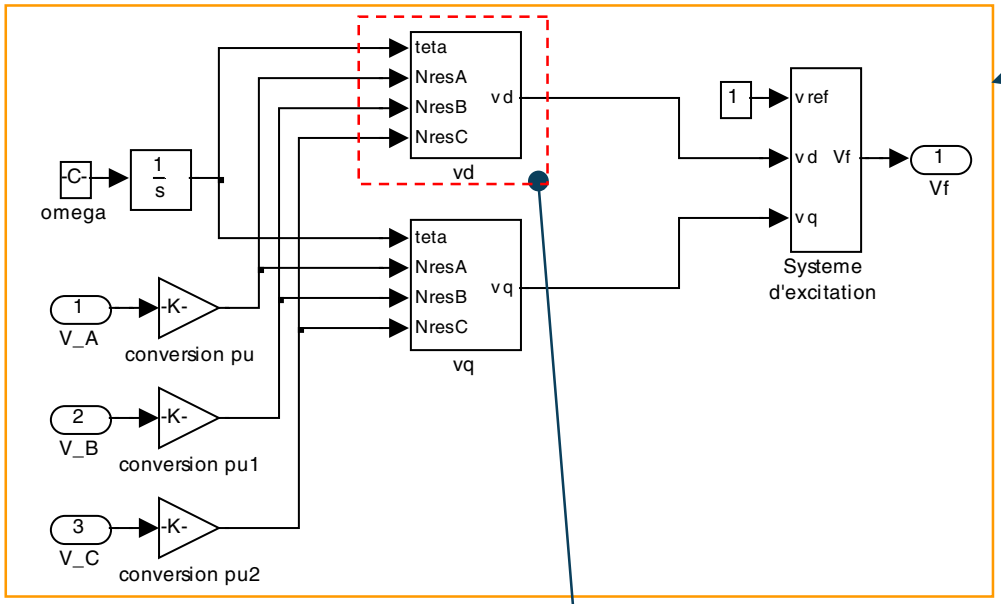
- Power system networks
- Electric machinery
- Power electronics
- Control and measurement
- Triphase library

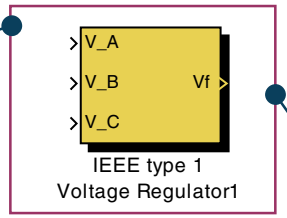
- **Power System Blockset**
  - developed at IREQ labs
  - Marketed and distributed by MathWorks
- **Simulink**
  - commercial product developed by Mathworks
  - requires MATLAB for its operation.
  - graphical block diagrams to simulate the mutually interactive components of a dynamical system.
  - used for system design optimisation.

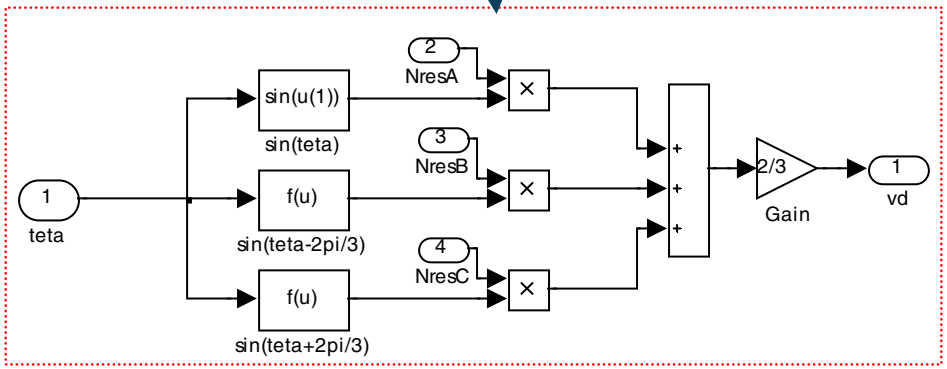
Library of objects for WD analyses



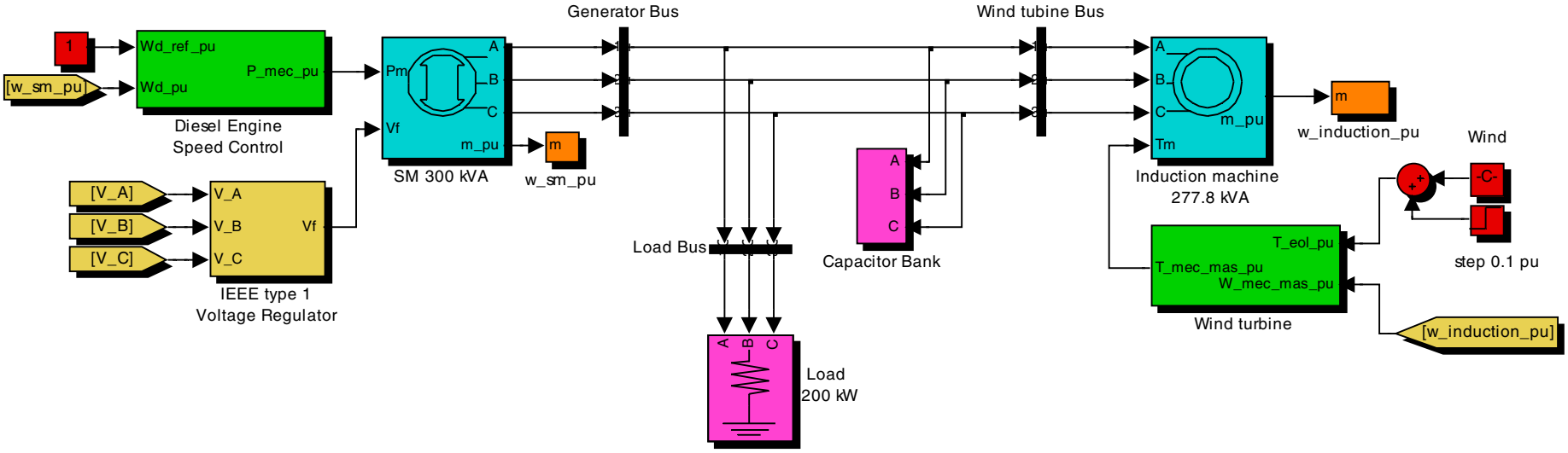
Object description and sub-models



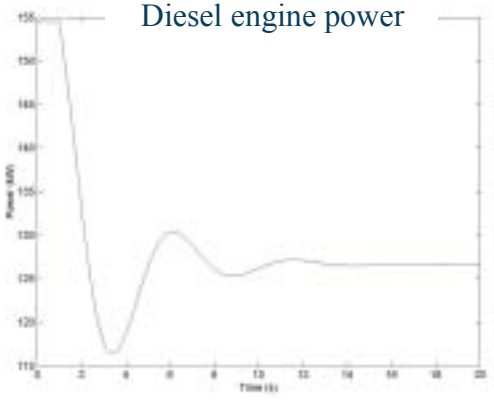




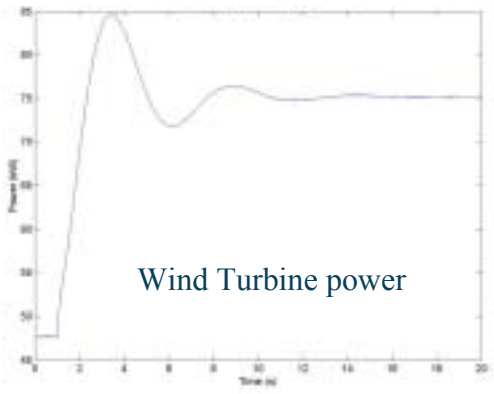
Wind Turbine And Diesel Generator



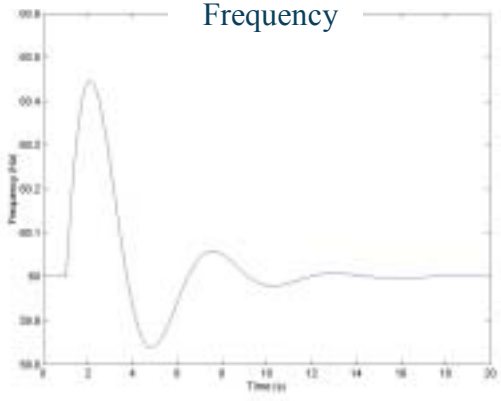
Diesel engine power



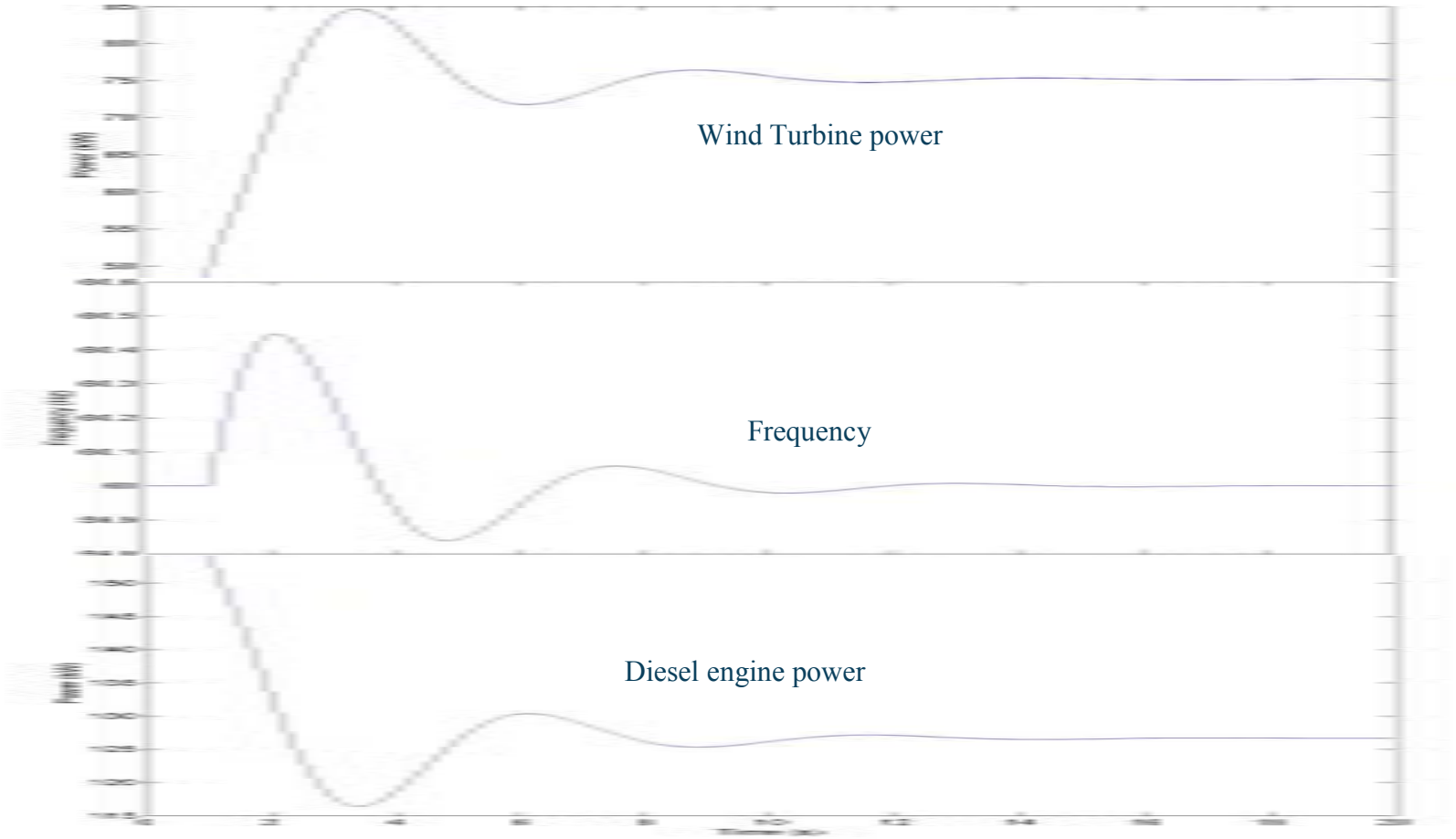
Wind Turbine power



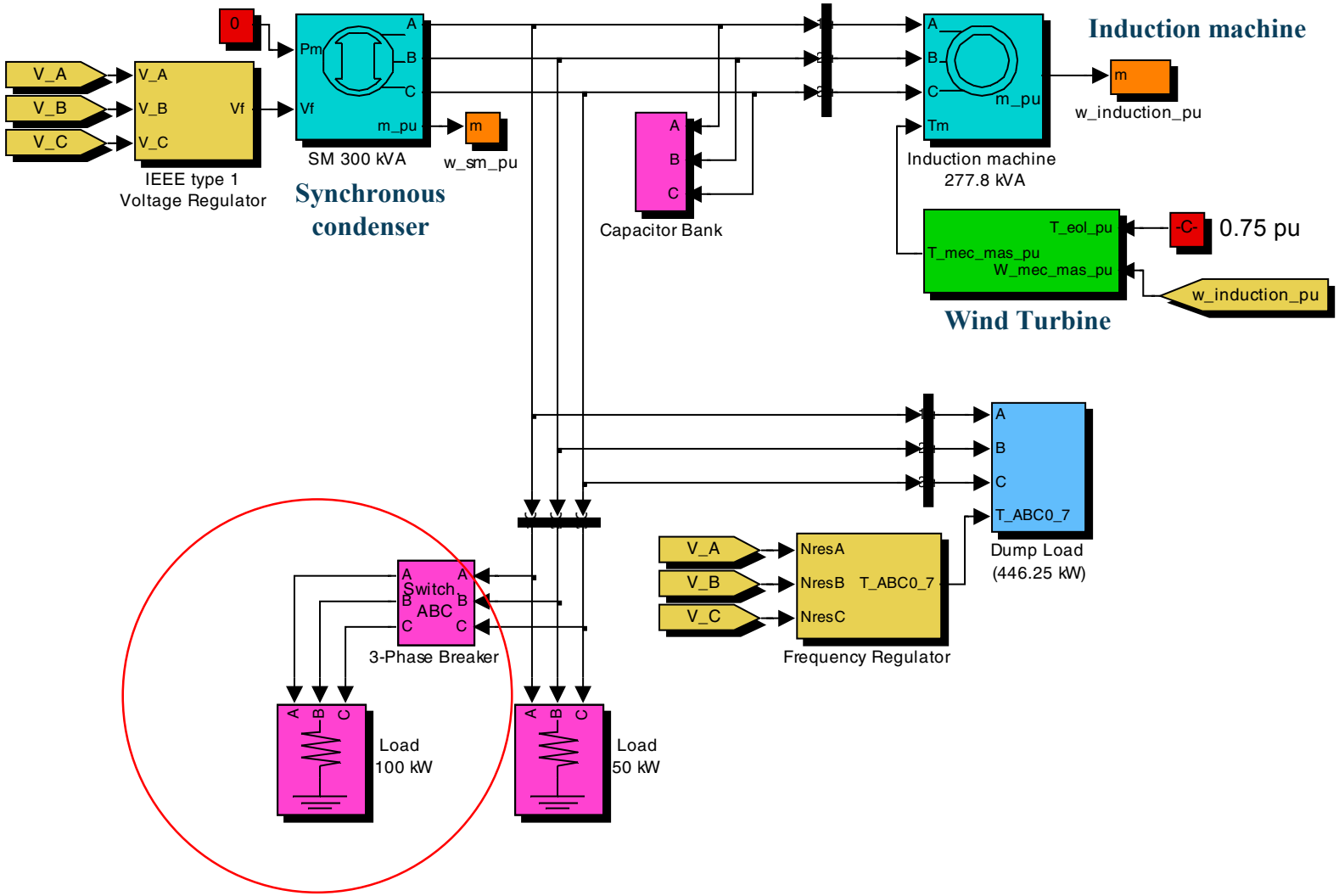
Frequency



Diesel speed regulator response to a wind power increase



Secondary load regulator response in All-Wind mode (HPNSWD)



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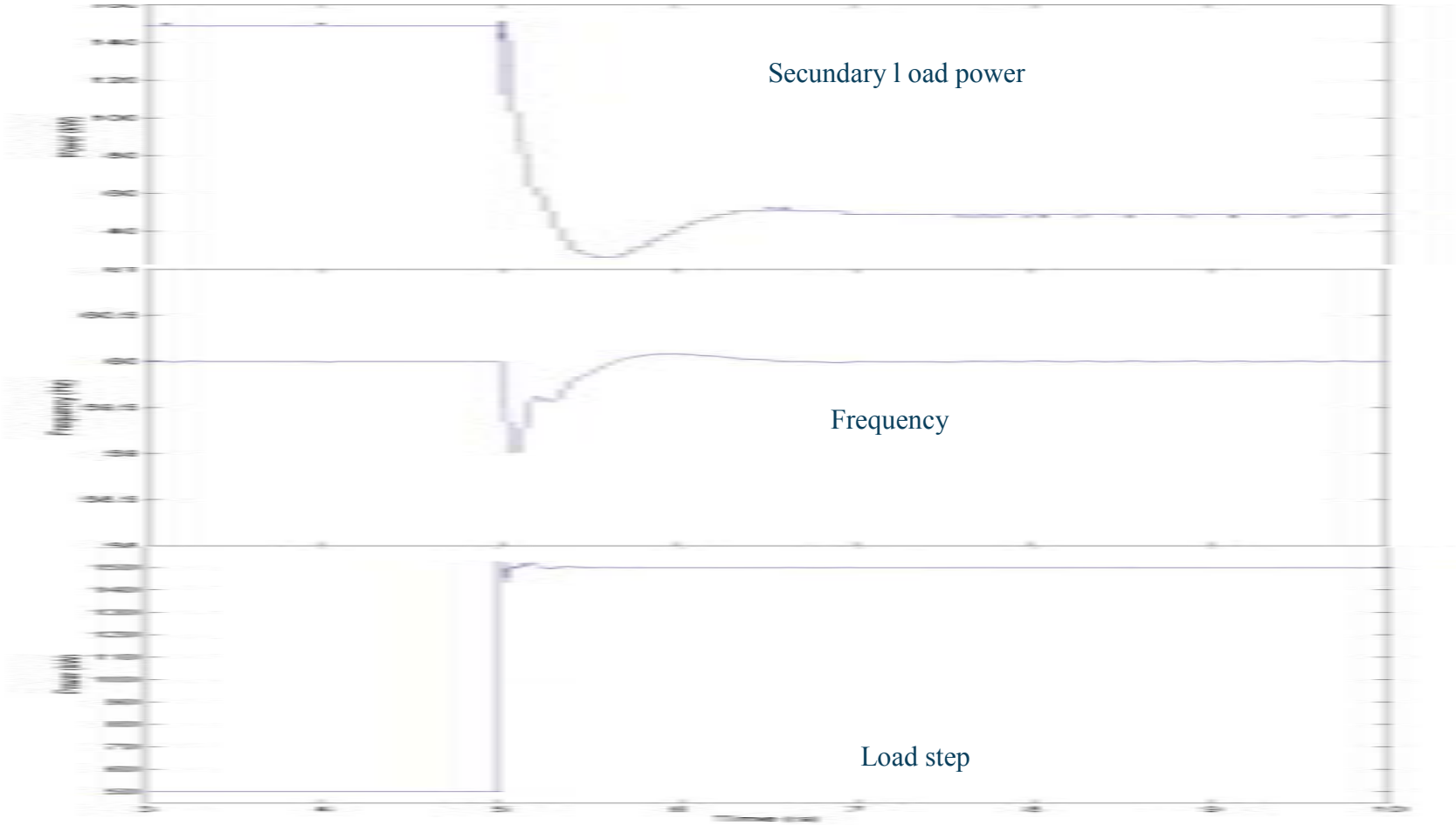

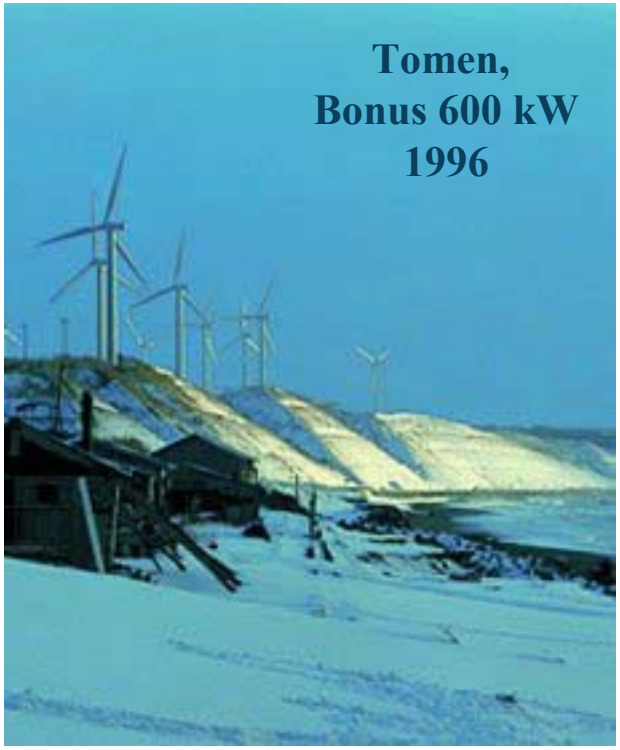

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