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GREEN INSIGHTS

Newsletter on Eco-labelling and Eco-friendly Products

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GREEN INSIGHTS
October-December 2015

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FOREWORD

There is increasing concern among consumers across the world on the subject of sustainable living, and thus, for environment protection. Adoption of best practices, implementation of the 6 R's – Reinvent/Rethink, Refuse, Reduce, Reuse/Repair, Recycle and Replace/Rebuy – are becoming the key drivers to sustainable production, and sustainable development. Especially so, when worldwide evidence shows consumers' growing concerns for the environment and their favourable attitudes towards, and growing demand for, environmentally-friendly products.

Besides best practices, Innovative production plays a vital role in the quest for sustainable development. According to French academic Michael Matlosz "The ambition of eco-efficiency is to close the loops in the life cycle. Value chains, supply chains and market relationships are changing, so business models must adapt. And we must teach people how to work with people in other fields. Sustainable development is both a challenge and an opportunity for the process industries."

Eco-innovation is the improvement of products and processes that lead to sustainable development. Industry has a key role to play in optimising the contribution that research makes to sustainable development. Research & Development departments play an important role in improving the environmental performance of industry. Eco-innovations help make the transition from research to commercialisation. It has cultural, social, as well as commercial dimensions. Eco-innovation is also the basis for Greening the Environment and achieving resource efficiency, both of which provide sustainability and technology improvement.

With increasing recognition of adverse consequences of their production processes, industries are gradually becoming more environmentally and socially responsible; they are increasingly looking at investing in the environment. With the growing and favourable demand for sustainable and socially responsible products and services, Green Marketing is emerging.

Eco-friendly innovations are revolutionising the way we generate energy, recycle waste and protect the planet. This Issue of Green Insights presents how inedible agricultural waste and mushroom roots can convert into packaging material, and how new technology produces electricity from the exhaust heat from generators, furnaces, chimneys and engines. It points to a greener future for transportation, and turning agricultural waste into energy. It provides a glimpse into different aspects of Eco-innovation, as also into the promises and challenges ahead.

“Green” Packing Material? Mushrooms!

Josh Chamot
Media officer for engineering at the U.S. National Science Foundation

A composite of inedible agricultural waste and mushroom roots, its manufacture requires just one-tenth the carbon dioxide of traditional foam packing material.

A new packing material that grows itself is now appearing in shipped products across the United States.

The composite of inedible agricultural waste and mushroom roots is called MycoBond, and its manufacture requires just one-eighth the energy and one-tenth the carbon dioxide of traditional foam packing material. And unlike most foam substitutes, when no longer useful, it makes great compost in the garden.

The technology was the brainchild of two former Rensselaer Polytechnic Institute undergraduates, Gavin McIntyre and Eben Bayer, who founded Ecovative Design of Green Island, New York, to bring their idea into production. “We don't manufacture materials, we grow them,” says McIntyre. “We're converting agricultural byproducts into a higher-value product.”

Because the feedstock is based on renewable resources, he adds, the material has an economic benefit as well: it is not prone to the price fluctuations common to synthetic materials derived from such sources as petroleum. “All of our raw materials are inherently renewable and they are literally waste streams,” says McIntyre.

With support from the U.S. National Science Foundation, McIntyre and Bayer are developing a new, less energy-intensive method to sterilize their agricultural-waste starter material—a necessary step for enabling the mushroom roots, called mycelia, to grow. McIntyre and Bayer are replacing

a steam-heat process with a treatment made from cinnamon-bark oil, thyme oil, oregano oil and lemongrass oil.

The sterilization process, which kills any spores that could compete with Ecovative's mushrooms, is almost as effective as the autoclaving process used to disinfect medical instruments and will allow the MycoBond products to grow in the open air, instead of their current clean-room environment.

Much of the manufacturing process is nearly energy-free, with the mycelia growing around and digesting agricultural starter material—such as cotton seed or wood fiber—in an environment that is both room-temperature and dark. Because the growth occurs within a molded plastic structure, which the producers customize for each application, no energy is required for shaping the products.

Once fully formed, each piece is heat-treated to stop the growth process and delivered to the customer—though with the new, easier,

disinfection treatment, Bayer and McIntyre are hoping that by 2013 the entire process can be packaged as a kit, allowing shipping facilities, and even homeowners, to grow their own MycoBond materials.

"The traction that they have gotten with their early customers demonstrates how companies can build strong businesses around products whose primary competitive advantage lies in their sustainability," says Ben Schrag, the National Science Foundation's program officer who oversees Ecovative's Small Business Innovation Research award.

In addition to the packaging product, called EcoCradle, Ecovative has developed a home insulation product dubbed Greensulates. Comparable in effectiveness to foam insulation, it is also highly flame retardant.

Ecovative has also received support from the U.S. Department of Agriculture's Agricultural Research Service, the Environmental Protection Agency, and the New York State Energy Research and Development Authority.

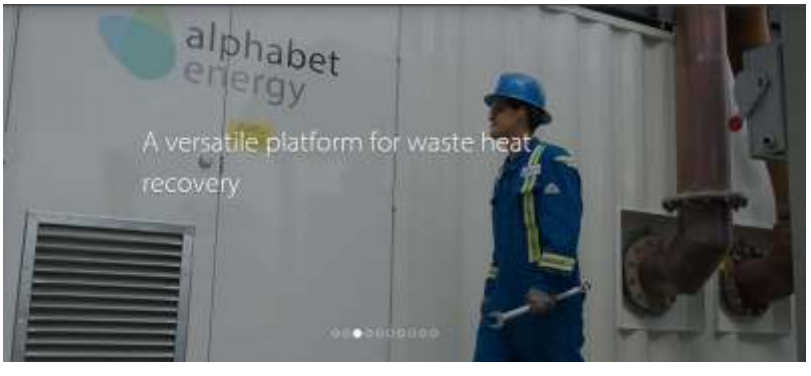
Source: Span, January/February 2012
http://span.state.gov/science-technology/green-packing-material-mushrooms/20120103

Powered by Waste Heat

By Steve Fox
Freelance writer, former newspaper publisher and reporter based in Ventura, California.

A California company's technology produces electricity from the exhaust heat from generators, furnaces, chimneys and engines.

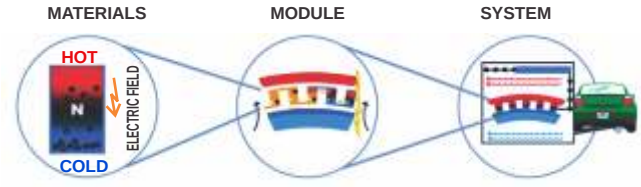
Imagine this: the electronics in your car are being powered by electricity generated from the heat coming out of the exhaust pipe. You charge your cell phone by putting it in your pocket to absorb heat from your body.



Science fiction? Maybe not for long. A small California-based company, Alphabet Energy, Inc., has found a way to make advanced thermoelectric material out of silicon—the natural element already widely used in computer chips and solar panels. Alphabet's material, which is about the thickness of an index card, forms the heart of customized devices that can be attached to furnaces, chimneys, engine exhausts—almost any heat source—to generate electricity.

Thermoelectricity has been around for a long time—the basic principle of transforming heat into energy was discovered in 1821—and the NASA has used this technology on some of its spacecraft since 1977, with radioactive isotopes supplying the heat. When one side of a thermoelectric material is heated, electrons flow from that side to the cooler side, generating electricity.

Until now, commercial thermoelectric technology has relied largely on material made from rare earth elements, which are both scarce and expensive,



Thermoelectric power generation requires three major pieces of technology: thermoelectric materials, thermoelectric modules and systems that interface with the heat source

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Alphabet Energy has made major advances in all three areas, enabled by breakthroughs in nanotechnology.

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making thermoelectric projects a costly undertaking for companies.

“Alphabet's breakthrough is that we can make thermoelectric material out of silicon, which is abundant and low-cost, and in our proprietary technology that offers a much more efficient way to connect the material to the heat transfer source,” Alphabet's founder and CEO, Dr. Matthew Scullin, explained in an interview.

Alphabet, which has filed for more than 40 patents in the last four years, was honored as a 2014 Technology Pioneer at the recent World Economic Forum in Davos, Switzerland, where Scullin met with executives in the mining, oil and gas industries—huge users of energy.

“Our first products are going into fairly remote areas where diesel generators are being used to produce electricity,” said Scullin, who holds a Ph.D. and M.S. in materials science from UC Berkeley. “Alphabet's technology produces electricity from the exhaust heat from the generators. That means those generators will be more efficient, and, of course, using less diesel fuel is inherently green because there are fewer emissions. It's an enormous potential benefit for countries that have a poor electrical grid. At some point, we'll also get to applications like wearable technology.”

Although modern societies require massive amounts of electricity to function, we're still not very efficient at producing it. For example, according to the Union of Concerned Scientists, only about a third of the heat produced by coal-burning power plants is transformed into electricity, with the rest lost into the atmosphere or into the plant's cooling water. Waste heat is also common in factories, locomotives, ships, trucks and other machinery.

“What Alphabet is really doing is enabling a new asset—waste heat—and creating new markets where they hadn't existed before,” Alphabet's Vice President of Marketing, Mothusi Pahl, said in an interview. “The future of thermoelectricity is one we don't fully understand yet, any more than we could envision 25 years ago what GPS would mean. In the near-term, once you make a viable business and financial case that demonstrates the costs and payback times for thermoelectric, then you can start asking the question, 'Can you as a business really afford not to capture waste heat and convert it to power?'”

Scullin believes companies will adopt thermoelectric power widely once they understand the benefits.

“From the customer's point of view, the main point is that there's a very rapid payback time because this is essentially bolt-on technology—we're taking advantage of a heat source that's already there,” he said. “It doesn't require building a new power plant or changing the way the company is operating. Our technology enables very simple, straightforward thermoelectric systems. There are no moving parts, virtually no maintenance, and everything is very easy to install.”

Companies—and investors—are paying attention. CalCEF Innovations, TPG Biotech and Claremont Creek Ventures are some of them. Encana, Canada's largest natural gas producer, is installing Alphabet thermoelectric devices and also has invested in the firm, as have a number of seasoned venture capital companies.

Source: Span, March/April 2014
http://span.state.gov/science-technology/powered-by-waste-heat/20140303

A New Fuel Mix

By Howard Cincotta
U.S. State Department writer and editor

There are many roads to a greener future for transportation.

It's easy enough to describe the ideal green energy source for today's cars and trucks: low emissions and high fuel economy without sacrificing performance—and all at a reasonable price.

Now pick the alternative fuel that best meets those requirements: gas-electric hybrids, all-electric vehicles, diesel, natural gas or biofuels. That's a far tougher question. Each of these alternatives holds great promise, yet all of them also carry significant economic and technological challenges.

"There are no clear winners or losers right now, or even a clear roadmap to the alternative fuel future," says John O'Dell, senior editor at the automotive research firm Edmunds.com.

Hybrid and electric

An alternative fuel that hits the mark for emissions, economy and performance is only one part of the equation; the other side is the decision of customers to buy it. The first power system to pass that test in the United States is the hybrid-engine automobile, which integrates the power and range of the internal combustion engine with the efficiencies of one or more electric motors and a battery pack.

Just a few years ago, U.S. hybrids consisted of only several small hatchback vehicles, but today manufacturers offer models across the full range of vehicle types, including SUVs and luxury sedans. Plus a distinctive new category: the plug-in hybrid. In 2013, sales of hybrid vehicles in the United States soared to almost 500,000, and although Toyota's Prius remains the top-selling brand, the fastest-growing U.S. hybrid model is the Ford Fusion.

Meanwhile, sales of all-electric cars, starting from a much smaller base number, hit 47,600 last year—an increase of more than 240% over 2012, according to data from Ward's Automotive. Here, too, U.S. and Japanese brands are jostling for the top sales spot: the General Motors Volt versus the Nissan Leaf.

The tale of the electric car illustrates both the promise and pitfalls of green fuel technologies. Like hybrids, all-electric cars have a higher initial purchase price that must be weighed against the savings in gasoline. Electric cars offer the prospect of no gas bills and zero tailpipe emissions, but they also present significant hurdles: safety and performance concerns, driving range and the perennial question for any new or innovative fuel: where do I fill up or plug in?

As a result, sales of electric cars were, for many

years, anemic. However, in the last several years, the technology matured and infrastructure started appearing—both home and public plug-in units—winning over increasing numbers of customers.

"It is the future of transportation," said Columbia University energy expert David Sandalow to The New York Times. "The only question is how fast and how soon."

Natural gas and biofuels

What about fossil fuels that are both significantly cheaper and cleaner than conventional gasoline? Countries lacking either oil reserves or refining capacity, such as Italy and Argentina, have embraced vehicles using clean natural gas. So has India, where many cars are dual-equipped to run on gasoline and compressed natural gas. In the United States, natural gas fuels fleet of city buses, trash haulers and other types of commercial trucks. The total number is a modest 135,000 nationally, but growing rapidly.

Only one company, Honda, makes a U.S. natural-gas passenger car—the Honda Civic CNG—and it has won the designation of the greenest, most environment-friendly automobile in 2012 from the American Council for an Energy-Efficient Economy—even ahead of all-electric vehicles. Electric cars, after all, require factories to manufacture batteries and must plug into a grid whose power may be generated by coal-fired plants. Everything counts when you're measuring total environmental impacts.

As with other alternative fuels, natural gas vehicles must overcome the infrastructure hurdle of enough refueling stations, whose cost can only be justified if there are enough customers out there.

Nevertheless, the attractiveness and cost of natural gas, driven in part by a revolution in U.S. production from domestic shale sources, has triggered new investments and technologies: dual-fuel pickup trucks, natural gas trains, lighter and safer fuel tanks and the conversion of natural gas to liquids for transportation use.

Plus you can't beat the price. When Edmunds.com

editor O'Dell commutes in his natural-gas Honda, he is paying about 80 cents a gallon—next to drivers whose gasoline costs more than $3.50 per gallon.

The success of gas-electric hybrids in the United States has overshadowed other attractive fuel options, such as renewable biofuels that, although a small share of the market now, may well figure prominently in the world's energy future. Today, ethanol, made primarily from corn, makes up 10% of the mix in U.S. gasoline, but new second-generation biofuels will shift to non-food cellulose products such as grasses, straw and wood byproducts that can power a growing number of flexible-fuel cars and trucks.

Another alternative: biodiesel, which is manufactured from a variety of organic materials ranging from soybean oil to recycled cooking oil and animal fats.

All of these alternative fuels offer varying degrees of low, or even zero, emissions and high mileage without sacrificing performance. But all come with their own technical or economic tradeoffs. Electric cars are of little use without a reliable electrical grid, for example, and no one will drive a natural gas or biofuel vehicle without easy access to a gas station.

Success will come to those alternatives that best pull off two large challenges: protect the environment and deliver what car buyers want and need.

Source: Span, March/April 2014
http://span.state.gov/science-technology/alternative-fuels/20140500

Turning Onion Juice into Electricity

By Steve Fox
Freelance writer, former newspaper publisher and reporter based in Ventura, California.

A California company wins awards, saves money and cuts greenhouse gas emissions by turning agricultural waste into energy.

Think about innovative California companies and what probably comes to mind are Google in search engines, Oracle in business software, Intel in silicon chips, and Hewlett-Packard in printers and computers. Certainly not Gills Onions.

Think again. This family-owned processor of onions in the coastal town of Oxnard, about 95 kilometers north of Los Angeles, is making electricity from onion juice—and saving itself more than $1 million a year in the process. By installing what the lead engineer on the ground-breaking project calls “a big stomach” at its plant, Gills is turning agricultural waste into energy and winning praise from engineers and environmentalists alike.

As one of the largest processors of raw onions in the United States, Gills slices up some 362,800 kilograms of the pungent vegetable every day for a wide variety of customers, including supermarket chains, restaurants and fast-food companies such as McDonald's. About 40% of the onion is lost in the process, leaving Steve and David Gill, the brothers who own the company, with a challenge that might bring some to tears.

“I had to solve the problem of our onion waste,” Steve Gill says in a SPAN interview. “It was very expensive to haul away and we were spreading so much of it on the fields that it was beginning to affect the crops we were growing. I had to find another way.”

The solution didn't happen overnight, but the Gills, who started their company in 1983 with 16 people and now employ 400, learned patience on a family farm in California's fertile Central Valley where they grew tomatoes and peppers.

“It took me 12 years to figure it out,” Gill says. “The technology wasn't available to handle waste like this when I started looking into it, and I had to do all the research and development myself. But I was persistent. Then the permitting process took quite a while, and financing was difficult, too. The technology is ahead of what everybody is used to, so that slows everything down a lot.”

What became the company's Advanced Energy Recovery System ultimately cost $10.8 million, with Gills Onions receiving assistance in the form of $1.8 million in investment tax credits from the federal government and $2.7 million from Sempra Energy

as part of the utility's renewable energy Self - Generation Incentive Program. Gills now gets about 80% of its power from onion juice and expects to recover its investment in six years while removing more than 90,700 kilograms of onion peelings from the plant's waste stream every day. The company also eliminated a significant amount of greenhouse gas emissions associated with the thousands of truck trips formerly needed to haul the waste away.

To put the innovative project together, Gills brought in Bill Deaton of Utah-based Deaton & Associates. An independent consultant with a background in chemical engineering and 25 years of food industry experience, Deaton took Gills into the finer points of waste-to-energy conversion and assembled a team to turn the concept into reality.

“It was a great project to manage because we had a lot of sharp people who were all eager to do things, and that was critical because we had to create our own resources as we went along,” Deaton says. “Nobody had really done a project like this before, and nobody was working with onions.”

Deaton's team included engineers from HDR, Inc., an Omaha, Nebraska-based architecture, engineering and consulting firm that has done projects in all 50 American states and 60 countries. Among HDR's many unique projects are a solar power system for Alcatraz Island, the infamous former prison in the middle of San Francisco Bay that is now a U.S. national park; and design and construction support on the Hoover Dam Bypass, which took car traffic off the mammoth dam and onto what is now one of the longest concrete arch bridges in North America.

The HDR contingent was led by Juan Josse, who is now vice president of engineering at UTS BioEnergy in Irvine, California.

“We had to develop the technology to extract the onion juice and we had to develop a way to digest the onion juice, which no one had done before,” Josse tells SPAN. “Then one of the biggest challenges was how to put together all the different technologies involved. We couldn't get anyone to commit to do the whole thing and give us a package, so we decided to put together the best equipment we could find and we did that successfully.”

The energy recovery system essentially involves piping the 113,500 liters of onion juice Gills winds up with each day into what's known as a high-rate upflow anaerobic sludge blanket reactor or, as Deaton puts it, “a big stomach.” Spurred by bacteria purchased from a beer brewery, the onion juice ferments inside the 548,800-liter digester and produces methane gas, which is treated and compressed, then used to power two fuel cells Gills purchased and had installed at the company's 5.6-hectare plant. The fuel cells produce enough electricity to power about 450 homes—or most of the company's energy needs. Onion waste that can't be converted into juice is sliced into fine pieces that are compressed into onion “cake” used for animal feed.

While the fuel cell technology was relatively straightforward, getting the digester to consume high-sulfur onion juice was somewhat trickier.

“The digester seems like it has a mind of its own and we had to deal with that,” Gill says. “But once we let it do what it wanted to do, it started producing a high-quality gas.”
The showcase project won a number of awards, including the Grand Conceptor Award of the American Council of Engineering Companies, the governor's Environmental and Economic Leadership Award (California's highest environmental honor), the Cool Planets Projects Award and McDonald's 2010 Best of Sustainability Supply Chain. In winning the engineering companies award, the innovations at Gills came in ahead of much larger projects that included the $1.3 billion Dallas Cowboys Stadium in

Arlington, Texas and the Sea-to-Sky Highway project in British Columbia, Canada.

"They're setting the standard," California Environmental Protection Agency Secretary Linda Adams said at an event Gills hosted in July to mark the first year of successful operations of the recovery system. "It's really a tremendous thing to see the private industry taking this kind of leadership."

Deaton and Josse believe more companies will follow the example that Gills set.

"These projects are getting to be very popular and there are going to be a whole lot more of them," Deaton says. "You go to countries like Sweden and Germany and you'll find that they have converted lots of things into compressed biogas. The important thing is that it's renewable. You're taking something that was grown above the ground, converting most of it into energy and putting the rest back into the ground and renewing the cycle."

"What we did can be applied widely in any food processing industry, not just in the plant but out in the fields," Josse says. "A lot of the waste from harvesting that's now plowed into the ground could become energy, electricity. It could be done anywhere. It's just a matter of using the right engineering and the right technology."

Renewability and sustainability are now standard operating procedure at Gills, with the company looking at turning the plant into a zero-waste facility by, among other things, recycling employees' lunch leftovers.

"Our goal is to recycle as much of our waste as we can," Gill says. "It's a dollars and cents thing, but it's also accountability to the environment."

Source: Span, November/December 2010
http://span.state.gov/science-technology/turning-onion-juice-into-electricity/20101101

Wiser Power Plants

By Jason Chiang
Freelance writer based in Silver Lake, Los Angeles

A breakthrough water-repellent coating aims to drastically reduce carbon dioxide emissions in power plants.

With over 62,500 power plants operating around the world, the balance between global energy production and environmental sustainability has become more crucial than ever before. Thanks to a new technology, steam-driven power plants, which generate more than 85 percent of the world's power, can be transformed to ensure cleaner energy production, reduced water consumption and less carbon emissions.

Professor Kripa K. Varanasi, associate professor of mechanical engineering at Massachusetts Institute of Technology, and his colleagues at DropWise Technologies Corp., have developed a breakthrough water-repellent coating that makes power plants more efficient and environmentally sustainable, while saving millions of dollars in annual costs.

Global carbon emissions from fossil fuels have radically increased over the past 100 years. According to the U.S. Environmental Protection Agency, emissions increased over 16 times between 1900 and 2008, and 1.5 times between 1990 and 2008. Professor Varanasi says that applying DropWise's new coating at just one steam-driven

power plant would reduce yearly emissions equal to taking 4,000 cars off the road. Power plants using the new coating could also save up to half a million dollars per year on fuel cost. “From Day 1, our team's goal was to focus on improving an existing process, rather than reinventing the wheel,” says Professor Varanasi. “We saw a huge opportunity to realize efficiencies that would have a profound effect on global energy.”

All steam-driven plants are powered by condensers. Fuel—nuclear, coal, natural gas or solar thermal—is burned to produce steam that spins a turbine. As steam surfaces, it is suddenly cooled down and condensed back into water, generating a powerful suction force that helps propel the turbine and create energy.

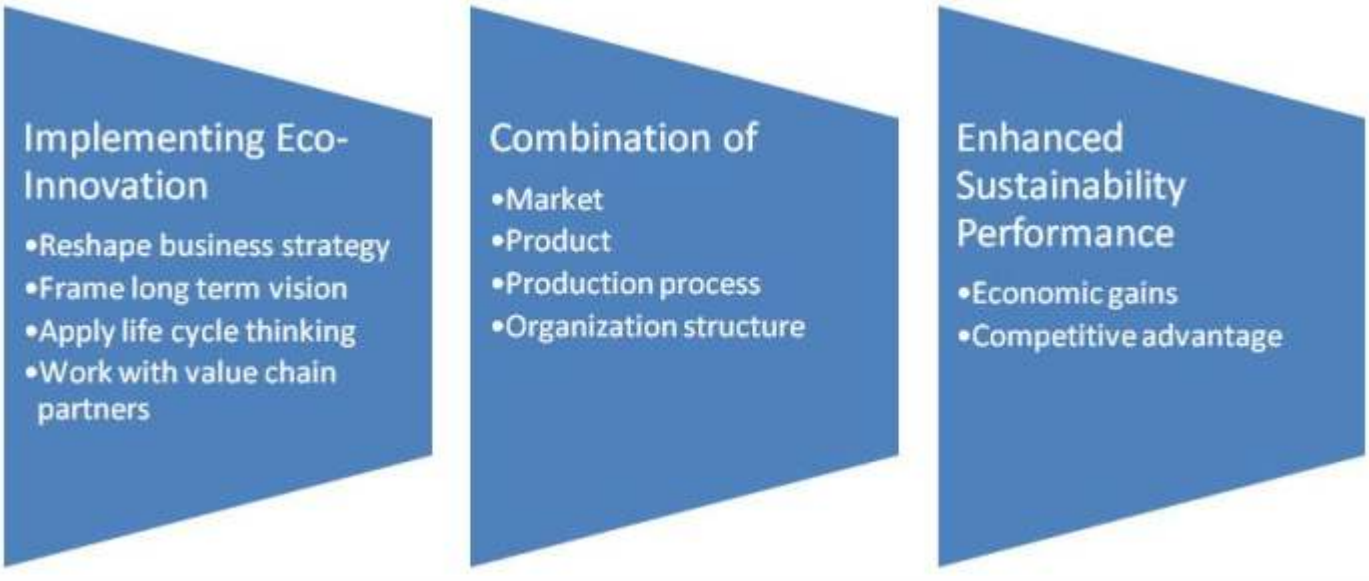
During the process, however, it is common for a film of water to build up on the walls of the condensers, slowing the cooling procedure and making the method less efficient. A water-repellent coating could reduce the inefficiency in the steam condenser. “Solving this materials challenge was our first obstacle,” says Professor Varanasi. “We're talking about a coating that is 2,000 times thinner than a piece of paper, yet strong enough to withstand years of harsh usage in a power plant.”

After years of testing at MIT's research labs, DropWise is now prepared for the commercial launch of the product. The startup was officially formed in late 2014, and has been busy lining up strategic investors. DropWise will deploy the water-repellent coating through a patented vapor-phase process, now capable of forming a durable bond on a variety of complex industrial parts.

Professor Varanasi estimates that power plants would start using the coating within the next two years, which would immediately deliver a 3 percent efficiency gain in the plants' output. Thermal power plants are the second largest consumer of water on the planet, and the improvement in condenser efficiency would have a huge effect on global energy production and environmental sustainability.

DropWise's unique coating could significantly improve the global energy outlook. Professor Varanasi says DropWise's goal is to see their product make the world a better place. “We don't want to stop at writing papers about our research; we want to scale things up and completely change the paradigm.”

Source: Span, May/June 2015
http://span.state.gov/science-technology/wiser-power-plants



http://www.unep.org/ecoinnovationproject/

The Environmental Information System acronymed as ENVIS was implemented by the Ministry of Environment & Forests by end of 6th Five Year Plan as a Plan Scheme for environmental information collection, collation, storage, retrieval and dissemination to policy planners, decision makers, scientists and environmentalists, researchers, academicians and other stakeholders.

The Ministry of Environment and Forests has identified Consumer Education and Research Centre (CERC), Ahmedabad, as one of the centers to collect and disseminate information on "Eco-labelling and Promotion of Eco-friendly Products". The main objective of this ENVIS Centre is to disseminate information on Eco products, International, and National Eco labeling programs.

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"Suraksha Sankool" Thaltej, Sarkhej-Gandhinagar Highway,
Ahmedabad 380 054, Gujarat, India.
Phone : 079-27489945/46,27450528, Fax : 079-27489947
Email : cerc-env@nic.in, cerc@cercindia.org, Website.
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