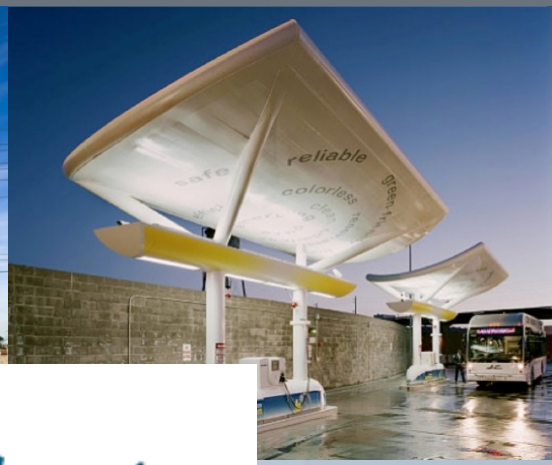
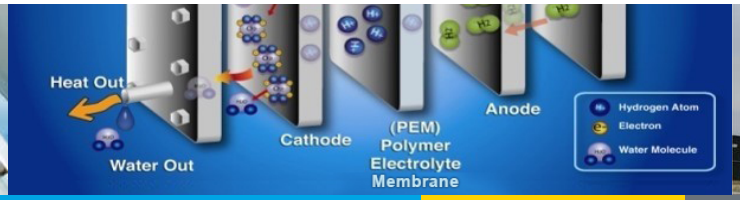
U.S. Department of Energy
Fuel Cell Technologies Office

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

ElectroCat
Electrocatalysis Consortium



Introduction of the Energy Materials Network's (EMN) ElectroCat Consortium

Argonne National Laboratory
July 26, 2016

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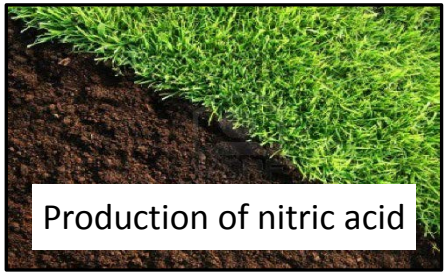
Program Manager, Fuel Cells
Fuel Cell Technologies Office
U.S. Department of Energy

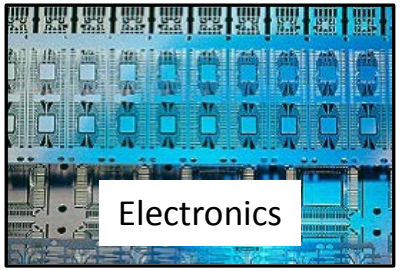
ElectroCat (Electrocatalysis Consortium)

A materials domain with several potential application routes

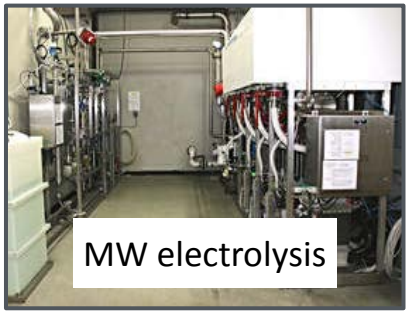

Petroleum refining


Production of nitric acid


Vehicle Pollution Control


Electronics

FCEV


MW electrolysis

Main Focus: **PGM-free catalysts for transportation-based fuel cells**

ElectroCat (Electrocatalysis Consortium)

Goal

Accelerate the deployment of fuel cell systems by **eliminating the use of PGM catalysts**

Mission

Develop and implement PGM-free catalysts by:

- **streamlining access** to unique synthesis and characterization tools across national labs
- **developing missing strategic capabilities**
- **curating a public database** of information

The Bigger Picture

ElectroCat
Electrocatalysis Consortium

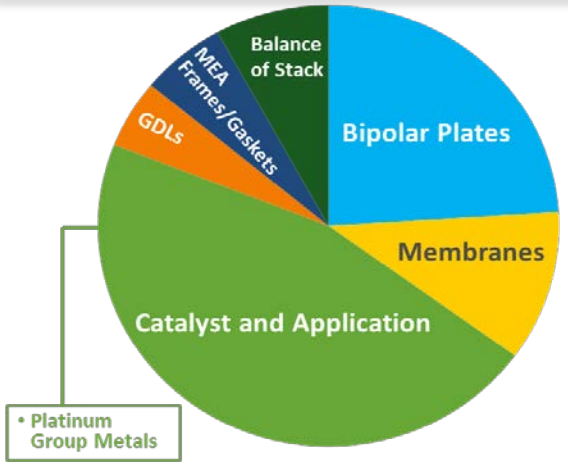
Part of

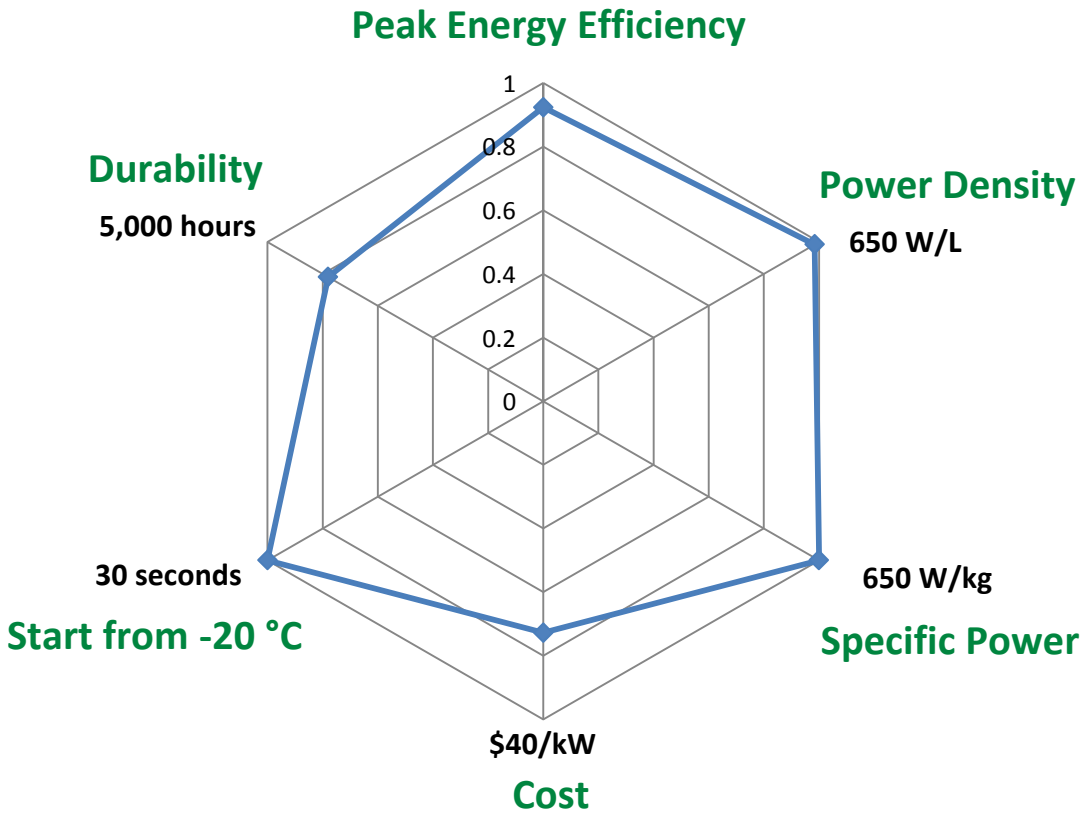
Energy Materials Network
U.S. Department of Energy

Problem Statement

Fuel cell system targets set to be competitive with ICEVs.

Durability and Cost are the primary challenges to fuel cell commercialization and must be met concurrently





PGM-free catalysts lag behind platinum in efficiency, durability, cost, and ease of integration into membrane electrode assemblies.

Strategy: Research + Tool Development Priorities

Materials Discovery & Development	***Catalysts*** *for oxidation reduction in PEMFCs and PAFCs*
	Catalysts *for oxidation reduction and hydrogen oxidation in AMFCs*
	Development of ***electrodes and MEAs*** *that are compatible with PGM-free catalysts*
Tool Development	*Optimization of* ***atomic-scale and meso-scale models*** *of catalyst activity to predict macro-scale behavior*
	High-throughput techniques for catalyst synthesis
	High-throughput techniques for characterization *of catalysts, electrodes, and MEAs*
	Aggregation of data in an easily searchable, public database *to facilitate the development of catalyst materials and MEAs*

ElectroCat Electrocatalysis Consortium

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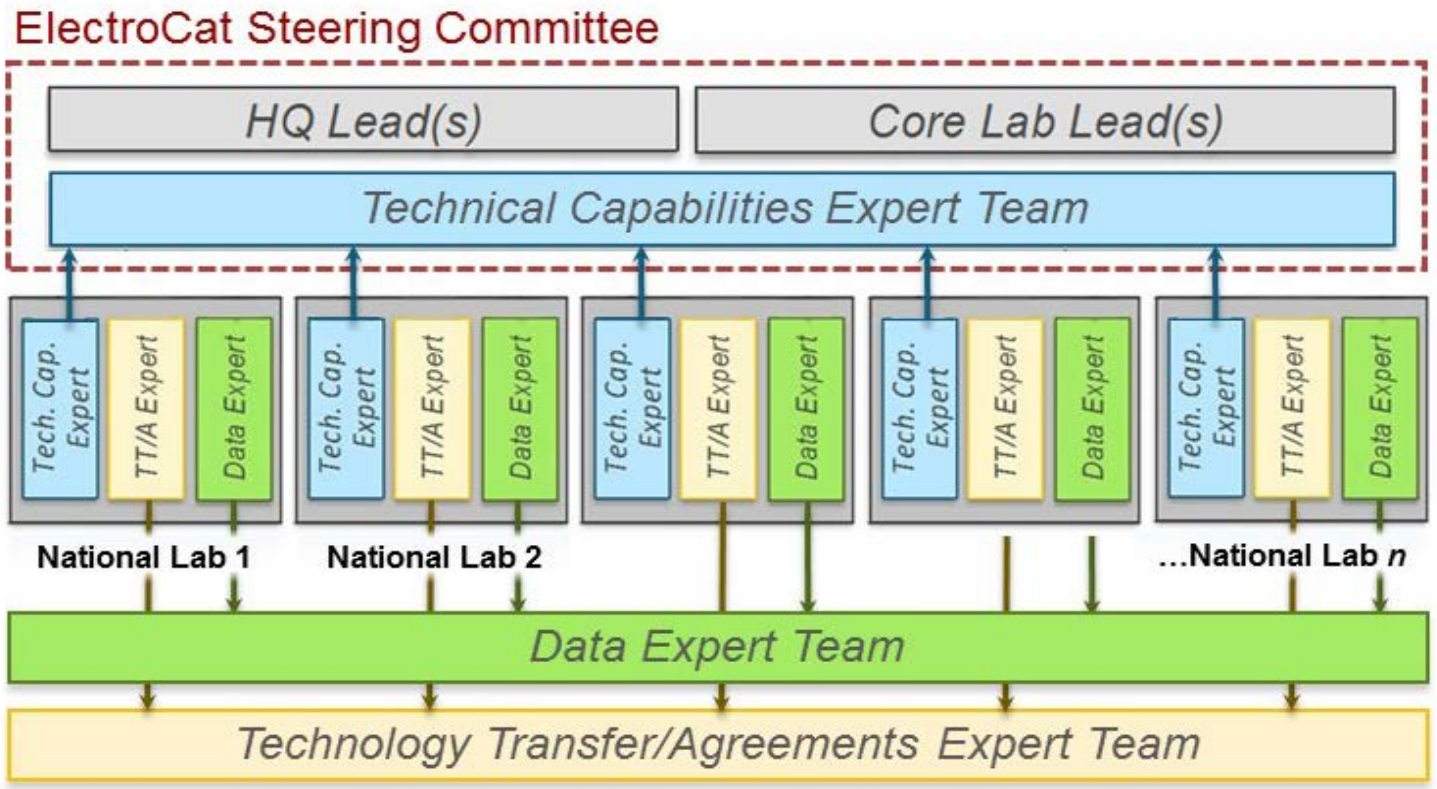
Consortium Structure



Web-Based Consortium Access

Capability information and concierge are found at:

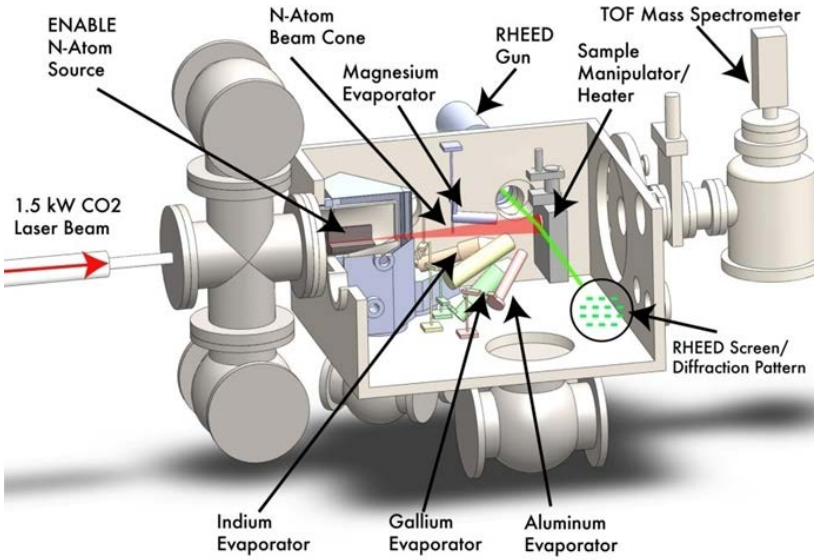
contact@electrocat.org

Core Lab Leads

Argonne NATIONAL LABORATORY

High-throughput combinatorial materials discovery, characterization and testing

Los Alamos NATIONAL LABORATORY



Design and synthesis of PGM-free catalysts and electrodes

ElectroCat Electrocatalysis Consortium

Technical Capability Leads

Argonne NATIONAL LABORATORY — **Deborah Myers (co-director)**

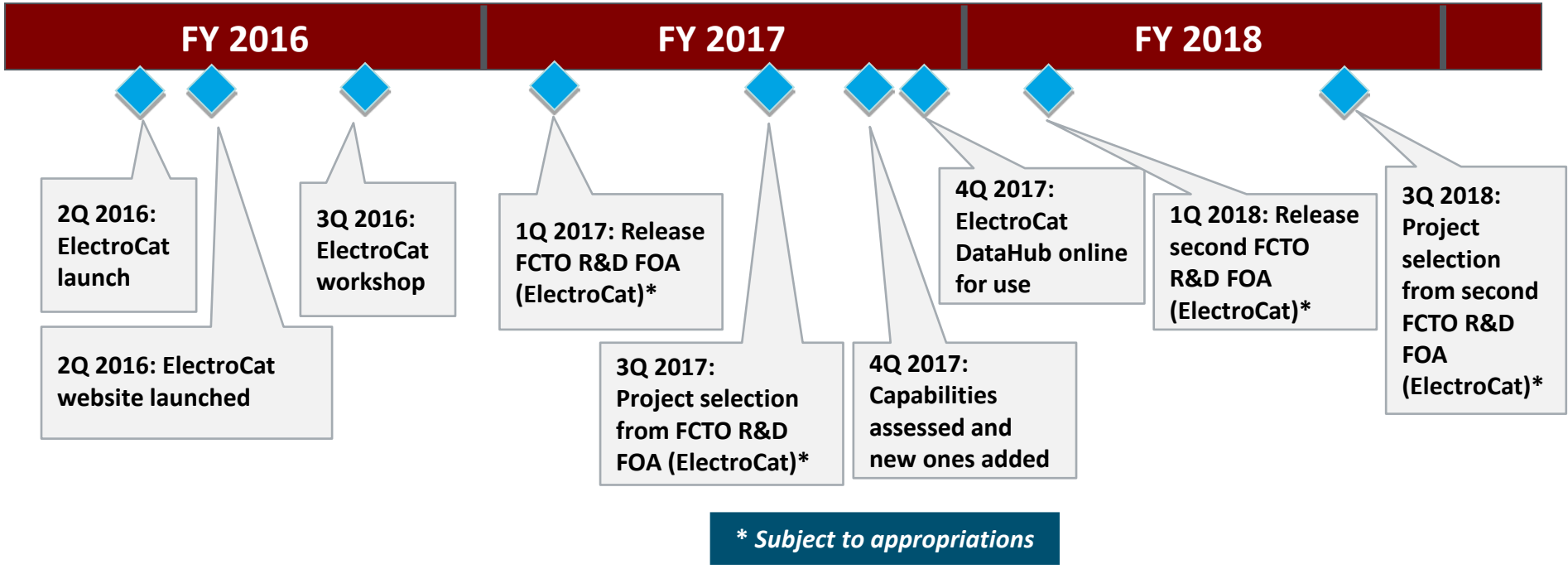
Los Alamos NATIONAL LABORATORY — **Piotr Zelenay (co-director)**

NREL NATIONAL RENEWABLE ENERGY LABORATORY — **Huyen Dinh**

OAK RIDGE National Laboratory — **Karren More**

Summary of Activities

ElectroCat launched to coordinate PGM-free catalyst development and gather state-of-the-art tools at the national labs under one umbrella for easy access by stakeholders and the research community



Thank You

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hydrogenandfuelcells.energy.gov

ElectroCat
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Backup Slides

ElectroCat Electrocatalysis Consortium

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Current ElectroCat Capabilities

ANL

- High-throughput characterization
- High-throughput synthesis
- Kinetic transport modeling
- Combinatorial hydrodynamic screening
- Model system synthesis and characterization
- Electrode structural modeling
- *In situ* and *operando* and nanostructure characterization

LANL

- Advanced fuel cell characterization techniques
- Analytical techniques for PGM-free catalysts
- Electrochemical and fuel cell testing
- Controlled functionalization of model catalysts
- In situ fluoride and carbon dioxide emission measurements
- MEA fabrication
- Multi-scale modeling and rational design of PGM-free catalysts
- PGM-free catalyst synthesis
- X-ray characterization techniques

NREL

- High-resolution segmented cell
- Differential cell measurement of kinetics and transport
- Experimental and computational materials data infrastructure
- Thin-film high-throughput capability suite
- Cube2 sputtering and heteroatom implanting

ORNL

- Sputtering deposition of PGM-free catalysts
- Manufacturing porous electrodes
- In-situ STEM
- High-resolution analytical STEM
- STEM-based 3D electron tomography
- X-ray photoelectron spectroscopy