

# **High-Volume, High-Velocity Deployments of Emerging Technologies in Industry**

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## **ABSTRACT**

Industry today is faced with numerous simultaneous options and constraints. Innovating and incorporating new solutions and interventions can be challenging in a business run by tight margins, fast-paced competition, and an ever-changing cast of competitors. It can be difficult to scan all aspects of innovation while running an operation. New tools and methods are needed to synergistically develop and re-engineer an organization's products or services.

A new and proven path to scale and success is to arrange for entire industry sectors to scan and evaluate large numbers of market-ready innovative solutions that address a wide range of commonly-shared problems, and then facilitate a drilling-down for deployment investigations only in cases for which high probability of success is clear. In this report, we describe a method that enables industry-sector enterprises to conduct such high-volume scanning continuously, effectively, at very low cost, with low disruption of staff, and with no travel.

This methodology has been piloted in the Pacific Northwest on several technologies and market partners and is proving successful in broadening the scanning of new technologies as well as creating synergistic partnerships for industry and utilities alike.

This paper will outline the process and early-stage success over the last 18 months.

## **Introduction**

The Northwest Energy Efficiency Alliance (NEEA) sponsored the Innovation Showcase program through an 18-month pilot with industry participation from the Northwest Food Processors Association (NWFPA) and Oregon Forest Industries Council (OFIC). The program was designed and produced by Emerging Tech Accelerator LLC. Based on successes so far, the National Institute of Standards and Technology (NIST) has joined as a pilot sponsor in order to more quickly move emerging technologies to adoption within NIST's Manufacturing Extension Partnership (MEP) program.

### **A Manageable and Effective Industrial Program for Utilities, NGOs, Trade Associations, and Research Labs**

This program can provide utilities, NGOs, trade associations and research labs (i.e., "Interested Organizations") with an agile path to generating a high volume of industrial energy efficiencies at high velocity. This can be accomplished with a relatively light lift; it is not necessary to construct an arduous, expensive, and risky new set of best practices and capabilities.

This paper explains Innovation Showcase methods and results as well as participation options open to Interested Organizations.

## **The Status Quo is Low-Volume, Low-Velocity**

If industrial energy-efficient “innovation” is a positive force, then, like most positive forces, there will be an army of opposing forces arrayed against it. These opposing forces are described below. This discussion sets the stage to describe how the Innovation Showcase method neutralizes the opposing forces, activates supporting forces, and enables deployment of innovations at high volume and high velocity.

### **The Challenge in Finding Innovative Solutions Worthy of Deployment Today**

- A group of similar industrial companies can identify at any time about 50 mutual major product or process mega-problems.<sup>1 2</sup> These mega-problems are of the scope that solving any one of them would substantially improve both profit and loss (P&L) and competitive position. However, many of the imagined solutions are currently out of reach and most of the problems remain in place.
- A continual flow of emerging technologies under external development may solve such mega-problems once they become deployable products.
- Challenges exist for inventor-suppliers and companies seeking solutions to find one another on a timely basis. This difficulty constitutes a force that prevents deployment of solutions.
- Only a handful of industrial companies have the internal capacity to overcome this inertia and the ability to sleuth out externally-developed innovations on a timely basis.

### **Deciding Which Currently-Deployable Innovations to Buy**

- Current conditions don’t allow an industrial company to fund all the capital projects it wants to execute. This includes the innovative ones.
- Projects get funded based on two key measures: those that yield the biggest P&L benefit together with creating a new major competitive advantage.
- Innovations that deliver both P&L improvement and improved competitive position will typically be considered “strategic” and urgent.
- Stated in reverse: capital projects whose only contribution is to reduce expenses are last in line to get funded. Energy efficiency projects regularly fall into this camp.

### **Accomplishing Large-Scale Energy Efficiencies**

- “Strategic” industrial innovations, as defined above, generally bring with them significant improvements in reduced energy intensity; however, this is a side benefit, not a primary decision-driver.
- This is because strategic innovations impact the core production activity of the industrial company where most of the energy is consumed.

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<sup>1</sup> A problem that is both urgent and important to P&L and competitive position

<sup>2</sup> As an example, a list of food processing industry mega-problems currently in development for Innovation Showcases is available [here](#).

- Therefore, the path of least resistance to achieving significant industrial energy efficiencies would appear to be to encouraging customers to pursue “strategic” innovations, focused on P&L improvements.

### **Barriers Faced by Interested Organizations in Leveraging These Forces**

- Best practice has been to promote a small set of innovations that appeal to large bodies of users, such as improved windows. This has proven effective for residential and commercial customers. An example of a comparable emerging technology that could be applied across nearly all industrial users is improved motors and bearings. However, as noted above, simply improving the motor does not increase unit production or product quality. This illustrates the reason why, in industry, the “appeal-to-all” best practice usually loses the customer’s capital allocation battle.
- What if the Interested Organization shifts its program focus from “efficiency” to “strategic P&L benefit?” There remains the problem that 10 companies making the same widget will have evolved 10 different methods of making that widget. So, even if the Interested Organization hits a bull’s-eye on selection of an industrial problem to solve, there will be unpredictable and unmanageable variations in how the same emerging technology is deployed within each of the 10 plants.
- As a result, best practices optimized for commercial and residential customers cannot execute a parallel effort to promote a variety of solutions for the relatively smaller number of industrial customers. A completely different approach is needed.
- For each Interested Organization to build its own new, and completely different, best practice – one that supports the strategic P&L needs of industry – would require it to accept daunting cost and risk.

### **Opportunities to Be of Service While Accomplishing Your Own Objectives**

The observations above indicate an opportunity to fill a vacuum. If there were a way for Interested Organizations to promote an array of highly-focused and strategic innovative solutions to more of their industrial customers, the Interested Organizations would help to provide significant competitive advantages to their end-customers while also moving toward their own targets for industrial energy efficiency.

This Innovation Showcase program has the potential to help Interested Organizations promote, track, and report large improvements in the reduction of industrial energy intensity, and to do this without increasing their own headcounts or workload.

### **Description of the Innovation Showcase Program**

An Innovation Showcase culminates in a two-hour Web TV event that focuses on emerging tech solutions for a single industrial-sector mega-problem. The target audience is a mix of decision makers and technical staff who understand industrial facilities’ roadblocks to significant breakthroughs for optimizing productivity and reducing energy intensity. An ongoing series of Innovation Showcases is produced with no charge to the attendees.<sup>3</sup>

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<sup>3</sup> An archive of past events and “resource packs” that summarize each event can be found [here](#).

## Event Design and Preparation

The components of each event include a “Situation & Trends” expert panel; presentations by two or three innovative suppliers with market-ready products; and elevator pitches by suppliers about their pre-product innovations to which industrial customers are generally not exposed.

The mega-problem topics for a series of Innovation Showcases are identified and prioritized months in advance by targeting pilot teams identified as early adopters and pioneers to innovation within the industry sector. Topics are scoped and developed with extensive input from these innovators.

For each topic, the pilot team provides qualifying requirements, such as:

1. “I have not yet invested in a solution for this problem because....”
2. “I will not attempt to deploy a solution until the following new capabilities can be delivered....”
3. “What it is costing me to live with this problem is....”

Once the problem is scoped in this manner, the Innovation Showcase producer conducts a worldwide search to find innovations that might contribute to or provide a complete solution. This scan generally produces over 50 possibilities, from which the pilot teams rank the top ten. Those vendors or suppliers are then approached and fully vetted<sup>4</sup> to arrive at the event’s complement of three market-ready innovative suppliers.

## Example Profile of Event Participants

February 25<sup>th</sup>, 2015: An Innovation Showcase on “Removing Suspended Solids from Waste Streams.” The target industry was food processing and manufacturing, but the problem is shared by other industries. Pulp and paper company representatives also attended.

Table 1 below illustrates how well-filtered and qualified this audience is, and therefore how valuable the exposure is for both buyer and seller. Table 2 identifies the registrants for this Innovation Showcase. The participant comments in Table 3 further confirm the program’s value. Audiences have been growing at about 30% per event during the pilot phase. The events could be conducted weekly, covering a wide variety of industry segments and topics. Thus, the program could influence thousands of urgent decisions each year, leading to innovation deployments which would bring with them substantial reductions in energy intensity.

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<sup>4</sup> Among the vetting criteria: Is the innovation actually “new” to most of the audience? Is it the best solution we can find for the industry mega-problem? Can it be purchased today on standard SKUs and reliably supported in the field? Will the supplier commit a senior executive presenter who can answer roadmap questions with authority? Will the presenter accept coaching on both content and TV skills? Can he/she captivate the audience with solution and use cases, as opposed to boring the audience with a technology download?

Table 1. Example Innovation Showcase participant profile – February 25, 2015

| Factor                               | Details   |
|--------------------------------------|---|
| Attendance                           | 230 registrations<br>109 buy-side attendees from 79 sites at 65 companies   |
| Team engagement                      | 16 companies with two or more people attending<br>14 companies had attendees from multiple sites<br>One top-50 food processor had five attendees from four locations  |
| Roles and hierarchy                  | 6% C-level and VP<br>40% Manager/Director/Supervisor<br>35% Engineers or Operations<br>1% Sales<br>8% Consultants or misc.<br>10% Other   |
| Geography                            | Attendees from 20 states and three provinces  |
| Desire to engage and urgency of need | The registration form included five optional questions to identify attendees' needs and wants.<br><br>The question "How immediate is your need to find and deploy a solution to your problem?" yielded these responses:<br>16% Immediate<br>59% Important, but not immediate<br>25% Curious, but not urgent |
| Post-event evaluations               | 80% "Please invite me to the next event"<br>80% "Send archive links to my colleagues"   |

Table 2. Companies attending the February 2015 Innovation Showcase on "Removing Suspended Solids from Waste Streams"

|                              |                                 |                               |                                   |                                |
|------------------------------|---------------------------------|-------------------------------|-----------------------------------|--------------------------------|
| AFP-Advanced Food Products   | ConAgra Foods Lamb Weston       | Gruma Corporate               | National Beef                     | Shearers Food                  |
| Agri Beef                    | Conagra/Lamb Weston/RDO Frozen  | Heb Dairy                     | National Frozen Foods Corporation | Smithfield Farmland Corp.      |
| Alfa Laval Inc               | Cornestone Ventures LLC         | Heinz                         | Nebraska MEP                      | Snak King                      |
| Apex Industries              | crunch time foods llc           | Hermiston Foods/NorPac Foods  | NEEA                              | Snyder Lance                   |
| Apio Inc                     | CWT                             | HJ Heinz Co, LLC              | Nestle                            | Snyder's-Lance, Inc.           |
| Armstrong World Industries   | Daisy Brand, LLC                | Initiative Foods              | Nestle Dreyers Ice Cream          | Soiltest                       |
| ATN                          | Darigold                        | Inland Empire Paper Co        | Nestle Purina PetCare             | Standard Bag Company           |
| Barry Callebaut              | Davisco Foods                   | ITAC                          | NIST MEP                          | Star Kay White, Inc.           |
| Bartush Schnitzius Foods Co. | Del Monte Foods                 | J Product Solutions           | Norpac Foods                      | Stonyfield Farm                |
| Birds Eye Foods              | Delta Corrugated Paper Products | J R Simplot Company           | NW Penn Industrial Resource Ctr.  | Sunshine Dairy Foods           |
| Blind Canyon Aquaranch Inc.  | Dewafelbakkers                  | JD Irving                     | Nutriom LLC                       | SVZ-USA, Inc.                  |
| Bolthouse Farms              | Dierbergs Markets               | John Morrell Food Group       | NW Pulp and Paper                 | Taylor Farms                   |
| BrucePac                     | Dietz and Watson                | Joseph Farms                  | OMEP                              | TechSolve, Inc.                |
| Buoy Beer Company            | Economic Development Admin      | Kabobs, Inc                   | Oregon Fruit Products             | Teeny Foods Corp               |
| Butterball LLC               | EcoStream Water Recycling Corp  | Kellogg                       | Orengo Systems, Inc.              | Terex                          |
| California Dairies           | Elk Partners LLC                | Kerr Concentrates             | Pepperidge Farm                   | Tillamook County Creamery Assn |
| Campbell Soup Company        | Enfield Farms                   | King & Prince Seafood         | Perdue Farms                      | Tree Top                       |
| Canada Malting Co. Ltd.      | Ever Fresh Fruit Company        | Kraft Foods                   | Pierce Fittings                   | Tree Top Foods, Prosser        |
| Caremoli-USA                 | F&S Produce Co., Inc.           | LIFT                          | Pinnacle Foods LLC                | Trident Seafoods               |
| Cargill                      | Fresh Cut Produce               | Little Rapids Corp            | Purdue TAP                        | Tyson Foods                    |
| Cascade Earth                | Frito-Lay                       | LYCO Manufacturing            | Rainsweet Inc                     | tyson foods, Inc               |
| Cavendish Farms              | Fruiterown Products Corp.       | maid-rite specialty foods llc | Riceland Foods                    | Univar USA                     |
| CDM Smith                    | Gehl Foods                      | Maine MEP                     | Rich Products                     | VaCom Technologies, Inc.       |
| CIFT                         | General Mills                   | MD Mfg Extension Partnership  | Rich Products Corporation         | Ventura Foods, LLC             |
| City of Grants Pass          | Giorgio Foods Inc.              | Medline ReNewal               | Royal Ridge Fruits                | Warne Scope Mounts             |
| Clean Water Technology, Inc  | Glanbia                         | Microchip Technology          | Sacramento Container              | Wayne Farms LLC                |
| Columbia Steel Casting Co.   | GloryBee                        | Mitchell Lewis & Staver       | Santa Monica Seafood              | West Linn Paper Co             |
| Conagra Foods                | Green Bay Packaging             | Mother Parkers Tea & Coffee   | Schreiber Foods Inc.              | Western Polymer Corp.          |
|                              |                                 |                               |                                   | Wm. Wrigley Jr. Company        |

Table 3. Examples of Innovation Showcase participant verbatim feedback

| Industry conveners and sponsors   | Event attendees  |
|---|--|
| <ul style="list-style-type: none"> <li>• “You guys are doing some amazing things. You have taken a great concept and operationalized it for true meaningful work based on solid business strategies.”</li> <li>• “I have been searching worldwide for a solution like yours. No one has one. I have only been able to dream of a collaboration toolset like yours.”</li> <li>• “Provides a vital conduit to advancing solutions to our members in a fraction of the time it would take them to discover them on their own.”</li> <li>• “Innovation Showcases have provided a tangible vehicle to provide a really useful educational opportunity for our members that we would have been hard-pressed to produce ourselves.”</li> <li>• “Starting by understanding a particular industry’s technology issues allows for a more organic and creative solution discovery process. So far, there have been a number of innovation supplier/innovation seeker connections that would never have been made without Innovation Showcases to connect the dots.”</li> </ul> | <ul style="list-style-type: none"> <li>• “A great opportunity and a unique way to get to know products or services that could solve our business needs and that we would not have been able to find by [ourselves].”</li> <li>• “More than just vendors talking about their products.”</li> <li>• “This process for uncovering additional ways of thinking about a company’s need for technology/systems is fascinating and very powerful.”</li> <li>• “Vendors come to us. It’s moderated. No sales pressure.”</li> <li>• “I liked the fact that buyers have the possibility to ask questions and that the showcase is available worldwide. I liked the TV production elements. So many visuals to go along with the presentation.”</li> <li>• “What I liked best was the quality and preparation of the speakers.”</li> <li>• “We never would have found these guys.”</li> </ul> |

## Origin and Evolution of the Innovation Showcase Program

### Intel Capital -- 2002

Intel Capital maintains venture capital investments in several hundred early-stage companies. Executing the investment strategy requires that this portfolio of innovations be visible to, and deployable by, Intel’s largest customers.

Because the traditional tech transfer method is unaffordable,<sup>5</sup> Intel reversed the flow, removed the emphasis on recommending innovations, and instead made it very easy for customers to scan the portfolio and prioritize for themselves.

Intel Capital developed a program called “Intel Capital Technology Days” and offered it to individual large enterprises. Intel Capital would bring the top 10 selected innovators to make problem/solution presentations at the customer’s headquarters. As a quid pro quo, the customer would commit to having in attendance a cross-functional audience of 20 to 30 managers and line workers. This audience would select the 10 presenting companies on a consensus basis.

The results metrics were impressive. On average, seven of the 10 presenters were asked to continue engagement for detailed investigation. One or two of them would become suppliers. Roughly half of the innovators selected by this method were off-label surprises whose inventions had generally been developed to solve a different problem in another industry.

<sup>5</sup> The discipline “tech transfer” originated with this method: “Hi. Based on what I think I know about your needs, I have selected one of our innovations for which I would like you to give me several one-on-one hours to explain.” This method does work, and yields benefits to both buyers and sellers. However, using it to convey 400 ideas to 4,000 companies would require 1,600,000 complex cognitive events -- and that’s just one hit per company. A supplier would actually have to approach and re-approach committees within each company.

## **Spinout of the Single-Enterprise Method**

Large enterprise customers began asking to have the program repeated and expanded to include a scan of all worldwide sources of innovation, not just Intel Capital's portfolio. Emerging Tech Accelerator LLC was established to provide this service.

## **Adaptation for Presentation to Entire Industries**

Shortly after development of the Troubled Asset Relief Program (TARP) in 2009, government agencies and public policy groups began asking Emerging Tech Accelerator whether the method could work for small and midsize businesses. The answer was yes, of course; however, the cost to provide the service is the same whether the client's revenue is \$5 million or \$5 billion, and was more than most midsize businesses could bear.

The challenge was how to make the process available to small and midsize businesses, not just the Global 4000.

In 2012 NEEA twice engaged Emerging Tech Accelerator to run the enterprise process for its in-house emerging technologies team: once to find emerging technologies that could enhance the performance of heat pump electric water heaters, and once to survey emerging technology trends in lighting and building controls.

As these programs were wrapping up, NEEA was preparing its 2013-14 engagement program to drive energy intensity reduction improvements with members of the Northwest Food Processors Association (NWFPA) and Oregon Forest Industries Council (OFIC). NEEA decided to extend the single-enterprise web forum model to be a Web TV event, open at no charge to all members of industrial segments.

NEEA provided funding and direction for an 18-month pilot program with multiple Innovation Showcases. NWFPA and OFIC made their standing committees available to develop content priorities and Emerging Tech Accelerator provided event design, technology scanning, vendor preparation, and event production.

## **“Pull” is Better Than “Push” for Promoting Innovations**

The excellent results begun at Intel were in part driven by 1) showing the customer only what he/she urgently wanted to see and 2) the use of team consensus to select the top 10 presenters, thus reducing organizational conflict and inertia. Each participant had advance confidence that were they to initiate a detailed investigation of a presenting innovator, the other functional unit directors would support, not thwart, the effort.

Intel bowed to the reality that it could not afford to “prescribe” 400 innovative solutions to its customers. This should reassure energy efficiency advocates struggling to determine how to comprehend and advocate based upon the sizeable scale of industrial strategic solutions such as those mentioned earlier in this paper.<sup>6</sup>

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<sup>6</sup> Assuming roughly 50 mega-problems in each of the ~30 industries and manufacturing sectors defined within NAICS codes suggests at least 1,500 variations of urgent problem/solution opportunities for Interested Organizations to consider on the way to deciding the handful of solutions that an Interested Organization can afford to systematically promote. If 5 are selected from 1,500, what's the probability of choosing correctly? As Intel determined for itself, it is more effective and far less work to ride the wave of P&L-driven innovation decisions that

Identifying the problems customers want solved is preferable to prescribing solutions. Suppliers should determine how to make visible a high volume of potential strategic emerging tech solutions to those problems to a large number of customers. The utility manager could then spend his/her time reviewing the custom incentive requests that are submitted as a result – exactly the path made possible by the Innovation Showcase program.

## Case Studies

### The Key Learning From Case Studies

Innovations are best directed toward addressing an industry's strategic opportunities.<sup>7</sup> Innovations that do this also deliver – as a matter of course – large improvements in energy efficiency and reduced energy intensity.

### Dimension Lumber Sawmill Case Study

The success of this particular forest products industry case was instrumental in demonstrating the method's efficacy for use with industrial segments, and led to creation of the Innovation Showcase model.

**Sawmill problems and opportunities.** When working with an individual client, the process begins by asking: 1) “Which area of your operation offers the greatest opportunity to increase production throughput and improve quality?” 2) “What problems would you like to solve there?” and 3) “What would a new invention need to do for you in order to move you to replace your current method?”

The case of a single sawmill producing dimension lumber provides a relevant example. Its staff identified the primary breakdown saw as its biggest opportunity for two reasons.

First, shoving 4,000-pound, 30-foot logs into a high-speed, multi-blade bandsaw (often referred to as the “head rig”) frequently breaks the saw blades. The hydraulic ram pushes the logs through at a constant speed for optimal throughput of the average soft log. However, some logs have invisible areas of higher density or very heavy sap. These problem logs lead to burning or breaking saw blades when the ram operates at standardized speed and force. Blades are expensive, and downtime is worse; this type of process failure closes the entire line and idles people and equipment.

Second, another challenging element for the head rig is that branch tissue extends into the core of all logs. The axial orientation of the first cut determines the quality of the resulting lumber. An ideal cut means that the final-product boards have cross-section knots in them; a bad cut means that some boards will have tubes of branch tissue running from one edge to the other, reducing compression and deflection strength in the finished product. This results in boards graded “Number 3” and selling for a fraction of the price of Number 1- and 2-graded boards.

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customers make for themselves. Doing so minimizes the forces opposing deployment and activates supporting forces. The Interested Organization wins in any case because nearly all the deployments lead to substantial energy efficiencies.

<sup>7</sup> “Strategic” means that deploying the solution results in increased revenue, reduced operating expenses, and improved competitive position.



Knowing the locations of branch tissue before making the first cut would allow operators to orient logs to increase the yield of higher-grade boards by up to 20 percent.

**Sawmill solutions.** Our methods found existing technologies that could be applied, off-label,<sup>8</sup> to significantly increase production throughput and quality.

We asked the sawmill client whether they had considered replacing the head rig’s hydraulic ram with a linear motor. They had already considered and rejected linear motors; however, the only use cases they had seen for linear motors consisted of transporting work pieces from station to station for light assembly of electronics. Our scanning of other industrial sectors revealed linear motors being used for rail guns, fighter plane catapults, and light rail. Moving a big log through a bandsaw is not much different from moving a rail car along a track. This client’s interest was rekindled.

The scanning process also discovered that a process for CAT<sup>9</sup>-scanning logs in Europe was transitioning from field test to production. Instruments and software exist to scan to the core of the log and then instruct the head rig saw cradle to rotate the log to achieve optimal cuts. These technologies could be integrated in this sawmill case to maintain optimal cuts while maximizing production throughput with less downtime.

**Sawmill case summary of benefits.** Table 4 summarizes the benefits of using this method in the sawmill case described above.

Table 4. Summary of benefits in sawmill case study

| Revenue increases  | Cost reductions  | Energy intensity: for the client, and upstream from the client   |
|--|--|--|
| <ul style="list-style-type: none"> <li>• Up to eight hours per week of increased plant operation through reduced breakage and longer blade life at the breakdown saw.</li> <li>• 20% increase in higher-grade lumber through tomography and optimal orientation of first cut. Improving revenue and reducing waste.</li> </ul> | <ul style="list-style-type: none"> <li>• Smaller footprint – now it’s just the head rig – no space required for axial motors, pumps, and hoses.</li> <li>• Maintenance – no pumps, hoses, or axial motors to maintain. No stand-by spares required. No worn cables and stops to adjust.</li> <li>• Lower power consumption – Hydraulic pumps run at full speed all day, and bleed power away in every foot of hose. Linear motors burn electrons only when they’re moving. Virtually no load when in idle mode. With a linear motor solution, the biggest single power consumer is the head rig. The head rig operation will draw less than half its former energy.</li> </ul> | <ul style="list-style-type: none"> <li>• The sawmill will reduce power consumption at the head rig saw by over half, while increasing production of higher-quality boards by 20 percent.</li> <li>• This sawmill works on demand with no finished inventory. Orders will be filled using 20% fewer logs. That means – for the same number of board feet – fewer trees have to be grown, cut, transported to the mill, then stacked, watered, and debarked. Energy is saved at every step. These additional energy and non-energy benefits are not part of the identified savings.</li> </ul> |

**Creating awareness that otherwise may never have occurred.** The discovery phase and method do not create the innovation; they help the buyer and innovative supplier find each other months or years faster with a fraction of the customary effort.

<sup>8</sup> “Off-label” means aside from the originally-intended use; e.g., heart-attack prevention is an off-label use of aspirin, which was originally designed as a painkiller.

<sup>9</sup> Computerized Axial Tomography

Although the European log tomography supplier was a year or two away from establishing US distribution, it could afford to present to our sawmill client as a one-off because the method incurred zero sales and marketing costs (it didn't push; we pulled). Because the supplier was also briefed on client needs and wants, preparation time was minimized.

During the market scanning process, we approached more than 10 linear motor suppliers and made arrangements for the two most relevant suppliers to present. However, all 10 suppliers said the forest products industry was completely off their marketing radar because selling to mills requires travel time to rural destinations, and there are too few mills to make it worthwhile. In this case, none of the suppliers would have knocked on the customer's door – or on this industry segment's door.

Reducing the elapsed time to find and deploy an innovation is important. To paraphrase Gladstone, "Efficiency delayed is efficiency denied."<sup>10</sup>

**Energy efficiency will follow as a matter of course.** This sawmill customer is a model corporate citizen, fully aware of energy issues, and had already invested tens of millions of dollars to build a cogeneration plant. Even so, energy efficiency was a tertiary motivator for the case described above.

The reason the customer engaged in the process was to find a way to increase production throughput and increase quality. Energy efficiency came along with the deal rather effortlessly from the perspective of Interested Organizations such as utilities and trade associations.

This case demonstrates a nearly universal phenomenon. Emerging tech innovations that deliver increased throughput and quality almost always bring with them substantial operating cost reductions. They run faster, take less space, require less maintenance...and are much more energy efficient.<sup>11</sup>

### Structure of the Ideal Strategic Innovative Solution for Industry

Our work on the sawmill case codified our understanding and ability to define the structure for an ideal industrial strategic innovative solution, as Table 5 summarizes.

Table 5. Structure of the ideal strategic innovative solution for industry

|   |   |
|---|---|
| Increases revenue   | Reduces overall operating costs   |
| <ul style="list-style-type: none"> <li>• Increases production speed and throughput, yielding more units to sell</li> <li>• Reduces breakage and/or improves quality, yielding more units to sell at a higher price</li> </ul> | <ul style="list-style-type: none"> <li>• Managed day-to-day by fewer people with lower skill levels</li> <li>• Costs less to maintain</li> <li>• Occupies less space</li> <li>• Reduces exposure to regulatory penalties</li> <li>• Reduces energy consumption</li> </ul> |
| Leads to the creation of competitive differentiation: Better-quality product delivered to custom specifications more quickly  |   |

### Other Conceptual Case Studies

<sup>10</sup> "Justice delayed is justice denied." William Gladstone, British Prime Minister, 1868

<sup>11</sup> While we say this based on our own experience and work product, this assertion is also supported in Chapter 12 of (Hopp and Spearman 2011).

While report length does not allow inclusion of a second full case study, below are a few capsule summaries of problems being solved by newly-arrived, externally-developed innovations. Table 6 summarizes just a few recent Innovation Showcase topics. Each example reinforces the observation that focusing on solving the problems that industry perceives as most urgent nearly always yields big energy savings.

**Hydrophobic coatings.** The subject of hundreds of federal research projects to keep airplane wings from icing. Can be used on food processing surfaces to increase flow rates in tubes; stop substances from sticking to knives and paddles; reduce the strength of detergent and the velocity and volume of water needed to clean surfaces every day; and decrease the time and resources required to clean and prep for product line change-overs. Energy savings: less pumping power in process pipes. Less resistance on paddle motors, water presses, and less hot water.

**Binary fluid ejecting chillers.** Five times faster return on investment for converting less-than-boiling temperature waste heat into chilled output. Not only recovers more waste heat from building ventilation and industrial process, but does it with less reliance on mechanical pumping.

**Collaborative robots.** Can work without protective fencing. Can be trained by non-programmer line workers. Cost of entry is \$25,000. Pay for them in less than a year. Enable reshoring of entire production lines to the US. Can operate in the dark. Don't use the bathroom, the break room, or the parking lot, cars, gas. Can work shifts 2 and 3 for modest additional cost, leveraging the value of the line and the building.

Table 6. History and titles of some Innovation Showcase topics – 2013-15

| Topic area  | Innovation Showcase titles  |
|-------------|---|
| Energy      | <ul style="list-style-type: none"> <li>• Retaining Cold. R Values &amp; Fast Doors</li> <li>• Refrigeration Controls</li> <li>• Waste Heat Recovery               <ul style="list-style-type: none"> <li>○ From Flue Gas to Warm Fluid</li> <li>○ From Warm Air or Liquid to Chilled Liquids</li> </ul> </li> </ul> |
| Packaging   | <ul style="list-style-type: none"> <li>• Enhanced Packaging</li> <li>• Improved Handling of Existing Packaging</li> </ul>   |
| Production  | <ul style="list-style-type: none"> <li>• Traditional Robotics</li> <li>• Collaborative Robotics</li> <li>• The Internet of Things</li> </ul>  |
| Water       | <ul style="list-style-type: none"> <li>• Removing Suspended Solids</li> <li>• Removing Dissolved Solids</li> <li>• Monetizing Sludge</li> <li>• Ultra Filtered Process Water</li> <li>• Reducing Adhesion and Turbulence in Processing Surfaces</li> </ul>  |
| Food safety | <ul style="list-style-type: none"> <li>• Expiration Notification and Awareness</li> <li>• Cold Chain Assurance and Risk Management</li> <li>• Incremental Improvements to Inspection</li> <li>• Sensing Contaminants</li> <li>• Remediation of New Pathogens</li> </ul>   |

## **Even When “Ideal” Cannot Be Attained, Strategic Focus Still Delivers Significant Energy Efficiencies**

Certainly, not all topics listed above will lead to increased revenue for an industrial company. Unfortunately, the ideal strategic innovation profile described earlier cannot be realized as the solution to every problem.

On the other hand, the scale of process improvements within each of topics above delivers a serious material dent in overall operating expenses for the industrial company – including energy consumption.

With the exception of “Refrigeration Controls,” the topics and solutions listed in Table 6 do not typically appear within lists of prescribed incentive programs for industry.

## **Next Steps and Potential Program Expansion with NIST Engagement**

The National Institute of Standards and Technology (NIST) is using the Innovation Showcase program as an outreach tool and client discussion starter for its complement of manufacturing consultants. NIST’s Manufacturing Extension Partnership (MEP) program includes 1,200 consultants operating in 400 locations across the United States.

The job of these consultants is to execute short, focused engagements that drive lean process and marketing improvements, with the goals of increasing profitability and global competitiveness. The target market is small and midsize manufacturers.

A continuous flow of deployable, problem-solving, emerging technologies is key to achieving NIST’s goals. The Innovation Showcase Web TV method makes the flow of innovation visible to small manufacturers with a level of depth and convenience never before available to them.

NIST has a parallel mission to drive adoption of emerging technologies that have been developed by early-stage companies and by federally-funded research. The Innovation Showcase program helps NIST achieve this objective as well.

Since the MEP program engages with all manufacturing sectors, Emerging Tech Accelerator and the MEP program are looking forward to addressing more mega-problems with more industrial sectors. We anticipate that an increased frequency and variety of events will allow any type of industrial company to find solutions of immediate interest over the course of a few events.

After each event, we distribute attendees’ contact information to the closest MEP Center for a very low-key follow-up. The take rate on these outreach calls is high because the event audience is self-selected and highly motivated. On average 75% of the audience members report that they attended the event because their organizations experience that event’s problem and are determined to find and act on a solution. Over half of these acknowledge they arrive at the event seeking to understand how to scope the problem and/or understand the available solutions. Some companies bring as many as eight attendees to save time by having the whole committee see the information simultaneously.

## **Possible Synergies for Utilities, Trade Associations, and Labs to Engage with NIST**

The Innovation Showcase can educate MEP consultants to coach industrial companies to apply for custom incentives when the solution warrants (we can coach the innovative suppliers to do this as well).

Over time, this cadre of 1,200 MEP consultants could become familiar with qualifying requirements for incentives from the utilities within their territories.

This body of consultants offers skills and experience relevant to all industrial sectors. Therefore, for custom incentive applications for a technology or a solution type outside of the utility manager's area of expertise, he/she can consult with a neutral third party (the MEP consultant). MEP Centers could be developed as skilled but unpaid trade allies.

Best of all, this teaming of existing and mutually-supporting forces can happen without the need for NGOs or utilities to design and set up a new program with a long learning curve, and without the need for constant promotion and education. Instead, the continual flow of Innovation Showcases drives customers to take the initiative on new energy-saving innovations that are strategically urgent to them.

Utilities and NGOs can simply respond to new qualified opportunities, with local MEP assistance, without disrupting or truncating their current utility programs.

A national zip code directory of utilities' and NGOs' industrial energy efficiency managers would allow us to potentially share the event attendees with them as well.

### **Mutually-Supportive Public Policy Benefits**

The Innovation Showcase puts utilities, NGOs, federal and state agencies, and others together in a matrixed overlay that is fully synergistic and without collision.

Using just the federal level to make the point, finding emerging technologies for industrial companies serves the NIST goal of making manufacturers more profitable and competitive. It serves the Economic Development Administration (EDA) goal of creating wealth in communities. It serves the interests of an additional 22 sub-agencies, all of which fund billions of dollars of applied research per year, and all of which want to see that research commercialized and adopted by private industry.

Finally, rapid adoption of strategic innovations sought by NIST, EDA, and the other agencies delivers decreased energy intensity. It costs them nothing – it is in their interest – for this decrease in energy intensity to be observed and reported by utilities and NGOs. So, NIST's, EDA's, and the other agencies' pursuits of their own goals fulfills Department of Energy (DoE) goals as well, with little or no incremental effort required of DoE.

### **Conclusions and Future Directions**

Innovation Showcases drive energy efficiencies in core manufacturing processes, where most industrial energy is consumed. The method can be applied across nearly all industrial sectors, in a structured and highly-scalable manner. The method imposes few or no new burdens and risks on utilities or other interested parties. It works fast. It shaves months or years off the innovation deployment calendar.

For the industrial customer, the Innovation Showcase addresses profitability, global competitiveness, and corporate responsibility in one stroke. Customers are not being asked to contribute – or sacrifice – their dollars or their attention; rather, they are invited to look after

their own short-term survival and long-term strategic needs. The focus is entirely on the best interests of the customer – as the customer defines it for itself.

For 2015 and 2016, the program will continue to refine its methods and expand into other industrial sectors. The success so far in cross-disciplinary, cross-agency collaboration and leverage is gratifying. The authors welcome your thoughts on how to amplify these opportunities.

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