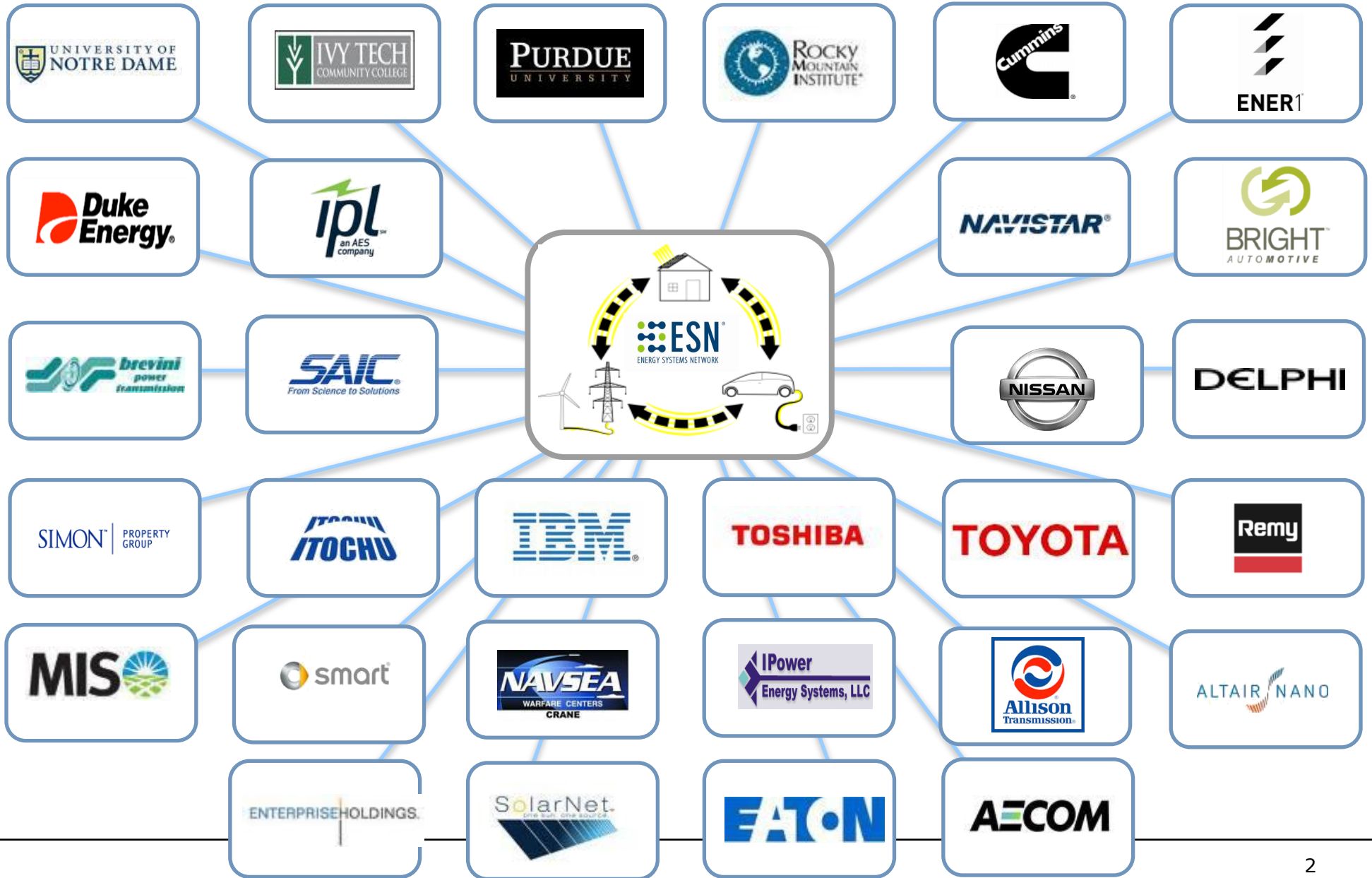




Building an Energy Ecosystem

Building an Energy Ecosystem



Board of Directors

Energy Systems Network (ESN) is a 501(c)6 non-profit corporation which provides project development and coordination for joint ventures and cooperative partnerships between network members who are seeking to bring new energy technologies, products, or applications to market.

ESN commercialization projects deliver systems level solutions by drawing on a rich diversity of established and emerging companies and institutions across Indiana and beyond who collectively make up a world-class clean-tech cluster with expertise that span the energy ecosystem.

ESN Board of Directors

Thomas Snyder (chair) – President, Ivy Tech Community College, retired CEO Remy Inc.

James E. Rogers – Chairman & CEO, Duke Energy

Tom Linebarger – President & COO, Cummins Inc.

Jeff Owens – President, Delphi Electronics and Safety

Eizo Kobayashi– Chairman, ITOCHU Corporation

Norio Sasaki – President & CEO, Toshiba Corporation

John Bear – President & CEO, MISO

Timur Ivanov –General Director, Russian Energy Agency

Mike Hudson – President, I-Power Technologies

Amory Lovins – Chairman & Chief Scientist, Rocky Mountain Institute

France Cordova – President, Purdue University

Mark Miles – President & CEO, Central Indiana Corporate Partnership

Energy Systems Network (ESN) has established a Technical Advisory Council (TAC) with deep and broad technical knowledge of the clean-tech sector. The TAC provides strategic market and technical counsel to ESN projects.

ESN Technical Advisory Council

Dr. John Wall (Chair) – CTO, Cummins Inc.

Dr. Richard O. Buckius – Vice President for Research, Purdue University

Dr. Jim Lyons – CTO, Novus Energy Partners; Chief Engineer, GE Global Research (retired)

Dr. Bill Wylam – Chief Engineer- Batteries; Director of International Manufacturing, Delco Remy Division of General Motors Corporation (retired)

Bob Sunada, Chief Strategy Office – Corporate Development Office, ITOCHU Corporation

Dr. Hideki Hayashi, General Manager – Smart Grid Technology, Toshiba Corporation

John Waters – President, Waters & Associates; Vice Chairman, Bright Automotive

Mike Thomas – Founder, Automotive Insight; former Executive Director of USCAR

Project Portfolio



A cooperative partnership between Cummins, Inc., the Delphi Corporation, Allison Transmission, Inc., Remy International, Inc., and Duke Energy Corporation which seeks to develop a fully integrated hybrid power train system that uses higher performance components and demonstrates next generation plug-in hybrid technology for light, medium, and heavy duty vehicles.



Develop a distributed power generation microgrid system to provide scalable power for military and commercial markets including back-up power for renewable energy developments. Accelerated systems testing and evaluation and product demonstration will occur at Naval Surface Warfare Center Crane (*Partners: SAIC, Duke Energy, Cummins, Delphi, SolarNet, I-Power, Ener1, NSWC Crane*)



PROJECT PLUG-IN

Commercial scale pilot of plug-in electric vehicles and smart grid technology working together to demonstrate and energy efficient transportation system solution. The pilot will provide a model regulatory framework and network architecture needed to take smart grid and plug-in systems to scale. (*Partners: Duke Energy, Indianapolis Power & Light, Nissan, Smart USA, Think, Navistar, Bright Automotive, ITOCHU, Toshiba, AECOM, Eaton, Ener1, MISO, Simon Property Group, Enterprise Holdings, Purdue University, and the Rocky Mountain Institute.*)



The Battery Innovation Center incorporates leadership from world-class universities and commercial enterprises to focus on the rapid development, testing and commercialization of safe, reliable, and lightweight energy storage systems for commercial and defense customers. (*Partners: NSWC Crane, Purdue University, University of Notre Dame, Indiana University-Purdue University Indianapolis, Delphi, Ener1, Cummins, SAIC*)

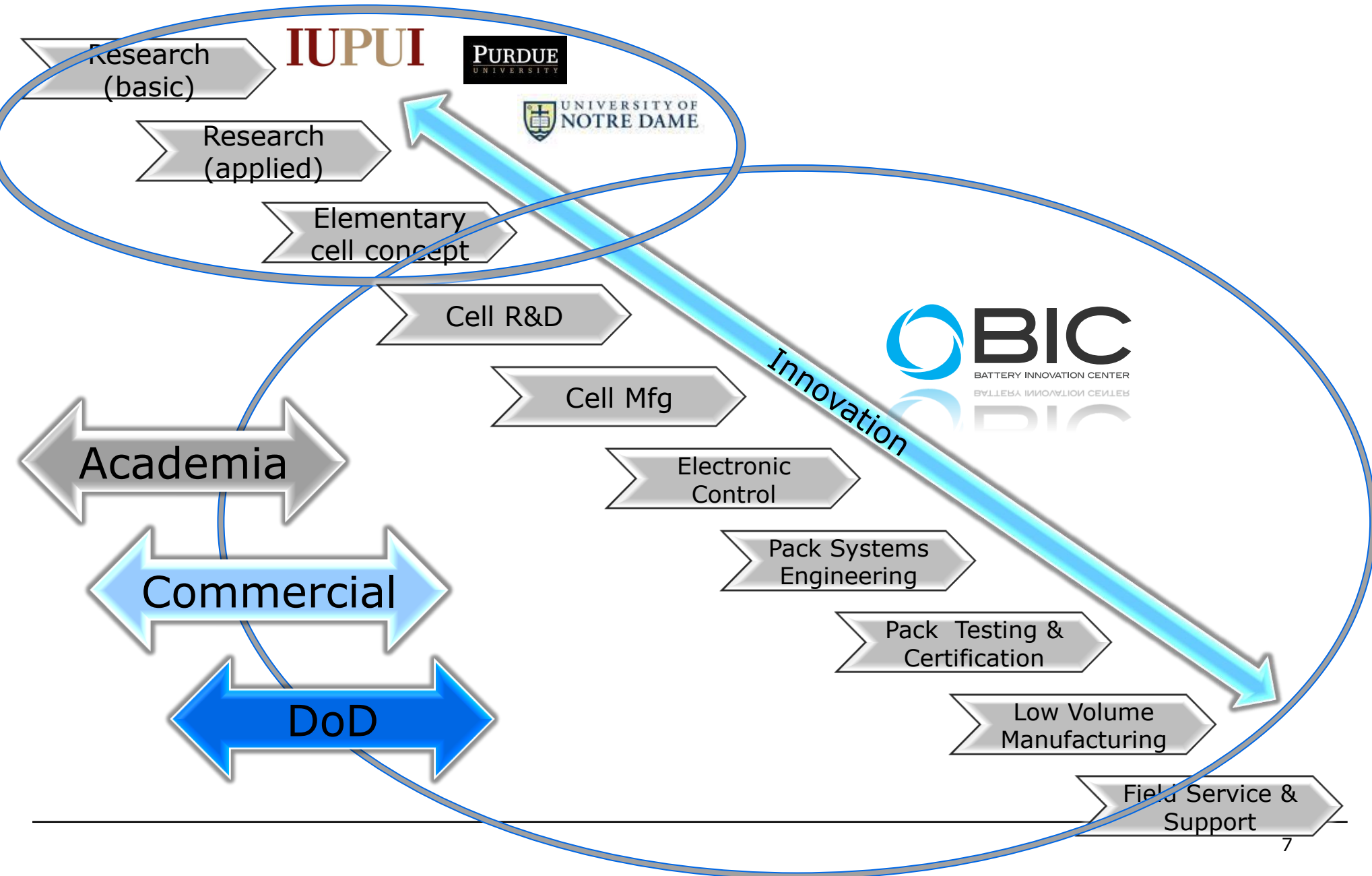


The Battery Innovation Center incorporates leadership from world-class universities and commercial enterprises to focus on the rapid development, testing and commercialization of safe, reliable, and lightweight energy storage systems for commercial and defense customers

- 1. Defense Industry:** Provide military and national security customers with a robust and secure source of battery development and low-volume production under one roof with linkages to an array of high-volume commercial manufacturing partners.
- 2. Commercial Industry:** Give commercial battery, transportation, and energy industry a one-stop shop for battery testing and certification along with a full spectrum of world-class support services from R&D to manufacturing solutions.
- 3. Research & Development:** Establish a network that would virtually and physically link university-led battery R&D and accelerate the transition from basic research to battery cell and pack prototypes capable of commercialization

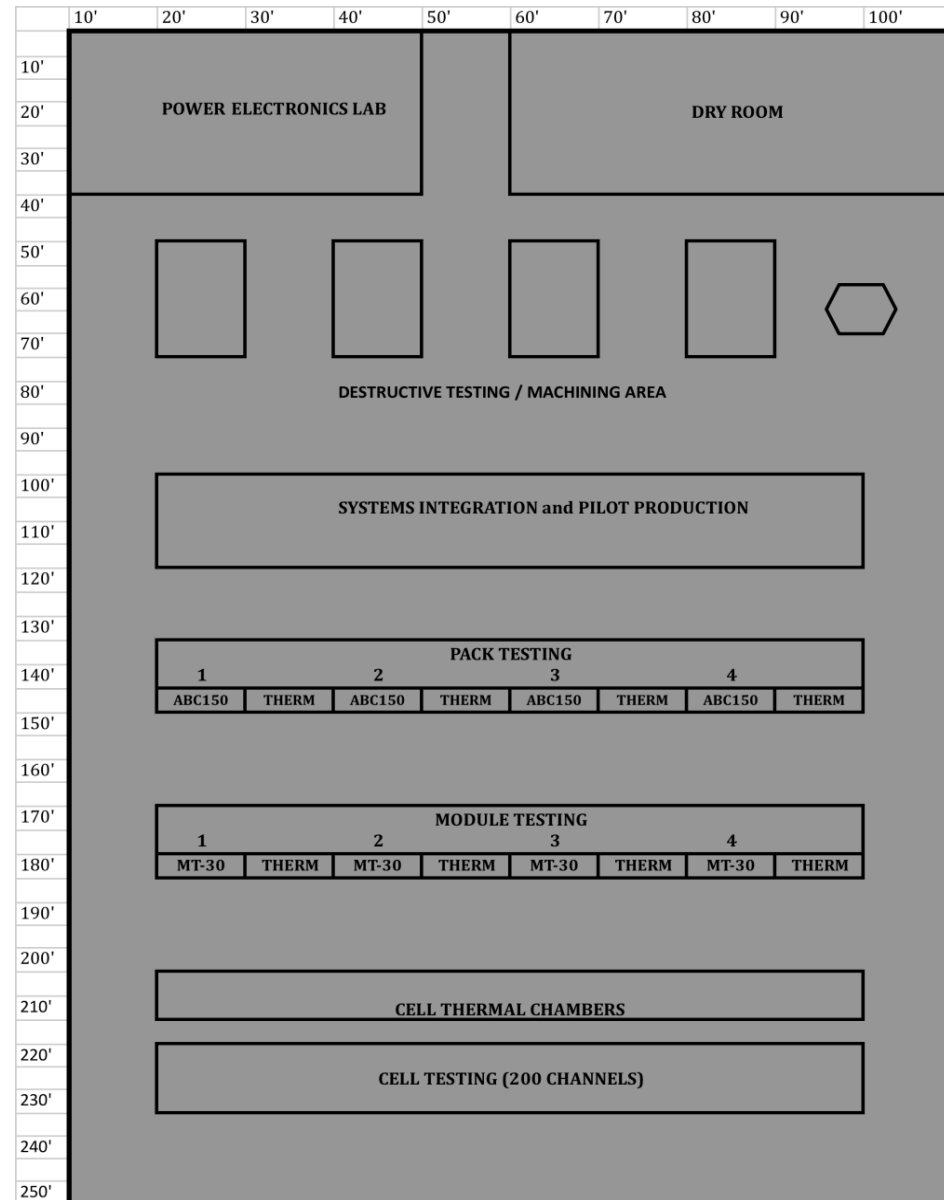


Capabilities

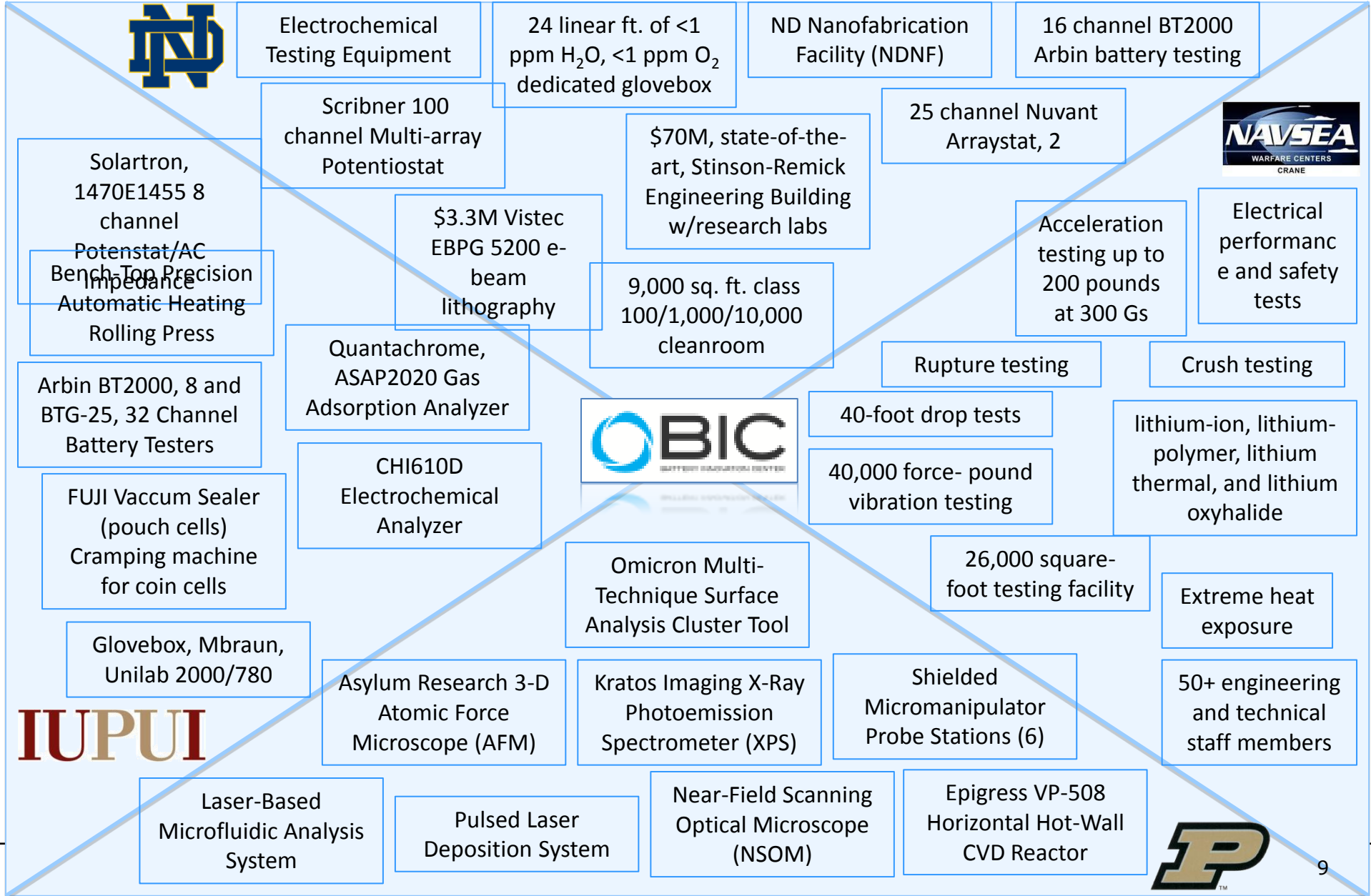


Facility Overview

- Minimum floor space:
 - 25,000 sqft lab area
 - 15,000 sqft staging, external equip, offices
- Cell Development
 - Mixing / Coating
 - Mixing: 1-2 kg, 5-10 kg
 - Film Line with dryer
 - Calendar
 - Dry room
 - Cutting and slitting
 - Stacking / Winding
 - Packaging
 - Filling
 - Formation
 - De-gas
- 200 cell test channels
- 8 module channels (cycling, four MT-30's)
- 8 pack channels (cycling, four ABC-150's)
- Paired thermal chambers
- Destructive testing
- Power Electronics lab
- Dry Room
- Systems integration area
- Pilot Production equip



The Power of Leverage (small sample of assets)





PROJECT PLUG-IN

Addressing the technical, business, regulatory, and consumer challenges to meeting our nation's goal of one million plug-in cars by 2015 requires a systems approach integrating plug-in vehicles and smart grid technologies in a real-world environment.

Effective solutions do not reside in a single technology or even within a single company. Success requires that the private sector collaborate across industry boundaries, taking full advantage of one another's strengths in order to build economies of scale and deliver cost-effective solutions to the marketplace.

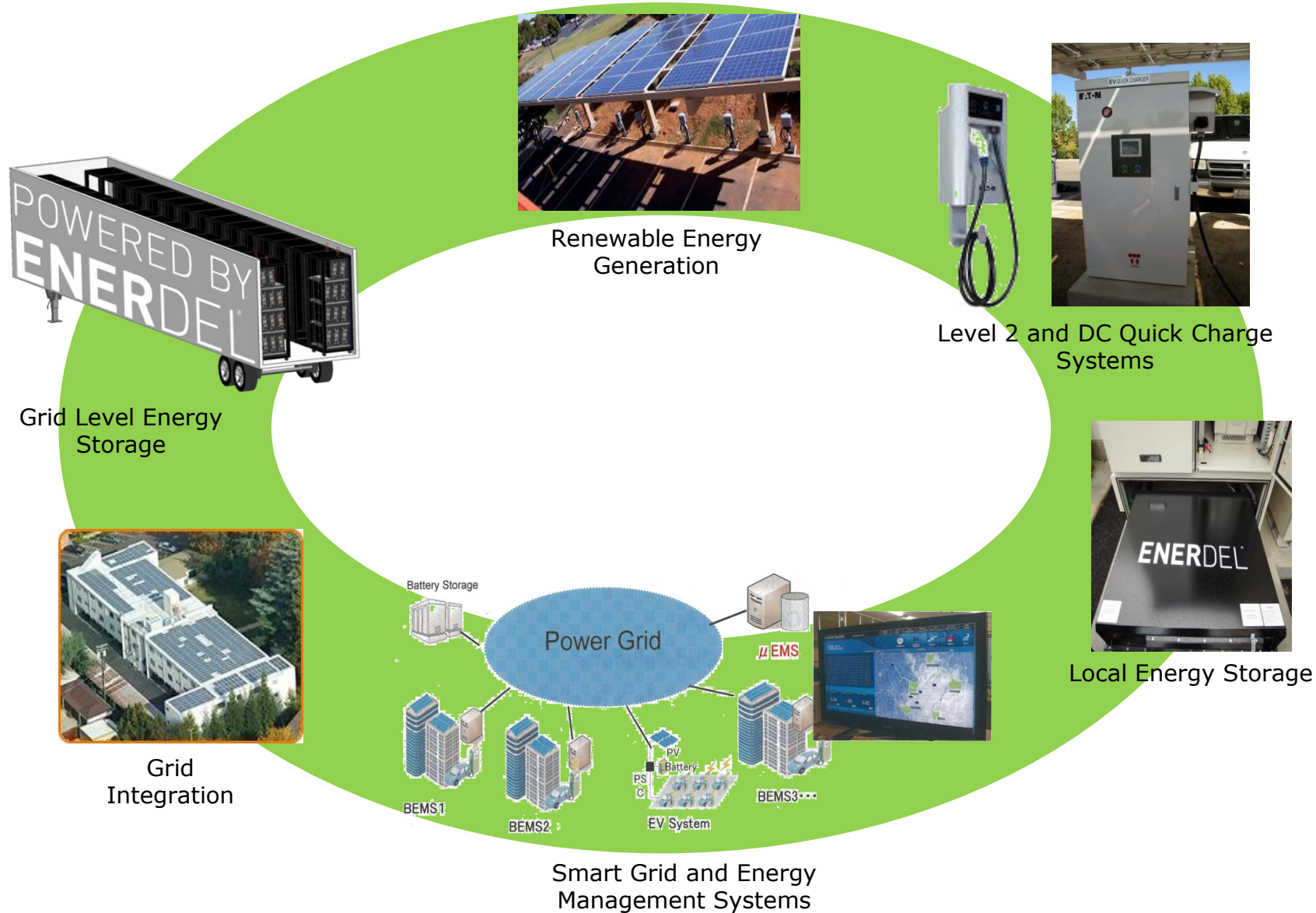
Energy Systems Network (ESN) has assembled a world-class team of partners with the collective technologies, resources, and expertise to deliver a plug-in ecosystem that consumers will embrace.

Emanating from our nationally recognized deployment hub in Indianapolis, Project Plug-IN will provide linkages to cities across the Midwest and key international markets.



























Building a Plug-IN Ecosystem

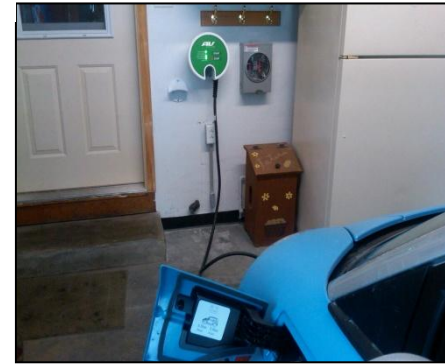
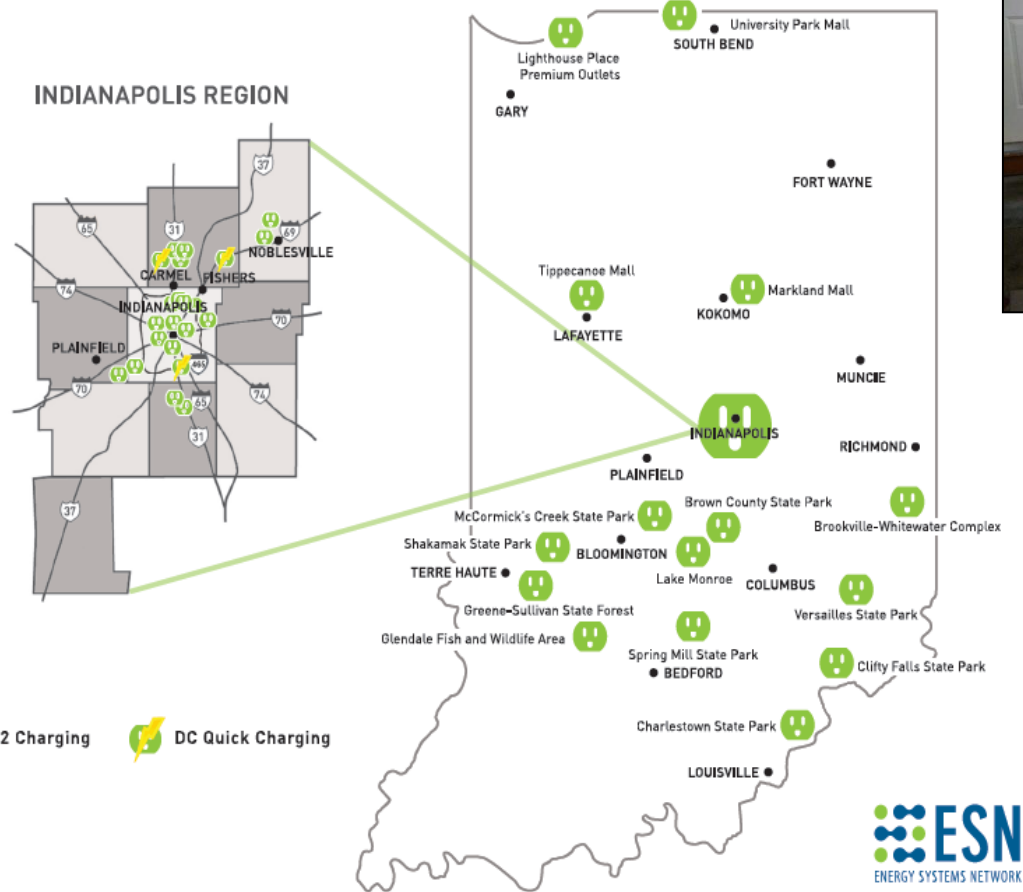


Charging Infrastructure



PROJECT PLUG-IN

-  Murphy USA - Indianapolis
-  Denison Merchant's Garage - Indianapolis
-  Shelby Library - Indianapolis
-  Jewish Community Center of Indianapolis
-  Indianapolis Convention Center/Georgia Street
-  City of Carmel
-  City of Carmel
-  MISO Headquarters - Carmel
-  State Parking Garage
-  Fort Harrison State Park
-  Denison Parking - Maryland & Capitol
-  Indianapolis Int'l Airport
-  Indy Park Ride and Fly
-  Circle Centre Mall
-  Fashion Mall at Keystone
-  Keystone Shoppes
-  Castleton Square Mall
-  Village Park Plaza
-  Greenwood Plus
-  Greenwood Park Mall
-  Hamilton Town Center Mall
-  Clay Terrace Mall

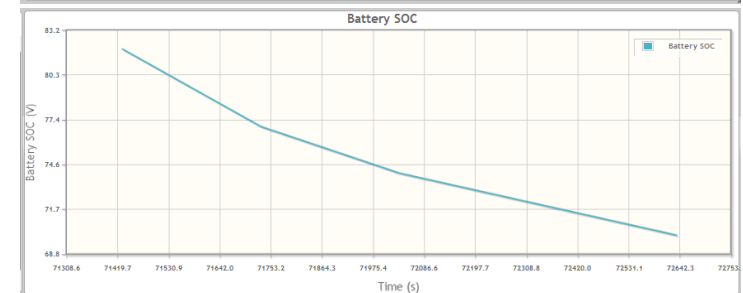
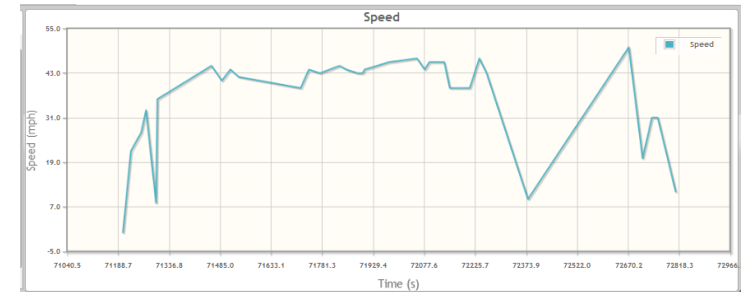
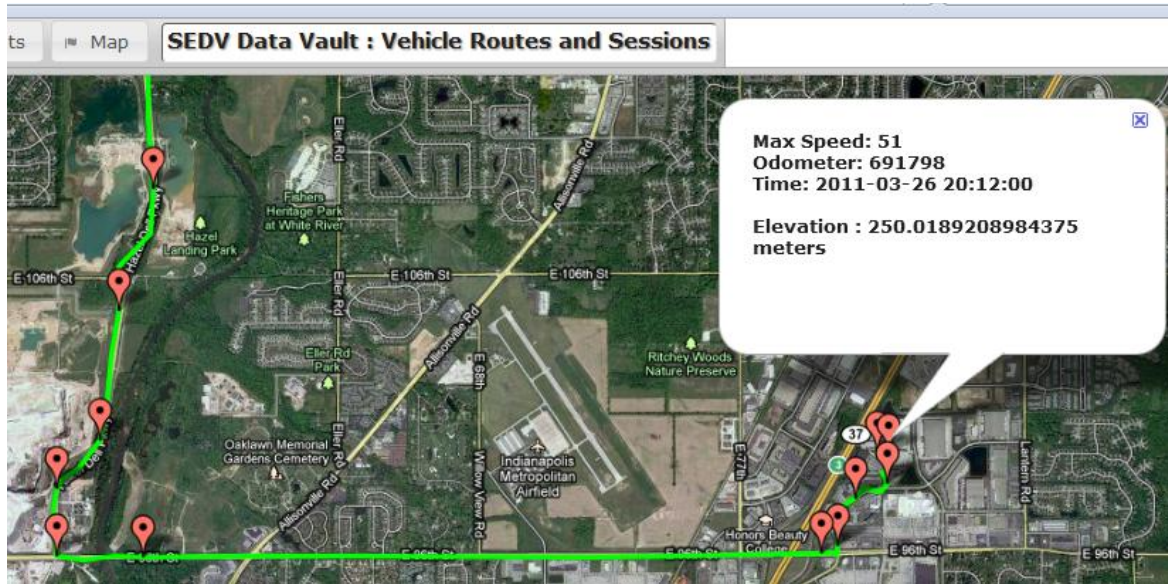


	Residential	Commercial (fleet, workplace)	Public L2	Public DC Fast Chargers	Total
ESN - Total	84	44	84	2	214

Plug-IN Data Vault - Integrated Data Management System & Analytics

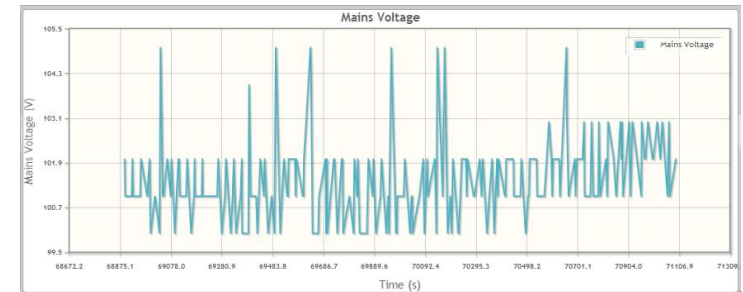


PROJECT PLUG-IN



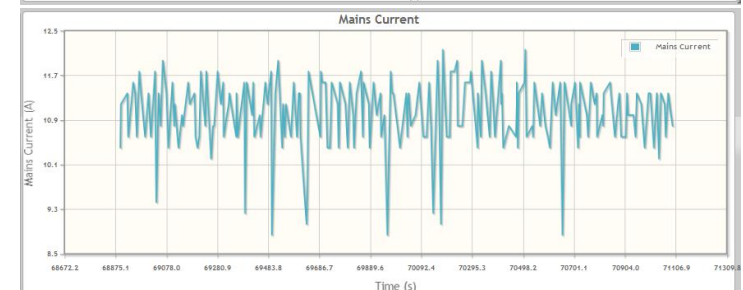
Drive Cycle Data

- Vehicle speed
 - Vehicle position
 - Battery state of charge (SOC)
 - Distance traveled
 - Time of day
- Time duration between charging sessions, distance traveled between charging sessions, mi/kWh, etc.



Charging Session Data

- Charging voltage
 - Charging current
 - Charge duration
 - Time of day
 - Battery state of charge
 - Vehicle position (can be used to identify the charging station used for a particular session)
- Charging power
- Total energy consumption



Public Outreach and Awareness



PROJECT PLUG-IN

- Provide community outreach opportunities to enhance consumer awareness of and interest in the benefits of EVs and associated energy conservation

- 20 Ride & Drive events reaching 2,500+ consumers
- Community events to showcase technology
- Emerging Technology Day – Indianapolis Motor Speedway
- Super Bowl 2012
- Educational forums and workshops

- Marketing

- Website development: Promoting industry partners, sharing relevant industry news and providing educational material and resources
- Marketing materials: Informative marketing tools, providing connections to consumer resources
- Newsletters: Sharing project updates and milestones to project participants, interested industry/government organizations

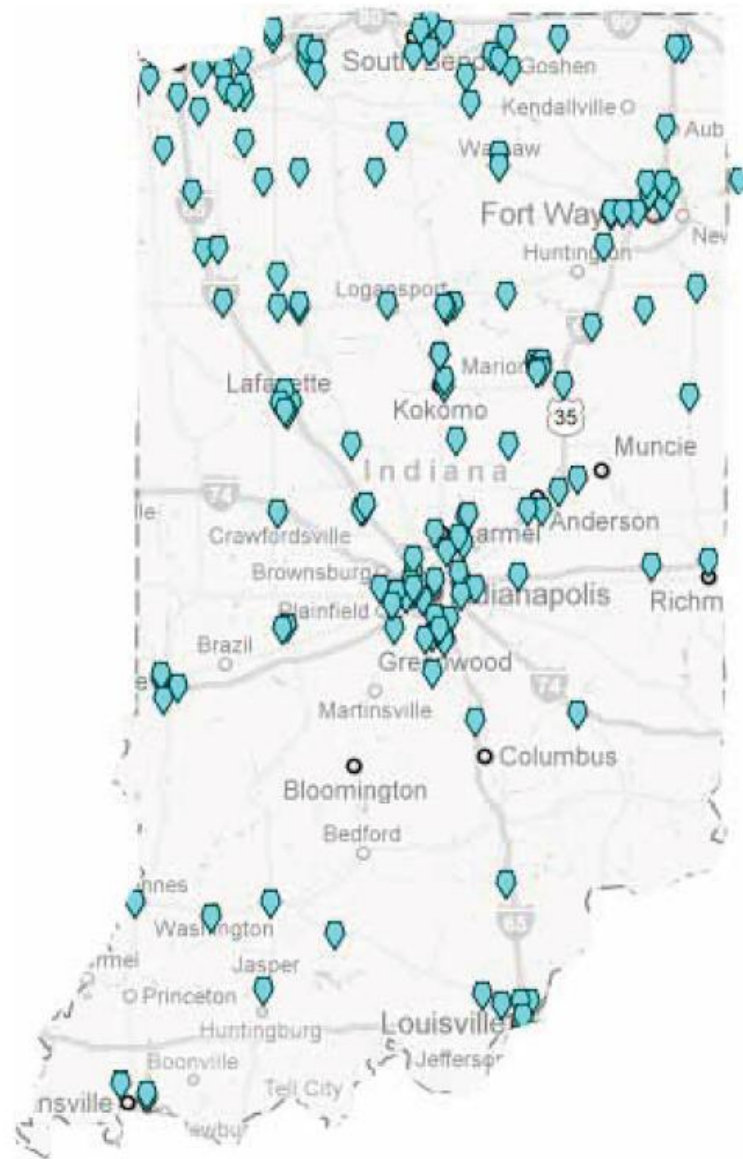


Indianapolis Motor Speedway May 7, 2011



Indiana's Ethanol Infrastructure

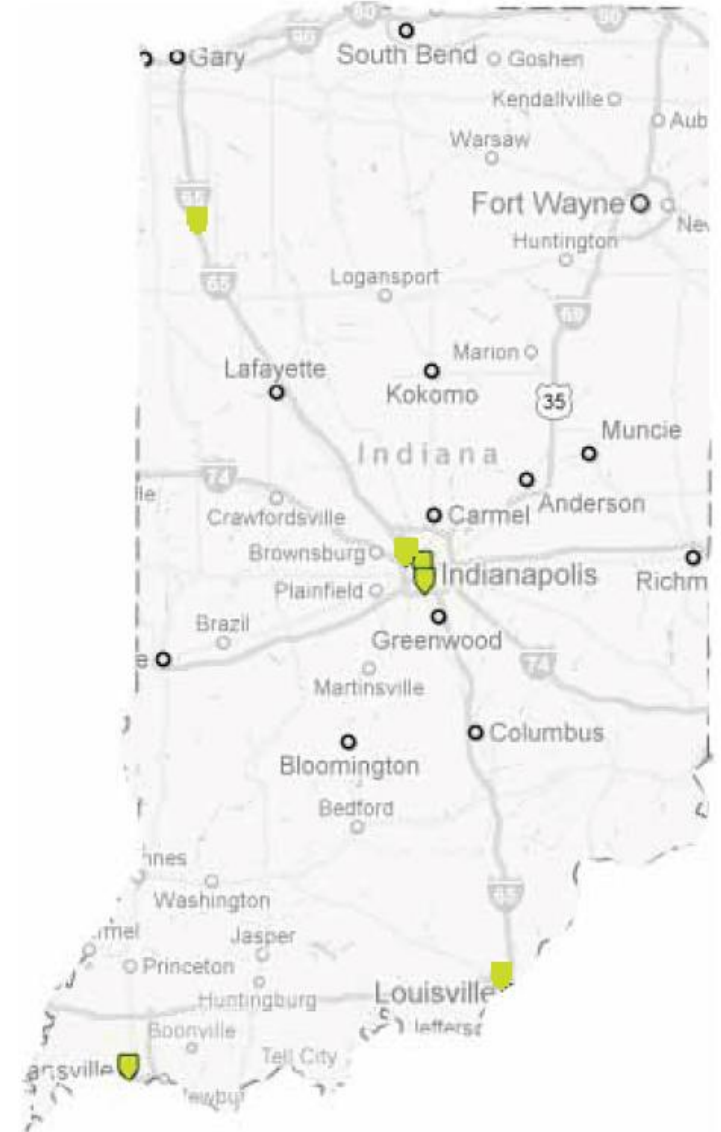
- Over 140 E85 stations in state
- Indiana's ethanol production equates to nearly 7% of the US ethanol industry
- Ethanol has potential for expansion due to Indiana's large production base of corn
- Indiana's ethanol industry has created over 3,500 full-time jobs within the state



Indiana Corn Marketing Council: Economic Impact of the Ethanol Industry on Indiana's Economy, June 25, 2010.

Indiana's Natural Gas Infrastructure

- In addition to public sites in map, are numerous private sites with CNG fueling stations for fleet use
- As of 2007, Indiana ranked 24th in natural gas production
- On Interstate I-65, CNG vehicle owners now have access to a fueling corridor the length of the state



Indiana Department of Transportation

INDOT: 225 LPG Retrofits, 19 New CNG Dump Trucks, and 115 New Build LPG Stations



- All 225 Bi-fuel, light duty trucks and vans have been retrofitted to AutoGas (propane), using two types of certified systems
- 19 CNG Dump Trucks have been deployed
- All 115 Propane fueling sites have been installed and are operational, all locations are accessible for other fleet use.
- Due to new infrastructure, have spent over \$2.5M of own funds to retrofit an additional 357 vehicles to propane. Were able to get new EPA Certifications for Ford Rangers