ENVIRONMENTAL ENGINEERING

DIVISION NEWSLETTER

DECEMBER - 2017

EED NEWSLETTER

ENVIRONMENTAL ENGINEERING features the Application of ENVIRONMENTAL Technologies to ENGINEERING Systems to attain OPTIMAL Performance according to ESTABLISHED Standards.

The Newsletter of the Environmental Engineering Division (EED) will attempt to highlight a Variety of Environmental Technology Applications aimed at Enhancing Engineering Systems Performances in accordance with the Latest Standards by presenting Excerpts of and Links to Selected Articles from a Variety of Websites. EED Members are encouraged to forward materials on Environmental Engineering topics for review by the Newsletter Editorial Staff. EED Newsletter Readers are urged to forward comments on materials that appear in its content.

The EED Newsletter will feature presentations in **NINE** Sections:

1. ENVIRONMENTAL TECHNOLOGIES
2. ENVIRONMENTAL REGULATIONS
3. EDITORIAL BOARD SELECTIONS
4. CHAIRMAN/DIVISION NEWS
5. NEWSLETTER READER COMMENTS
6. NEWSLETTER EDITORIAL BOARD
7. NEWSLETTER REFERENCES - TECH
8. NEWSLETTER REFERENCES – REGS
9. EDITORIAL BOARD SELECTION REFERENCES

It is envisioned that the EED Newsletter will be Monthly enterprise involving ALL members of the EED in its production. Your participation in providing and reviewing EED Newsletter materials is encouraged and will be greatly appreciated by the EED Newsletter Editors.

1. ENVIRONMENTAL TECHNOLOGIES

1. CERAMIC PUMP MOVES HIGH-TEMPERATURE LIQUIDS - 1

A ceramic-based mechanical pump developed at the Georgia Institute of Technology - with help from engineers at Purdue and Stanford universities - can move high-temperature (1,400°C) liquids such as molten tin. This could lead to high-efficiency, low-cost thermal storage for holding renewable energy generated by wind and solar power.

1. ENVIRONMENTAL TECHNOLOGIES

1. CERAMIC PUMP MOVES HIGH-TEMPERATURE LIQUIDS - 2

Researchers started with an external gear pump, which uses rotating gear teeth to suck in the liquid tin to a pipe and then push it out of an outlet. The gears were custom manufactured by a commercial supplier. The researchers made seals of graphite for the system. The pump operated in a nitrogen environment - to prevent oxidation at the extreme operating temperatures - continuously for 72 hours at a few hundred RPM in an average temperature of 1,200 C—with brief operation up to 1,500 C.

Because the researchers used a soft ceramic known as Shapal - a form of aluminum nitride known for its ease of machining - the pump sustained operational wear. But other ceramics with greater hardness will overcome that issue, and the team is already working on a new pump made with silicon carbide.

Among the most interesting applications for the high-temperature pump could be low-cost grid storage for surplus energy generated by renewables. Electricity created by solar or wind sources could heat molten silicon, creating thermal storage that could be used when needed to generate electricity. Molten silicon, with still-higher temperatures, may be more useful for storage because of its lower cost. The pump could operate at much higher temperatures than those demonstrated so far, even past 2,000 C.

Research teams are also looking at using the molten-metal pump as part of a device to extract hydrogen from methane without generating carbon dioxide. Because liquid tin doesn’t react with hydrocarbons, bubbling methane into liquid tin would crack the molecule to produce hydrogen and solid carbon without generating carbon dioxide - a greenhouse gas. (Ref 1)

1. ENVIRONMENTAL TECHNOLOGIES

2. COLBALT AND TUNGSTEN ARE KEYS TO CHEAPER, CLEANER H2

Researchers at the Institute of Chemical Research of Catalonia (ICIQ) and the University of Rovira Virgili in Catalan, Spain have discovered a compound made of cobalt and tungsten - technically called a polyoxometalate - that can accomplish water splitting better than iridium. Polyoxometalates are nanometric molecular oxides that combine the better of two worlds - the great activity of oxides and the wide versatility of molecules. Polyoxometalates are cheaper than iridium and allow operations to work in an acidic media - the optimal media in which to generate oxygen. Normally, acids usually consume catalysts. The catalysts also work especially well with low voltages. This will allow water splitting to be accomplished from renewable sources like solar. (Ref 2)

3. WASTE TREATMENT SYSTEM RECOVERS ENERGY

People in developed countries might not give much thought to what happens after the toilet is flushed, but in developing countries that's a serious problem. A system called the NEWgenerator is designed to help take the strain off sewage infrastructure, acting as a mini wastewater treatment plant that recovers energy, clean water and fertilizer from sewage. Units will soon be installed in South Africa.

Designed and developed by a team of engineers from the University of South Florida (USF), the NEWgenerator processes waste to produce three different resources. By hooking it up to existing toilet blocks, the system also removes the need for the facilities to be connected to sewage systems. The first generation of the NEWgenerator was installed for communities in India last year, and now the USF team has been awarded a grant of US$1.14 million by the Bill and Melinda Gates Foundation to bring two new versions of the system to Durban, South Africa. One is an updated version of the system used in

India, designed for use by up to 100 people per day, while the second is aiming to bump up that up to 1,000 users a day. (Ref 3)

1. ENVIRONMENTAL TECHNOLOGIES

4. CIGARETTE BUTTS - HYDROGEN STORAGE MATERIAL?

Chemists at the University of Nottingham, England have discovered that cigarette butt-derived carbons have ultra-high surface area and unprecedented hydrogen storage capacity. Cigarette butts presently are a pollution hazard because they contain cellulose acetate that is non-biodegradable. However, the cellulose acetate makes them an attractive starting material for valorization to porous carbons. Such valorization is in line with the current trend to move away from coal-based carbonaceous precursors to biomass-derived or waste-based starting materials for porous carbon synthesis. Hydrothermal carbonization, a process that requires only water and heat, of discarded cigarette butts yields a carbon product called hydrochar. When the hydrochar is activated it generates oxygen rich porous carbons that have high surface areas. This work raises the interesting question of whether valorization can solve the intractable cigarette butt problem and also offer porous carbons that attain new levels of hydrogen storage. (Ref 4)

5. NEW COATING TO PREVENT FAILURE IN STEEL BUILDING FIRES

Scientists from Nanyang Technological University (NTU) and a Singapore industrial developer, JTC have developed an affordable 3-in-1 coating that offers enhanced fire and corrosion protection. Existing steel structures in buildings are coated with a fire-retardant layer to shield the bare metal from damage by fire and meet the fire protection standard of 2 hours -- aimed at giving occupants enough time to evacuate the building. Today's conventional intumescent coatings are thick, more expensive and laborious to apply. In contrast, the Singapore *FiroShield*, coating can be applied to bare steel without the need for sandblasting to prepare the surface, reducing coating time by half, and will protect the material against fire for 2 hours without falling off. The new coating is cheaper and less laborious to

apply, and can function aesthetically like normal paint. *FiroShield* has also been tested on other construction materials, such as reinforced concrete and laminated timber, and has the same excellent performance. (Ref 5)

1. ENVIRONMENTAL TECHNOLOGIES

6. ENGINE DRIVEN BY NOTHING BUT EVAPORATION

A team of bioengineers at Columbia University has just created the first evaporation-driven engine. Using nothing more than a puddle of resting water, the engine, which measures less than four inches on each side, can power LED lights and even drive a miniature car. Better yet, the engine costs less than $5 to build.

The key to the new engine is a material called HYDRAs that are essentially thin, muscle-like plastic bands that contract and expand with tiny changes in humidity. A finger-length HYDRA band can cycle through contraction and expansion more than a million times with only a slight degradation of the material. HYDRAs can change shape in quite a dramatic way - they can almost quadruple in length.

The engine works at room temperature (70 F) with water over a wide range of temperatures—from 60 F to 90 F. Because water naturally evaporates faster at higher temperatures, hotter water works best. At 90 F, engine performance is 4 times better than its performance at 60 F.

For now, the evaporation engine is just a proof of concept meant to show that this unique type of energy generation really can be accomplished. Whether future devices will ever be able to compete with other renewable energy sources, such as wind or solar energy collection, may be a question that won't be answerable for decades. As Ozgur Sahin – the research team leader states: “The promise is there. Just consider the way the planet works: "The power in

wind on a global scale primarily comes from evaporation," he says, "So there's more power to be had here than there is in the wind." (Ref 6)

1. ENVIRONMENTAL TECHNOLOGIES

7. CAN JAPAN BURN FLAMMABLE ICE FOR ENERGY

Worldwide there are up to 2,800 trillion cubic meters of methane-bearing gas hydrate -- a frozen mixture of water and natural methane -- according to the United States Energy Information Administration. Vast reservoirs of this resource are found where high pressures and low temperatures combine -- i.e. buried inside thick Arctic permafrost and under deep ocean floors. Possibly the planet's last great source of carbon-based fuel, gas hydrates are thought to contain more energy than all of the world's other fossil fuels combined. So far though, no one is close to being able to extract it commercially.

Japan is trying. Between 2002 and 2017, its government spent $1 billion on hydrate research. In 2013, MH21 - a Japanese government-funded research group conducted the world's first extraction tests. The team positioned a drillship over a hydrate formation that lies 1,000 meters under the sea, south of the Japanese city of Nagoya. Hydrate melts if it is nudged out of its stability zone, which can be achieved by either raising the temperature or lowering the pressure. Pumping hot water under the seabed to heat the hydrates would require a lot of energy. The engineers drilled a well in the seabed and used a submersible pump to suck water out of the sediments. As the water level in the sediments drops, the pressure drops. This triggers the surrounding gas hydrates to start separating. The water is discharged into the sea, and the freed gas is piped to the surface. Japan's team became the first in the world to extract natural gas from offshore gas hydrate reserves. But their operation was short-lived. The venture was shut down after a few days when sand got into the outlet pipe. Earlier this year, the team made a

second attempt. They constructed two production wells and coated the pipes with a special polymer to reinforce them against sand intrusion. One well was still shut down by sand but in the other, the gas kept flowing. A total of 235,000 cubic meters of gas was extracted according to MH21 records. (Ref 7)

1. ENVIRONMENTAL TECHNOLOGIES

8. SOLAR GREENHOUSES GROW HEALTHY CROPS

Electricity-generating solar greenhouses utilize Wavelength-Selective Photovoltaic Systems (WSPVs), a novel technology that generates electricity more efficiently and at less cost than traditional photovoltaic systems. These greenhouses are outfitted with transparent roof panels embedded with a bright magenta luminescent dye that absorbs light and transfers energy to narrow photovoltaic strips, where electricity is produced. WSPVs absorb some of the blue and green wavelengths of light but let the rest through, allowing the plants to grow. WSPV technology was developed by two professors at UC Santa Cruz, who founded a company – Soliculture - in 2012 to bring the technology to market. (Ref 8)

9. SUSTAINABLE AVIATION SOLUTIONS

Researchers at University of Delaware (UD) are working to make bio-based fuels from corncobs and wood chips. The UD team has developed a technique that can produce fuel from ligno-cellulosic biomass. Affiliated to the Catalysis Center for Energy Innovation (CCEI) - an Energy Frontier Research Center backed by the U.S. Department of Energy - the UD team is benefitting from having access to leading scientists attached to the nine institutions linked to CCEI.

The low temperature of the UD process can enable cost-competitive and sustainable production of bio-based aviation fuels from lingo-cellulosic biomass. Airlines are keen to go down this route, with Quantas announcing earlier this month, that by the end of the decade its aircraft in Los Angeles will be powered

by biofuels. The airline industry needs to take these steps, as by 2035, the International Air Transport Association (IATA) estimates there will be 7.2 billion air passengers, up from 3.8 billion last year. (Ref 9)

1. ENVIRONMENTAL TECHNOLOGIES

10. AUTOMATED CONSTRUCTION SITES

Artificial intelligence, 3D printing, and robotics are poised to bring automation to building construction. Here are 6 leading construction technologies:

1. The ETH Zurich University FABRICATOR will soon be laying down bar for the NEST (Next Evolution in Sustainable Technologies) structure in Dubendorf, Switzerland The FABRICATOR – A ROBOTIC ARM ON CATERPILLAR TRACKS - will be constructing a mesh framework that will subsequently be filled with concrete.

2. Construction Robotics SEMI-AUTOMATED MASON, or SAM, can put down 6,000 bricks per day, with mortar. SAM won't eliminate all human workers, though. They will still be needed to tidy up the mortar and to load the SAM.

3. Copenhagen's BOD (Building On Demand) structure will be made this year with a Contour Crafting GANTRY PRINTER capable of putting down layers of concrete 50 to 70 millimeters thick at 2.5 meters per minute. The concrete it will use will be made from sand and recycled tiles.

4. Researchers at ETH Zurich University managed to use a few quad-copters, working in harmony, to build a rope bridge. If they can solve the small issue of power, drones could bring material to any point in space for any kind of building.

5. SMARTVID engineers used the millions of photos/videos of construction sites to teach their AI construction program what unsafe conditions look like. Now, anyone on a construction site can take a picture and have SMARTVID identify potentially unsafe areas. Similar technology could guide robots to fix errors or at least to flag a human when they see something dangerous.

6. This year MIT researchers used the DIGITAL CONSTRUCTION PLATFORM (DCP) to create a 12-foot high, 50-foot diameter dome out of foam insulation in only fourteen hours. The foam of that structure, or of any similarly constructed building, could easily be fitted with rebar and filled with concrete. (Ref 10)

2. ENVIRONMENTAL REGULATIONS

1. NEW MANDATE ENHANCES TRUCKING DELIVERY EFFICACY

Trucking companies represent more than 500,000 businesses in the US and utilize over 15.5 million trucks on the road. In December 2017, the Electronic Logging Device (ELD) Final Rule will come into effect. The law will require drivers to use either an app or on-board logging device to automatically record a driver's hours of service. Operators will be able to use ELD data to re-evaluate their routes and to potentially find more efficient courses. It is expected that ELDs will save the trucking industry $1.6 annually by enhancing delivery efficacy – bringing products more quickly over shorter and more direct routes. (Ref 1)

2. US POWER SUPPLY CAN ADAPT TO CLIMATE CHANGE

Improvements in resiliency are largely the result of efforts driven by policy and economic opportunities that are making the US power supply cleaner and more efficient, said scientists with the Advanced Science Research Center (ASRC) at the City University of New York (CUNY). Modern power plants use fewer natural resources, such as water, to produce electricity, making them more adaptable to warmer, drier conditions than older plants. And they are better able to maintain power supply reserves during peak demands. While some regions appear susceptible to climate-change-related constraints on electricity production, an excess of reserves in other less-affected regions can aid those with diminished reserves. The research team analyzed 1,080 thermoelectric plants across the contiguous United States under future climate conditions and evaluated both their individual and collective performance across 19 North American Electric

Reliability Corporation (NERC) sub-regions. The utilization of demand-response measures, gas turbines, renewable energy sources, and electricity imported from other regions may help ensure a steady supply of power that can meet demand under severe weather conditions. (Ref 2)

3. EDITORIAL BOARD SELECTIONS

1. FOURTH NATIONAL CLIMATE ASSESSMENT (NCA4)

PRIMARY FINDINGS OF THE REPORT

GLOBAL AND U.S. TEMPERATURES CONTINUE TO RISE

- The annual average temperature for the globe and the contiguous U.S. has increased 1.8 F from 1901 to 2016. Sixteen of the warmest years on record for the globe occurred in the last 17 years; the last three years were the warmest.

VARIABILITY IN TEMPERATURE AND PRECIPITATION IS INCREASING

- Heavy precipitation has increased in intensity and frequency across the U.S. since 1901, though there are important regional differences. Heat waves have become more frequent in the U.S. since the 1960s.

OCEAN TEMPERATURES ARE WARMING AND AN INCREASE IN SEA LEVEL

- Global average sea level has risen by about 7-8 inches since 1900.Global average sea level is expected to rise by several inches in the next 15 years.

TEMPERATURE INCREASES IN ALASKA AND ACROSS ARCTIC ARE GREATER THAN THE REST OF THE GLOBE

- Annual average near-surface air temperature in Alaska and across the Arctic has increased over the last 50 years at a rate more than twice as fast as the global average temperature.

- Since the early 1980s, Arctic sea ice extent has decreasedbetween3.5 percent and 4.1 percent per decade, has become thinner by between 4.3 and 7.5 feet, and on average the season of melting lasts 15 more days per year. (Ref 1)

3. EDITORIAL BOARD SELECTIONS

2. PATENTS ON SOLID-STATE BATTERY DESIGNS

Fisker scientists, including a co-founder of solid-state battery start-up Sakti3 filed patents this week (under a non-publication request) on flexible, superior energy density solid-state batteries. The patent includes claims over novel materials and manufacturing processes that are critical in achieving the required energy density, power and cost targets required for the widespread use of electric vehicles.

Fisker solid-state batteries will feature three-dimensional electrodes with 2.5 times the energy density of lithium-ion batteries. Fisker claims that this technology will enable ranges of more than 500 miles on a single charge and charging times as low as one minute—faster than filling up a gas tank. Fisker anticipates the technology to be automotive production grade ready in 2023.

Early results show that Fisker solid-state technology enables the construction of bulk three-dimensional solid-state electrodes with 25 times more surface area than flat thin-film solid-state electrodes and extremely high electronic and ionic conductivities—enabling fast charging and cold temperature operation. As a result, Fisker battery delivers 2.5 times the energy density of typical lithium-ion batteries, with the potential of costing one third of the 2020-projected price of those batteries due to advances in materials and manufacturing.

Fisker flexible solid-state electrode construction will enable batteries with versatile voltage and form factors. They may be wound in cylindrical cells with higher voltage output, allowing usage of current tooling and machinery for

battery packs—in addition to lesser cell-to-cell connections, thermal management and safety requirements. This further reduces battery system costs. (Ref 2)

(CONTRIBUTED BY DR. JAMES ZUCCHETTO, EED NEWSLETTER ASSOCIATE EDITOR)

4. CHAIRMAN/DIVISION NEWS

EED will be sponsoring a Joint Meeting with the St. Louis, MO Section of ASME and is currently looking for a Speaker for the event. The meeting will be scheduled in either February or March of 2018 at the Engineers Club in St. Louis, MO. We are looking for a speaker to present for 1-2 hours on an environmental topic such as Remediation/Superfund sites. If you are interested please email Ryan at ryanneil84@hotmail.com with a potential topic and availability.

5. EED NEWSLETTER READER COMMENTS

YOU ARE ENCOURAGED TO FORWARD YOUR COMMENTS ON THE TOPICS AND DISCUSSIONS PRESENTENTED IN THE EED NEWSLETTER. PLEASE FORWARD YOUR COMMENTS BY EMAIL TO ANY MEMBER OF THE EED NEWSLETTER EDITORIAL BOARD. THEIR EMAIL ADDRESSES APPEAR IN THE SECTION BELOW

6. EED NEWSLETTER EDITORIAL BOARD

DR. JAMES ZUCCHETTO – USA (jimzuc@comcast.net)

7. NEWSLETTER REFERENCES - TECHNOLOGIES

1. http://www.machinedesign.com/materials/ceramic-pump-moves-high-temperature-liquids

2. https://www.sciencedaily.com/releases/2017/10/171030134637.htm

3.https://newatlas.com/newgenerator-recovers-energy-clean-water-nutrients-sewage/52008/?utm_source=Gizmag+Subscribers&utm_campaign=9321454c20-UA-2235360-4&utm_medium=email&utm_term=0_65b67362bd-9321454c20-91116065

4.https://www.sciencedaily.com/releases/2017/10/171031120514.htm

5. https://www.sciencedaily.com/releases/2017/10/171031085428.htm

6. http://www.popularmechanics.com/science/energy/a16045/evaporation-engine/

7. http://edition.cnn.com/2017/10/31/asia/on-japan-flammable-ice/

8. https://www.sciencedaily.com/releases/2017/11/171104134440.htm

9. https://www.innovatorsmag.com/sustainable-solutions-a-high-priority/

10. http://www.asme.org/engineering-topics/articles/manufacturing-design/6-paths-automated-construction-site

NOTE: IN ORDER TO VIEW THE REFERENCES LISTED ABOVE, IT IS NECESSARY TO SWIPE OVER THE REFERENCE TEXT ON YOUR SCREEN – THEN COPY THE

REFERENCE TEXT – AND THEN ENTER THE TEXT COPY INTO A WEB ADDRESS AREA ON A SECOND WINDOW SCREEN TO VIEW THE REFERENCE MATERIAL.

8. NEWSLETTER REFERENCES - REGULATIONS

1. https://oilprice.com/Alternative-Energy/Renewable-Energy/New-Mandate-Pushes-Trucking-Industry-Fuel-Efficiency.html

2. https://www.sciencedaily.com/releases/2017/10/171030123410.htm

9. EDITORIAL BOARD SELECTION REFERENCES

1. http://www.greencarcongress.com/2017/11/20171113-fisker.html

2. https://www.sciencedaily.com/releases/2017/11/171106143741.htm

NOTE: IN ORDER TO VIEW THE REFERENCES LISTED ABOVE, IT IS NECESSARY TO SWIPE OVER THE REFERENCE TEXT ON YOUR SCREEN – THEN COPY THE REFERENCE TEXT – AND THEN ENTER THE TEXT COPY INTO A WEB ADDRESS AREA ON A SECOND WINDOW SCREEN TO VIEW THE REFERENCE MATERIAL.

DISCLAIMER

Disclaimer: This Newsletter may contain articles that offer differing points or views regarding energy and environmental engineering issues. Any opinions expressed in this publication are the responsibility of the Editor, Editorial Board

and the Environmental Engineering Division and do not represent the positions of the American Society of Mechanical Engineers (ASME).

DIVISION NEWS – SPECIAL ANNOUNCEMENT

ASME Enhances Environmental Impact Through EED Education Support Program

PROPOSAL DUE DATE: FEBRUARY 15, 2018

Environmental engineers use the principles of engineering, soil science, biology, and chemistry to make the air, water and land better and safer for humans. To engage students and educators in this discipline, and foster the impact of environmental engineering education in communities around the world, the ASME Environmental Engineering Division (EED) Announces the 2018 Environmental Engineering Education Support Program. This program will fund a maximum of $25,000 per year. No more than five proposals will be funded with a limit of $5,000 per award to students, educators and EED members who propose interesting ways to impact environmental education in their communities. Based upon judgment of final reports, at least one proposer will be invited to discuss their project at the annual EED meeting. All travel expenses will be provided.

Examples of Environmental Engineering Education Support Program Proposals

- **Funding an EED Member Paired with a Local Educator to Develop a Curriculum Unit Over a Summer that can be Put Into Practice the Following School Year. EED Members will Share Units that are Successful with Other Educators.**
- **Funding support for a non-ASME member educator (Primary and/or Secondary School Teacher) to Attend an ASME Sponsored Environmental Event (e.g., Conference, Training/Certification Program, Workshop, etc.) in Support of Curriculum Development.**

- **Funding of a Project Based on Environmental Engineering and Mechanical Engineering Principles that Appears Promising for Enhancing Environmental Education.**
- **Funding Support for a College, or a Graduate Student to Attend an ASME Sponsored Environmental Event (e.g., Conference, Training/Certification Program, Workshop, etc.).**

DIVISION NEWS – SPECIAL ANNOUNCEMENT

ASME Enhances Environmental Impact Through EED Education Support Program

This will be the THIRD YEAR that EED has funded an Education Support Program. Projects supported in the first two years of the program were:

- **"*Wind Energy Student Organization;*" Iowa State University (ISU)**
- **"*Lab Component for Sustainability Course,*" Philadelphia University**
- **"*Using Interactive iPython Simulations to Model Life Cycle Analysis of Ethanol Production,*" Marshalltown High School (Iowa), ISU**
- **"*High School Student Laboratory Education Module: Use of Abundant Waste Materials in Concrete Mix Design,*" University of Akron**
- ***"Education of Rural Community Members and Leaders About the Health Effects, Current State, and Minimizing of Particulate Matter Exposure in Rural Households that Use Biomass for Cooking,*" FEU Institute of Technology, Manila, Philippines**
- ***"Experimental Design: Development of a High School Environmental Research Program, "* Hope College, Holland, MI.**
- ***"Water for Life: A Project-Based Approach to the 7th Grade Classroom,"* Mission Achievement & Success Charter School, Albuquerque, NM**
- ***"Citizen Science: Effects of Stream Restoration on Water Quality,"* George Mason High School, Falls Church, VA**
- ***"Designing a Sustainability Makerspace,"* Rose-Hulman Institute of Technology, Terre Haute, IN.**

PROPOSALS - INCLUDING A BUDGET - MAX 5 PAGES - MUST BE SUBMITTED ELECTRONICALLY BY 15 FEB 2018 TO:

edelsonm2@asme.org

PROJECTS THAT PAIR AN EED MEMBER WITH AN EDUCATOR WILL RECEIVE THE HIGHEST PRIORITY. EXPECTATION IS THAT THE MAJOR SHARE OF FUNDING WOULD SUPPORT EFFORTS OF THE EDUCATOR.