The Economic Impact of Energy Research at Argonne National Laboratory

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Argonne: The First U.S. National Laboratory

- Founded in 1943, made a national laboratory in 1946.
- 1500-acre site southwest of Chicago.
- 3,200 employees.
- 1,450 scientists and engineers.
- 750 Ph.D.s.
- $675M operating budget.
- A broad, multidisciplinary R&D portfolio.
Argonne research thrusts

- Multi-program/multidisciplinary research.
  - Advanced Computing.
  - Alternative Energy.
  - Nuclear Reactor Technology.
  - Environmental Management.
  - Transportation.
  - Energy Storage.
  - Nanotechnology.
  - Biotechnology.
  - Policy Analysis.
“The Economic Impact of Argonne National Laboratory”

- Anderson Economic Group report.
- Measured *net new* economic impact of Argonne.
  - Excludes expenditures that would have happened regardless of Argonne operations.

- Argonne economic impact on Illinois in 2010:
  - $697M in economic output (earnings to households and businesses).
  - 4,952 jobs.
Mechanisms for Industry Collaborations

- Cooperative Research and Development Agreements (CRADAs).
  - Facilitating technology transfer.
  - 19 in 2010.

- Work for others.
  - Allowing Argonne to assist non-DOE organizations.
  - 76 non-federal in 2010.

- Technology Service Agreements (TSAs).
  - Allowing outside organizations access to Argonne facilities and expertise.
  - 24 non-federal in 2010.

- Total technology transfer agreements in 2010: **503**
- Patent and software licenses: **33**
An example success story

- DOE-supported R&D in the 1990s led to Argonne’s nickel-manganese-cobalt cathode technology for Li-ion batteries.
- The technology has been licensed to several companies.
  - BASF.
  - LG Chem Power, Inc.
  - Panasonic.
  - Samsung.
  - Sanyo.
- The LG Chem battery now powers the Chevy Volt
  - The first U.S. mass-market plug-in hybrid electric vehicle.
Argonne’s major user facilities

Center for Nanoscale Materials

- 470 users

ATLAS

- 170 users

Electron Microscopy Center

- 190 users

Argonne Leadership Computing Facility

- 928 users
Advanced Photon Source

3,796 users

Argonne total for 2010:
5,554 users
70 visiting faculty
300 post-doctoral researchers
600 undergraduate/graduate students
4,300 K-12 students
Fuel spray studies at the Advanced Photon Source

- Spray structure is important for efficient combustion. It depends on fuel properties and engine design.
- The hard, penetrating x-rays of the Advanced Photon Source allow us to see fuel spray in action.
- General Motors, Chrysler, Daimler.
- Visteon, Delphi, Bosch, Continental, Denso.
Solar Electricity

- Critical pathways to reducing the levelized cost of solar energy:
  - Novel materials.
  - Devices.
  - Process engineering.

- Supporting science and engineering methods:
  - Nanomaterial synthesis, self-assembly, and fabrication.
  - Advanced structural characterization.
  - Time-resolved x-ray and optical techniques.
  - Decision and information analysis.
Midwest Photovoltaics Analysis Facility (MPAF)

- Real-world performance data and local meteorological data are needed to accurately assess levelized cost of electricity (LCOE)*.

- Pilot facility constructed at the Illinois Tollway headquarters.
  - Five module technologies: c-Si, p-Si, a-Si, CdTe, CIGS.
  - Weather stations near modules and at standard height.
  - Monitoring of individual module performance in real time.

- Ultimately, a diverse network of such sites will feed into a publically available database of comparative performance.

Argonne’s wind power research

- Environmental impacts of wind power.
  - Impact on critical wildlife habitats.
  - Visual impact analysis.

- Wind turbine reliability.
  - Improved coatings and lubricants.
  - Better gear box reliability.

- Advanced drive train development.
  - Superconducting direct drive train.

- Wind power forecasting and electricity markets.
  - Improved statistical forecasting models.
  - Use of forecasting in operational decisions.
  - Stochastic optimization to reduce price volatility.
Adjoint analysis of numerical weather prediction models

- Indicates sensitivity of market (costs and efficiency) to uncertainties in weather (wind, temperature, radiation).
- Guides the optimal placement of weather sensors.
Reducing building energy consumption with adaptive management

Partner: BuildingIQ

Without optimization

Energy savings with Argonne optimization
Building efficiency – Chicago Loop Retrofit

- Demonstration elements:
  - Chicago Loop - 120 million square feet built.
  - Cold climate zone.

- Research elements:
  - Retrofit business case development – decision analysis under uncertainty.
  - Innovative strategies for accelerating retrofits.
  - Community vs. single building focus.

- Partners:
  - Georgia Institute of Technology
  - Sieben Energy Associates
  - Skidmore Owings & Merrill
  - Clinton Climate Initiative