# Energy Assessment and Optimization of Automobile Paint Shops

**LMAS**



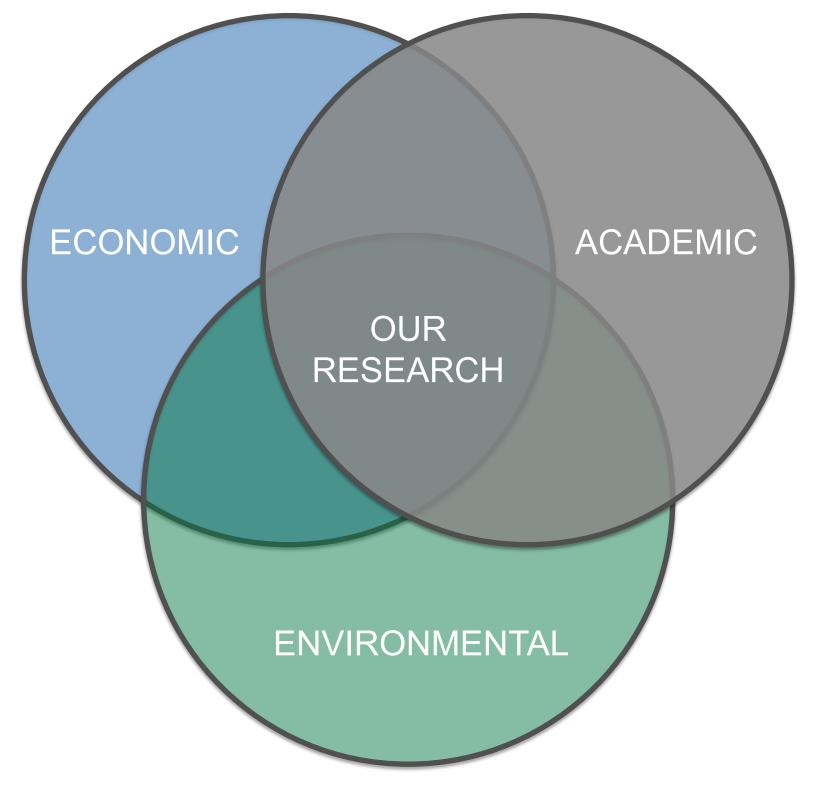Katherine C. McKinstry   © 2011  LMAS    contact email:  mckinstry@berkeley.edu


Funding Source: General Motors

## Applied Research with Measurable Results

**SUMMARY**

In our research, we seek to improve manufacturing processes to accomplish three goals: maximize profits, reduce environmental impact, and deliver innovative contributions to the field of sustainable manufacturing. While there are many efforts to produce results that satisfy only one of these goals, in our work we synthesize the best practices from multiple disciplines to deliver prioritized options.



ECONOMIC

ACADEMIC

OUR RESEARCH

ENVIRONMENTAL

Present options with appropriate economic payback periods. Every decision has related financial implications, and these will be included in our analysis.

Produce research that is innovative and integrates the best ideas present in academic research.

Minimize environmental impact. Evaluate using multiple metrics, including global warming potential, water and resource use, and toxicity emissions.

Seek solutions that leverage manufacturing to improve sustainability during the production, use, and end of life phases of the product life cycle.

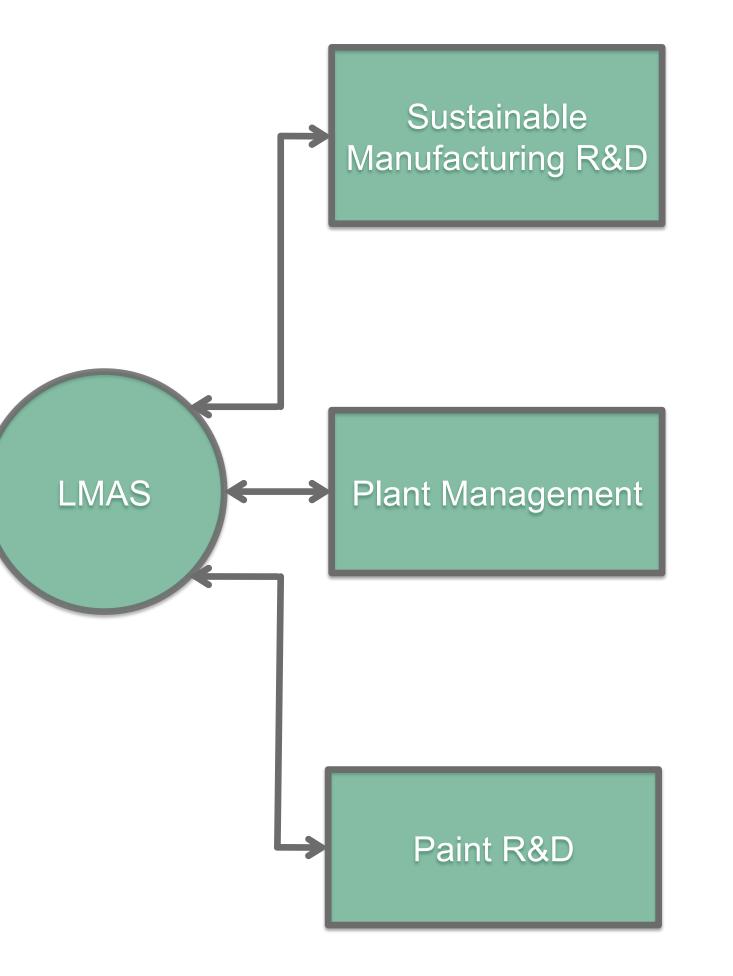## Case Study: General Motors, Lansing Delta Township Plant, Paint Shop

**WHY PAINT?**

PAINTING CONSUMES 60% OF THE ENERGY REQUIRED FOR AN AUTOMOBILE ASSEMBLY PLANT. [1]

**LMAS'S ROLE**

We plan to bring together the knowledge and expertise of plant management, sustainable manufacturing research and development, and painting research and development.
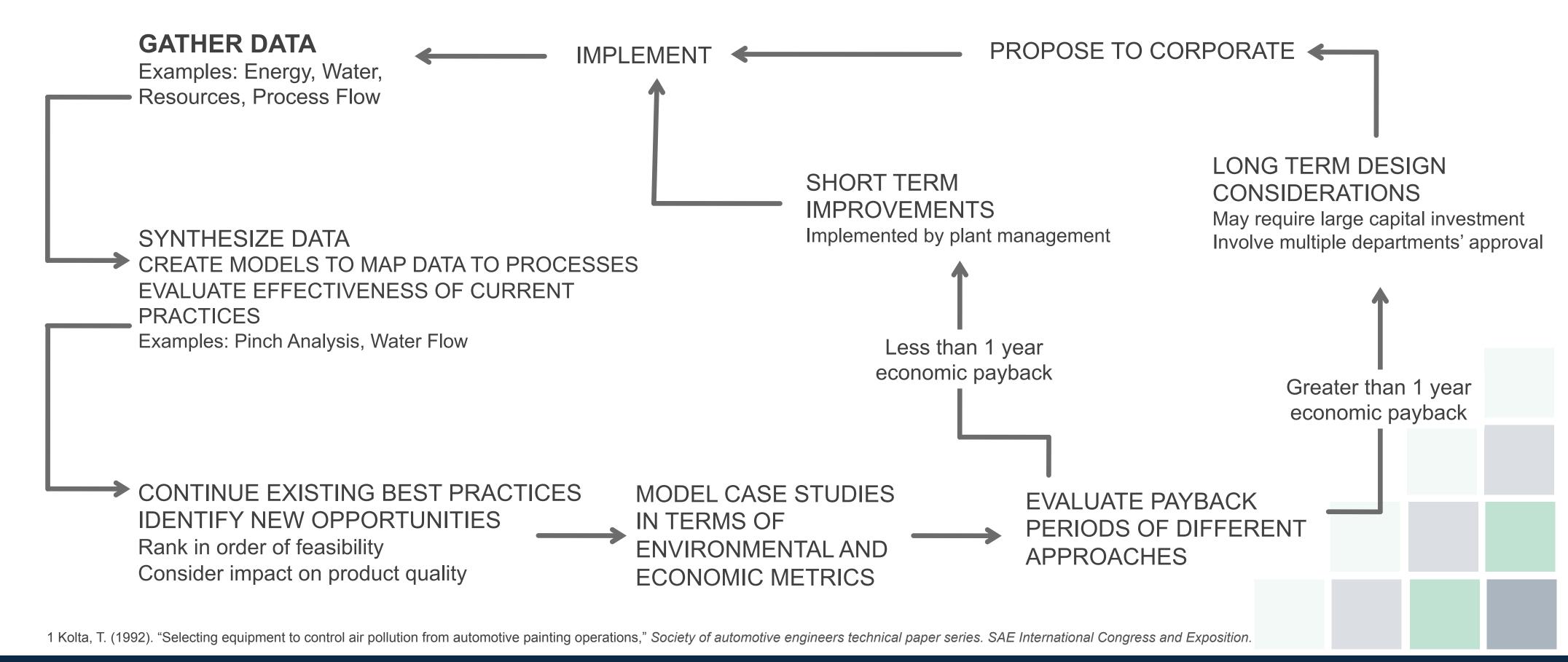
We approach our work equipped with tools for evaluating the environmental impacts of manufacturing processes. We take the data and observations from these three groups of experts, compile this information, and find areas in which we can improve a process. Our ideas could be implemented at a local, or plant level, or may need to be considered by other departments and presented to the corporate structure.



Sustainable Manufacturing R&D

LMAS

Plant Management

Paint R&D

The **sustainable manufacturing** research and development groups bring tools for evaluating the efficiency of manufacturing processes. Areas of particular expertise include modeling production systems and optimizing process lines.

**Plant managers** know every detail about how their paint shops run. They can identify idiosyncrasies in processes and can help us pinpoint areas ripe for short-term improvement. They know the reliability and repair rates of certain machines and the costs associated with running their shop.

**Paint** research and development groups specialize in fundamental research related to all aspects of painting, including the paint itself. They can identify decision making drivers and adjustable parameters.

## Evaluation, Implementation, and Results



**GATHER DATA**
Examples: Energy, Water, Resources, Process Flow

IMPLEMENT

PROPOSE TO CORPORATE

**SYNTHESIZE DATA**
CREATE MODELS TO MAP DATA TO PROCESSES
EVALUATE EFFECTIVENESS OF CURRENT PRACTICES
Examples: Pinch Analysis, Water Flow

SHORT TERM IMPROVEMENTS
Implemented by plant management

LONG TERM DESIGN CONSIDERATIONS
May require large capital investment
Involve multiple departments' approval

Less than 1 year economic payback

Greater than 1 year economic payback

CONTINUE EXISTING BEST PRACTICES
IDENTIFY NEW OPPORTUNITIES
Rank in order of feasibility
Consider impact on product quality

MODEL CASE STUDIES IN TERMS OF ENVIRONMENTAL AND ECONOMIC METRICS

EVALUATE PAYBACK PERIODS OF DIFFERENT APPROACHES

1 Kolta, T. (1992). "Selecting equipment to control air pollution from automotive painting operations," *Society of automotive engineers technical paper series. SAE International Congress and Exposition.*

**Berkeley**
UNIVERSITY OF CALIFORNIA