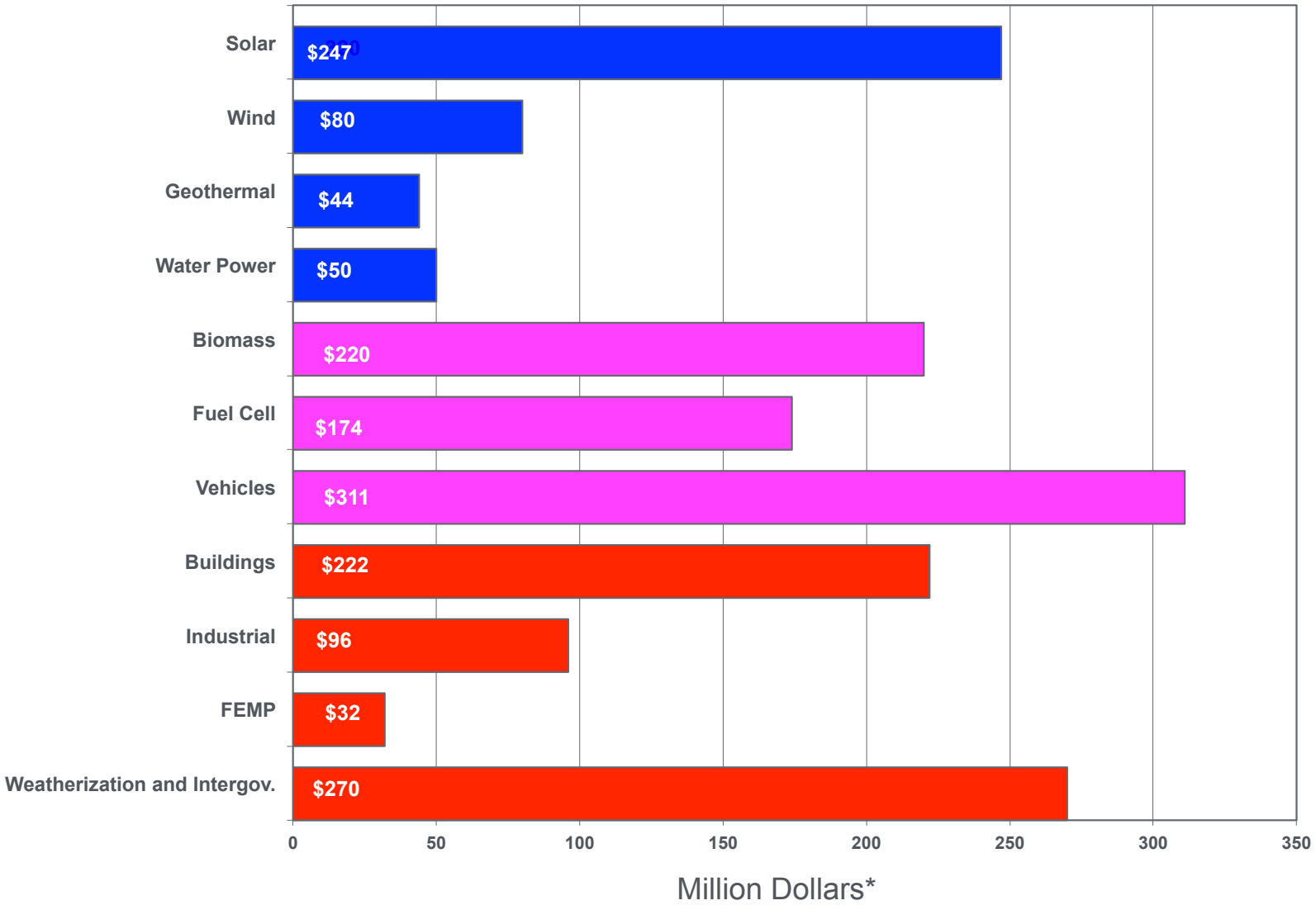
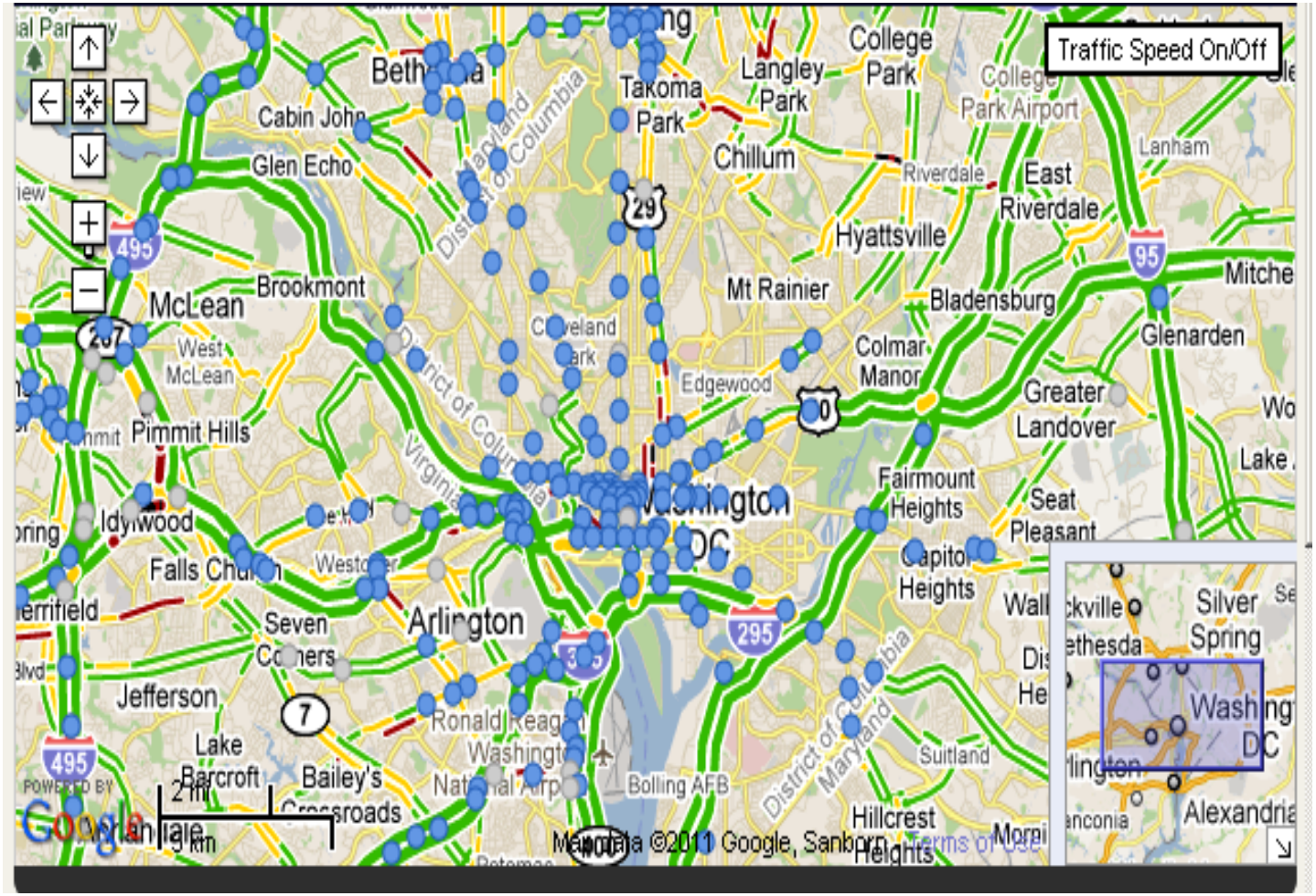
EERE FY 2010 Budget ($2,247)

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy



* Figures are based on FY2010 Conference Report. Excludes Facilities and Infrastructure, Program Direction, and Program Support


Traffic Speed On/Off
Bethesda
Takoma Park
Langley Park
College Park
College Park Airport
Cabin John
Glen Echo
Chillum
Riverdale
East Riverdale
Lanham
Hyattsville
Mt Rainier
Bladensburg
Brookmont
McLean
West McLean
Pimmit Hills
Edgewood
Colmar Manor
Greater Landover
Glenarden
Fairmount Heights
Seat Pleasant
Capitol Heights
Idylwood
Falls Church
Arlington
Seven Corners
Jefferson
Lake Barcroft
Bailey's Crossroads
Ronald Reagan Washington National Airport
Bolling AFB
Suitland
Hillcrest Heights
Silver Spring
Alexandria
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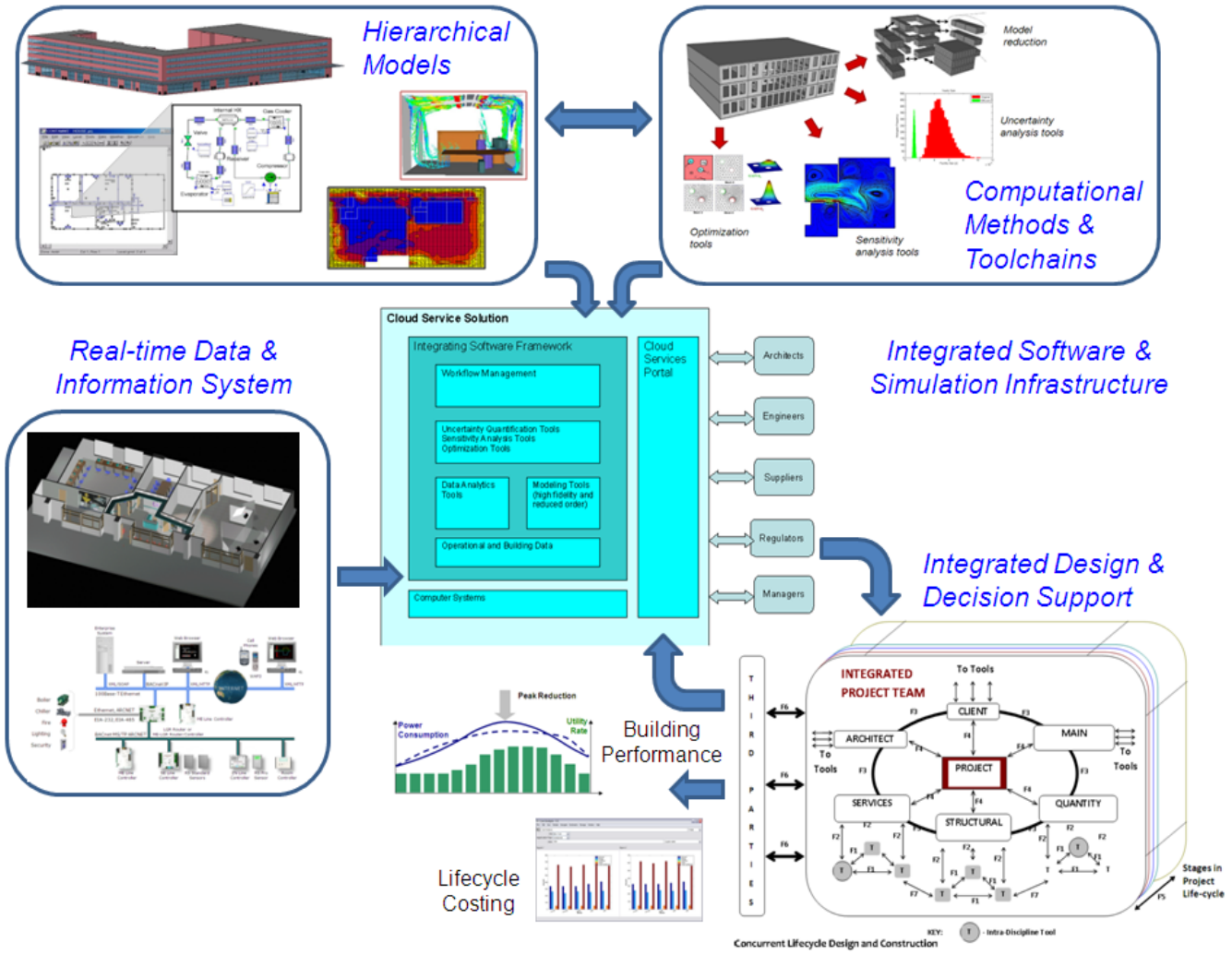
RD&D HIGHLIGHT 3: Integrated lifecycle building delivery

- The HUB will delivery an integrated building project delivery process that will allow interactive design and persistent data tracking.
- This will include high-level process maps to enable collaborative building design.
- This will include a change and dependency management tool, so that designers can understand the energy impacts of changes to one element of the overall design.
- This will include hierarchical models of building systems, using the open-source, object-oriented language Modelica.
- This will include tools for the optimum configuration of sensors and controls.



RD&D HIGHLIGHT 1: Building modeling and simulation

- The HUB will build analysis tools to simulate 3D airflow and heat transfer in buildings on the scale of single rooms, multiple floors, and full buildings, in real time. This is a prerequisite for a full-building "operating system".
- To date, most building energy simulation does not fully incorporate airflow, or treats airflow using a "multi-zone" approach that assumes full air mixing and coarse-grained, isothermal zones. [1]
- The HUB will incorporate full microscopic airflow models (CFD) into building energy simulations. The approach will use LLNL's parallel incompressible flow solver *Cgins* and multi-physics solver *Cgmp,* coupled with emerging "Fast Fluid Dynamics" techniques at Purdue, to make the simulation computationally tractable. [2,3] Will also use Open FOAM (optimized for Intel and BlueGene).
- Ultimately, the HUB will build tools to use full HPC capability for building energy simulation, using adaptive mesh approaches and numerical solvers developed by LLNL. [4]

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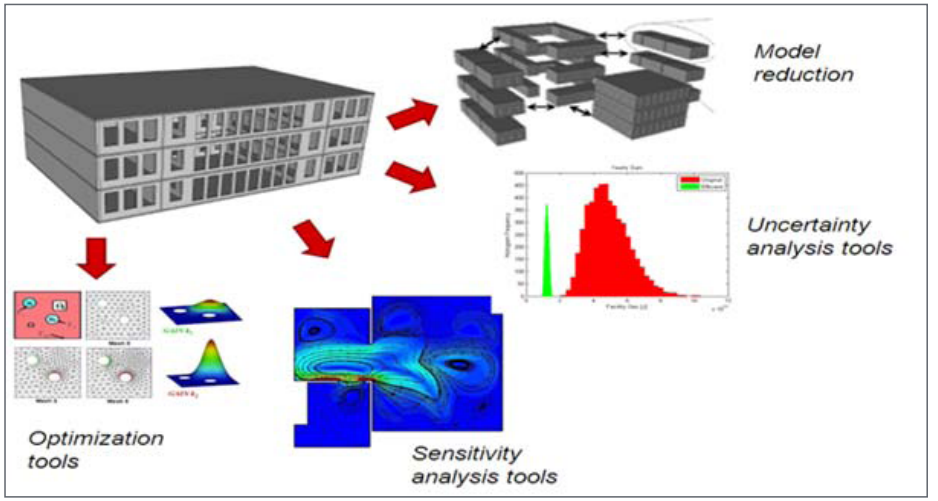
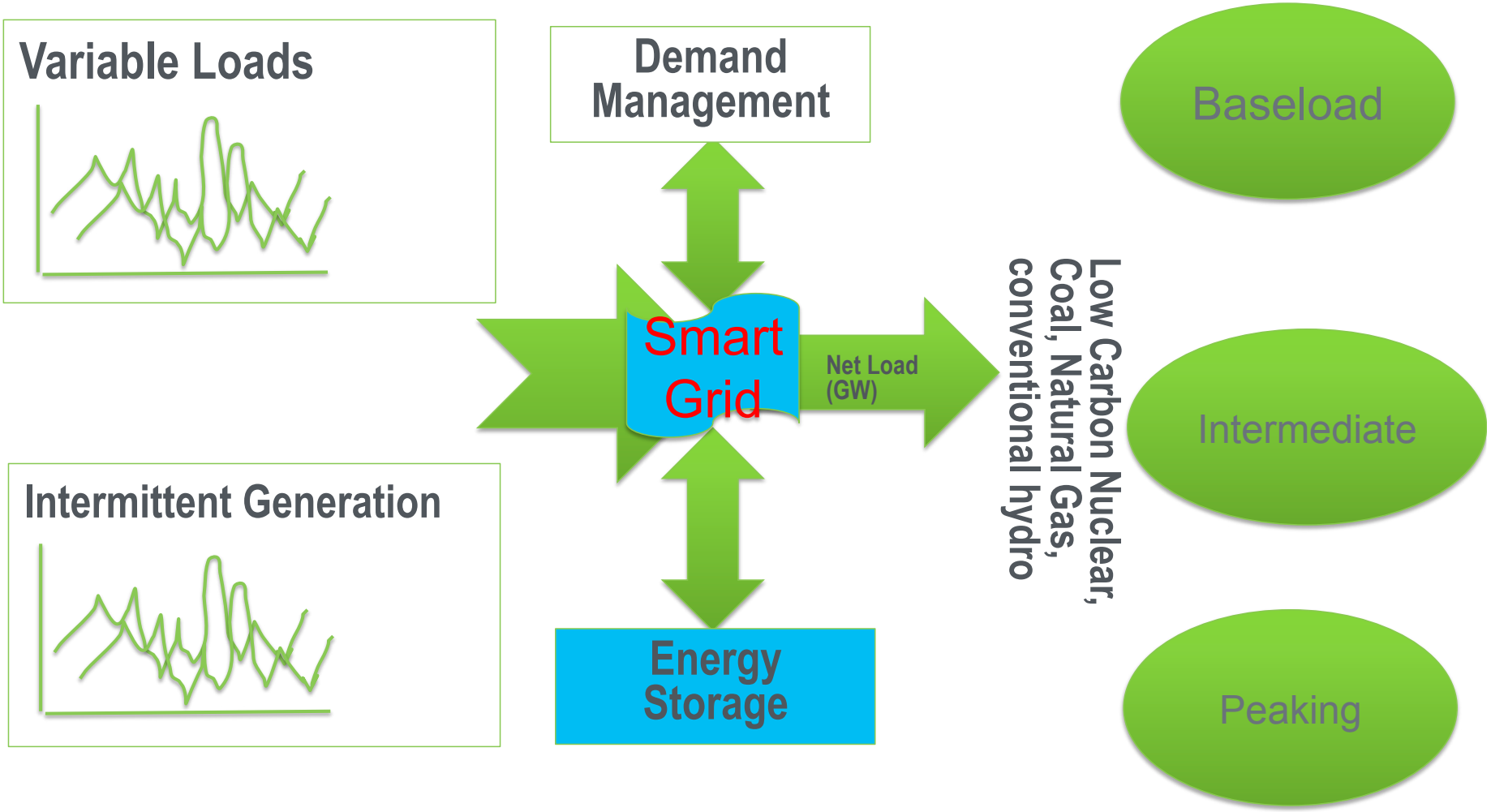


[1] See Brown et al, "Computational Fluid Dynamics in an Equation-Based Modeling Environment", 11th International IBPSA Conference, July 2009.
[12 Henshaw and Chand, "A Composite Grid Solver for Conjugate Heat Transfer in Fluid-Structure Systems", *J. Comp. Phys.* 228 (2009). Incompressible flow is a reasonable approximation for room-temperature air below Mach ~ 0.3.
[3] Zuo et al, "Fast and Informative Flow Simulations in a Building by Using Fast Fluid Dynamics Model on Graphics Processing Unit", *Building and Environment* 45, 747 (2010).
[4] See https://computation.llnl.gov/casc/SAMRAI and https://computation.llnl.gov/casc/sundials/


Variable Loads
Intermittent Generation
Demand Management
Smart Grid
Energy Storage
Net Load (GW)
Low Carbon Nuclear, Coal, Natural Gas, conventional hydro
Baseload
Intermediate
Peaking

Screenshot:

Interactive Pressure House - Scenario B