

**Johnson Controls Inc.**  
**“Domestic advanced battery  
industry creation project”**

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**ARRAVT019**

# Johnson Controls: a global, \$40 billion diversified company in energy storage systems, building and automotive industries

## Automotive Experience



A global leader in automotive seating, overhead systems, door and instrument panels, and interior electronics.

## Building Efficiency



A leading provider of equipment, controls and services for heating, ventilating, air-conditioning, refrigeration, and security systems for buildings.

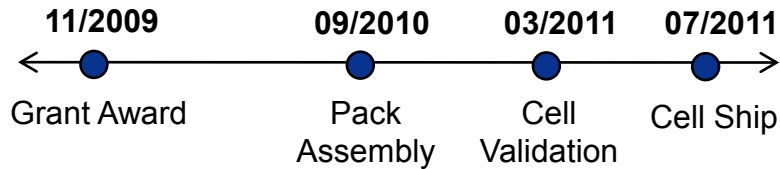
## Power Solutions



Lead-acid automotive batteries and lithium-ion hybrid and electric battery systems that make vehicles more energy efficient.

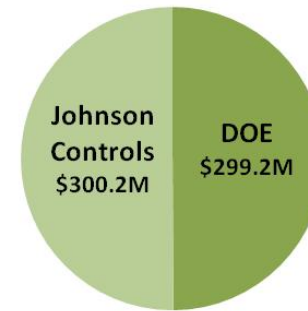
# Johnson Controls domestic advanced battery industry creation project overview

## Timeline

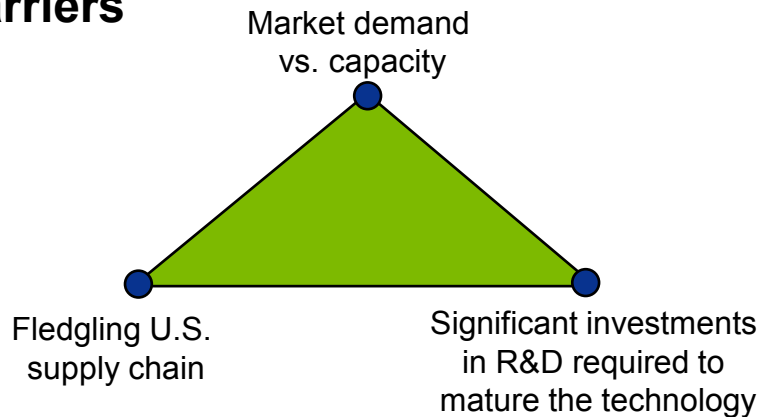


## Budget

- Total project size: \$599.4M



## Barriers



## Partnerships

- Entek Membranes
- Argonne National Laboratory



# Johnson Controls project objectives

## Establish a domestic advanced battery industry scaled to be globally competitive

- Build a sustainable demand base
- Develop a sustainable business model
- Manufacture energy storage systems
- Create jobs
- Build a domestic supply chain
- Accelerate the deployment of charging infrastructure
- Develop recycling technology and business model while leveraging mature recovery infrastructure



# Johnson Controls is meeting the goals of ARRA and the DOE



## American Reinvestment and Recovery Act (ARRA) Goals

- Create new jobs and save existing ones
- Spur economic activity and invest in long-term growth
- Foster unprecedented levels of accountability and transparency in government spending



## DOE Vehicle Technologies Program Goals

- Develop energy efficient and environmentally friendly vehicle technology
- Use less petroleum
- Increase mobility
- Promote energy security
- Lower advanced vehicle technology cost and reduce impact on environment

# Addressing market demand vs. capacity barriers

## Issue

*Market demand for advanced energy vehicle batteries is lagging installed/planned manufacturing capacity*

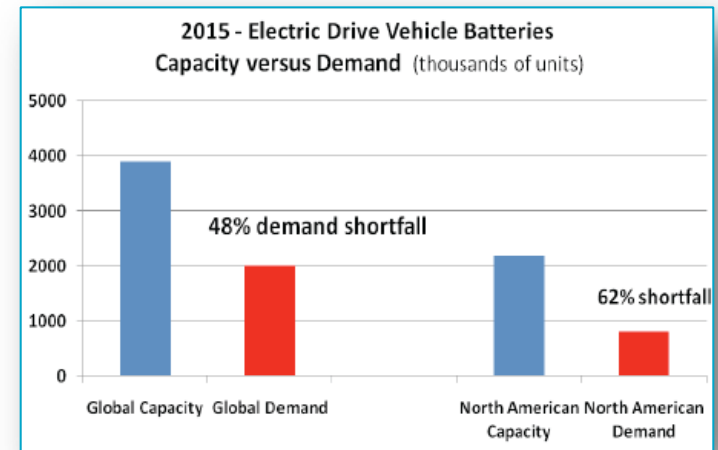
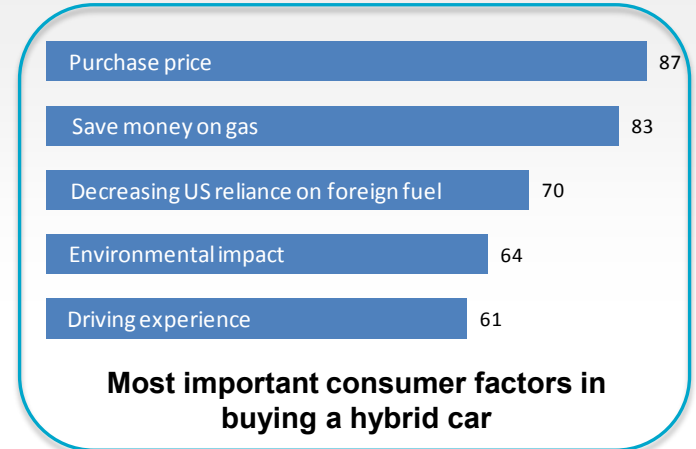
## Solution

Offer a portfolio of technology and energy storage system solutions to support market adoption of a spectrum of powertrain solutions. Continue to make investments in energy storage R&D to reduce cost and improve performance.

- Near term:
  - Start-Stop and Hybrid Electric Vehicles will offer the best performance and economic value equation
  - EV technology will continue to be demonstrated and proven in low volume applications

## Takeaway

Consumer adoption will be paced by performance, cost and infrastructure availability. Johnson Controls is leveraging our position as a technology leader through the electrification of our fleet .



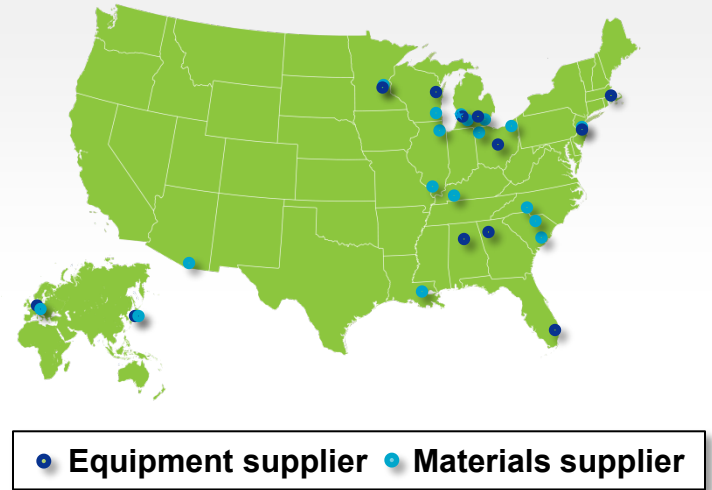
# Addressing the fledgling domestic supply chain

## Issue

*Nearly all the batteries for hybrid electric vehicles and plug-in electric vehicles, along with the materials and equipment to manufacture them, are made in Pacific Rim countries*

## Solution

- Developing a domestic supply base throughout the advanced battery value chain
- Giving first consideration to U.S.-sourced materials
- Recruiting foreign suppliers to locate in the U.S., for example Toda America and Soulbrain MI have located their operations in the United States to support the industry



## Takeaway

- Johnson Controls, with the ARRA matching grant funding as a catalyst, is developing a domestic supply base. We are sourcing all major components of our cells domestically.
- Eighty-seven percent of our capital expenditures have been with companies that produce their equipment in the U.S.



# Addressing the barriers to domestic technology development

## Issue

*America needs to reestablish our position as the world leader in transferring innovation into commercially successful products that are made in the U.S.*

## Solution

- Johnson Controls is building two U.S.-based plants to produce high-tech products. Our first plant launched in September 2010.
- Our plant is designed to manufacture breakthrough technologies, after Government incentives expire.
- Continue to develop the technology development collaboration model between the National Labs, universities and private sector to drive technology improvements. Johnson Controls is a leader in this area with significant relationships and investments in U.S. universities and National Labs.



## Takeaway

- The ARRA matching grant has knocked down the barrier to building manufacturing domestically. The matching grant solidified Johnson Controls' decision to expand advanced battery production in the U.S. versus Europe or Asia.



# Johnson Controls goals and accomplishments overview

## Investing in America

- We are making an investment in the U.S. to build an advanced energy industry
- Developing and bringing advanced products to market

## Investing in people

- We are hiring engineers, scientists, technicians, and an experienced manufacturing workforce in the U.S.

## Delivering successes

- Vehicles that use our batteries, like the Ford Transit Connect Electric, are reaching the public with great interest and success
- We are building a domestic supply base, as well as anchoring foreign suppliers in the U.S.
- Our plant has already begun domestic production of complete advanced battery systems
- Funded an Endowed Chair in Energy Storage R&D at the University of Wisconsin. Strategically partnered with Argonne National Laboratory



# Accomplishing Johnson Controls goals – manufacturing excellence

## Installing state-of-the-art equipment delivers:

- Automotive quality product
- High volume capability
- Significantly reduced cost
- Reduced environmental impact
- Processing efficiency

## Reducing costs

- Domestic production will allow us to reduce shipping and duty costs from our European plant
- Domestic sourcing
- Design optimization
- Manufacturing process optimization
- Johnson Controls operational excellence, Best Business Practices and continuous improvement



# Accomplishing Johnson Controls' goals – sustainability

## Certified LEED® Gold factory

- Achieved a cost savings of 24.5% for improved energy efficiency over a conventional building
- Reduced its landscaping water usage by at least 50% and its plumbing fixture water usage by 40%
- Received an *Innovation in Design* credit for the recycled content of the building materials (34% by cost)



## Cooling for free

- Our plant's cooling towers relieve significant pressure from our facility's chiller plant
- As a result, the plant will have more consistent operating costs throughout the year

## Recovering heat

- Heat from the battery formation process is captured and used in other areas of battery manufacturing

## Reclaiming what would have been wasted

- We have designed our processes to reclaim materials used in manufacturing to save time, cost and energy



# Accomplishing Johnson Controls' goals – employee safety

**At Johnson Controls, maintaining a safe, clean and sustainable environment for our employees is our top priority. Our safety plan is explicit:**

*“Equipment must provide adequate protection from hazards or safety risks to the operators or to those who are working on or in the area during normal operation, standing alone or during its non-production functions (e.g., manual cycles, set up modes, re-work modes, etc.). Servicing and Maintenance for equipment must be user friendly, safe, and convenient. In order that these goals may be met, Johnson Controls has compiled this specification, which represents Johnson Controls' interpretation of applicable standards and laws. Johnson Controls must authorize all deviations from this specification...”*



# Accomplishments towards ARRA goals

## Employing people – high quality jobs are being created

- In the last quarter, this project has resulted in direct 135.6 FTE jobs in the U.S.
- The Holland, Michigan plant currently employs 102 workers. 320 permanent full time jobs will be created when at full capacity.

## Spurring economic activity

- \$209.6M has been spent on customer programs, materials, equipment and service suppliers

## Growing for the long-term

- We are building a sustainable business model that does not rely on Government subsidies

## Defining accountability

- Meeting all reporting requirements of the ARRA and the DOE
- Our program office proactively self monitors and self audits internal processes and procedures to ensure uncompromised integrity in the use of tax payer dollars



# Accomplishments towards DOE Vehicle Technology goals

## Energy efficient and environmentally friendly highway technology

- Vehicles powered by our Li-ion batteries, including Daimler, BMW, Azure Dynamics, and Ford, produce fewer emissions and achieve better fuel economy than conventional internal combustion engines

## Reduced petroleum consumption

- Our combination of HEVs, PHEVs, and EVs reduce or eliminate petroleum usage

## Freedom of mobility

- Battery technology gains in cycle life and energy density are providing Americans with extended all-electric range vehicles to increase range confidence

## Energy security

- Domestic advanced energy storage products improve energy security by reducing petroleum imports and reducing the competitive risk of a foreign battery cartel

## Lower cost and reduce impact on environment

- Batteries manufactured at our facility are optimized for cradle-to-cradle product lifecycle, including recovery of key materials and recycling



30%

• Hybrid



70%

• Plug-in Hybrid



100%

• Full-electric

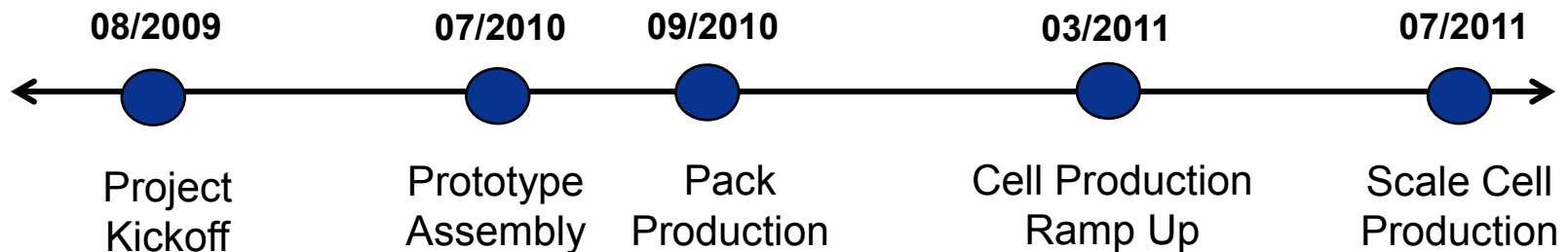
Reduction in petroleum usage

# Project status and milestones

## Environmental Assessment

- Johnson Controls' plant poses no threat to the environment around our plant and area of operations
- Finding of No Significant Impact (FONSI) was issued March 2010

## Milestones



Complete advanced battery systems are being produced in the U.S. -- powering vehicles on U.S. and European roads



# Johnson Controls' Collaborations and Partnerships

## Argonne National Laboratory

- Service provider to Johnson Controls
- Collaborating on technology development outside of the VT Program
- Unmatched expertise in energy storage materials and systems research



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## Entek Membranes

- Sub-recipient to the award
- Leader in the industry, involved within the VT Program
- Entek provides state-of-the-art Li-ion battery separators



# Future Work

Within the Fiscal Year we will continue:

- Cell and battery pack assembly at our Holland, Michigan plant
- Assembling complete battery packs with domestically produced cells
- Delivering market-derived solutions for transportation needs

In the remainder of the project

- Accelerate market demand to support the full capacity of our plant
- Announce location of and build our second U.S.-based Li-ion battery plant
- Continue to win production contracts to produce xEVs
- Continue to make technology investments to maintain Johnson Controls' leadership position



# Summary

## Johnson Controls will continue to be a leader by expanding the domestic advanced battery industry

- Building a significant manufacturing presence in Holland, Michigan
- Investing in our Wisconsin technology and engineering center
- Investing in University-led research and talent pipeline development
- Continuing to leverage strong National Lab strategic partnerships
- Expanding the domestic supply chain and using U.S.-produced components



## Johnson Controls is meeting the goals of the ARRA and the DOE Vehicle Technologies programs

- In the past quarter, this project has resulted in the creation of 136 jobs
- We have spent \$209.6M to deliver customer products, design and outfit our plant, and build our supply base, spurring economic activity
- We are committed to putting environmentally friendly vehicles into the market -- including our corporate fleet
- Our business is positioned for long-term growth

