Company Registration Number: 196300098Z

Immediate Release

Sembawang Shipyard's Green Wave Environmental Care Project for Schools 2010, Sets a New Benchmark with Record High Participation of Over 1,250 students From 77 Schools and Institutions

Singapore, January 13, 2011 : Sembawang Shipyard Pte Ltd, a subsidiary of Sembcorp Marine Ltd, achieved a new benchmark for its Green Wave Environmental Care Competition for Schools 2010 with a record participation of 312 project entries received from more than 1,250 students – an all-time high since the competition's launch eight years ago.

With active involvement from schools and strong support from the private and public sector, this annual competition has seen a more than two-fold increase in participation rate. The number of entries and participants have risen impressively by 166% and 99% respectively since the start of the competition in 2003, which saw 117 project entries from 627 students back then.

The 49 winning teams, representing the best entries from this year's Green Wave Environmental Care Competition, will be recognized during an award presentation ceremony graced by Guest-of-Honour Dr Mohamad Maliki Bin Osman, Senior Parliamentary Secretary, Ministry of National Development, and MP for Sembawang GRC (Admiralty) at the Marina Mandarin Hotel, Singapore this morning.

This annual competition is opened to all students from Primary, Secondary, Junior Colleges and Institute of Technical Education (ITE) to Tertiary Institutions. Organised by Sembawang Shipyard and co-sponsored by the yard's partners, Shell International Trading and Shipping Company Limited (UK) and BP Shipping Limited (UK), the competition aims to encourage young environmentalists to further create, sustain and implement ideas on environmental issues for the improvement and sustainability of its planet. This environmental outreach programme for schools

is widely encouraged and supported by prominent environmentalists and environmental groups in Singapore, many of whom are involved in the judging panels of the competition.

Mr Victor Savage, Chairman of the Green Wave Advisory Board who is also one of the judges of the competition said :"The panel of judges was impressed by the quality of the submissions and the depth of thought, practical knowledge and environment understanding which our young have demonstrated in their application of solutions to address critical environmental issues and challenges. Some of the winning entries are innovative products and prototypes which are practical and effective. The environmental innovations clearly have room for further redevelopment and commercial usage. In a nutshell, Greenwave as a platform seeks to encourage our youths to be entrepreneurs and our young to become environmental ambassadors of eco-friendly practices. One only has to witness our students' enthusiasm and infectious energy in demonstrating their innovations at the Exhibition to feel their passion and experience their commitment to nature and the environment."

Reinforcing the growing environmental awareness in schools, Mr Ong Poh Kwee, Managing Director of Sembawang Shipyard said: "It is heartening to see more and more participants for the Green Wave Environment Competition each year as it shows that our student population is taking an increasingly proactive role in tackling environmental issues and sharing creative ideas on environmental care and protection. I am impressed that even the younger ones have shown maturity beyond their years when it comes to environmental conservation and practical application of green ideas. I congratulate all the winners of the Green Wave competition and urge and encourage more students to use this meaningful platform to engage and showcase their innovative ideas and products. Together, our combined efforts will be a sum greater than its parts, and in our own ways, big or small, our contributions will collectively make a difference to our environment and towards our nation's strive to be a world-class green city."

Mr Ong further added : "The shipyard is grateful to our dedicated panel of judges for their unwavering support over the years. Our distinguished panel of judges for 2010 are from BP Singapore Pte Ltd, CH^{2}M Hill Singapore, Housing Development Board, Khoo Teck Puat Hospital, Ministry of Education, National Institute of Education, Nanyang Technological University, National Environment Agency, National Parks Board, National University of Singapore, Public Utilities

Board, Ngee Ann Polytechnic, Siloso Beach Resort, Singapore Environment Council, Singapore Science Centre and Singapore University of Technology and Design. We also thank our partners, Shell International Trading and Shipping Company Limited and BP Shipping Limited, the co-sponsors of this competition, for their continued strong support. Special appreciation also goes to the Green Wave Advisory Board for their guidance."

The Green Wave Environment Competition 2011 is now open for registration and all students and schools are invited to participate and share their ideas on environmental care and protection. Winning teams can expect the following attractive awards:

Primary Schools	1st Prize	S$4,000
	2nd Prize	S$2,000
	3rd Prize	S$1,000
Secondary Schools	1st Prize	S$6,000
	2nd Prize	S$4,000
	3rd Prize	S$2,000
Junior Colleges / ITEs	1st Prize	S$8,000
	2nd Prize	S$5,000
	3rd Prize	S$3,000
Tertiary Institutions	1st Prize	S$10,000
	2nd Prize	S$6,000
	3rd Prize	S$4,000

The 1st Prize in the Tertiary category is jointly sponsored by Shell International Trading and Shipping Company Limited and includes a one-month attachment to a Shell associate company. The 1st Prize in the Junior Colleges / ITEs category is jointly sponsored by BP Shipping and includes a one-month development attachment to BP Singapore. Winners of the top prizes at the Junior College / ITE and Tertiary levels will also be offered attachments with Sembawang Shipyard in divisions such as Engineering, IT, Human Resources, Operations and Business.

The prize money for the Primary, Secondary and Junior Colleges and ITEs should be shared on a 60%-40% basis with 60% of the prize award going to the school fund and the remaining 40% to the student/students in the project team. The prize money for the Tertiary Level will be shared by the student participants in the teams and the tertiary institutions on a 60% / 40% basis.

About Sembawang Shipyard

Sembawang Shipyard, a wholly-owned subsidiary of Sembcorp Marine, has one of the largest integrated ship repair and conversion facilities in Southeast Asia. With more than four decades of experience and proven track record in ship repair and offshore conversions, the shipyard's world-class reputation is based on the company's commitment to superior customer service, innovative solutions, quality, and strict Health, Safety, Security and Environment standards.

Besides the traditional sectors of tankers and bulkers, Sembawang Shipyard is a recognised specialist in the niche markets of FPSO/FSO conversions, offshore vessels conversions and newbuildings, complex lengthening conversions, passenger ship conversions/refurbishment, chemical tankers, liquefied gas carriers, offshore rigs and navy ship repairs.

In July 2002, Sembawang Shipyard became the first shipyard in South East Asia to achieve ISO14001 Environmental System Certification by Det Norske Veritas Ltd. The certification is a firm endorsement of the shipyard's commitment and efforts towards environmental preservation and protection. The Green Wave Environmental Care Project for schools is one of the shipyard's key environmental outreach programme. The shipyard is pleased to be the first in the industry to promote environmental care and protection to all schools in Singapore.

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The press release and details of the Green Wave Environment Competition is also available at our website: www.sembship.com/greenwave

APPENDIX 1

The Winners for the Green Wave Environmental Care Competition for 2010 are:

(A) PRIMARY LEVEL

Prizes	School	Title of Project	Participants
1st Prize S$4,000	Stamford Primary School	ER@Stamford	Lee Ming Hui, Yao Leyang, He Shiying, Wu Weiling, Riswana Begum, Glenn Ang Han Tong, Ang Lu Ling, Ang Lu Shing, Qu Mei, Ge Mingxuan, Tou Gimmy, Htat Wai Yan
2nd Prize $2,000	Corporation Primary School	Hydro-electric building (HEB)	Song Lizhi, Tay Yin Seng, Muhammad Fauzan Bin Fauzi, Yaw Qin Chang
3rd Prize $1,000	Methodist Girls' School	The green tote	Lianne Chia, Audrey Koh, Kezia Lam Jia En, Megan Tay Wan Ting, Leong Jann En, Maltida Woo Pui Shan, Janette Soh Yingrui, Chloe Ang Si-En, Angelia Gan, Elizabeth Lynne Chee
Merit Award $500	Yishun Primary School	Fruit-peel-wash	Bo O John Kobe Saludo, Soliven Janriel Stephen C, Liu Zhanghe, Tut Myat Bwar
Merit Award $500	Yew Tee Primary School	Homes in plastic...they're fantastic!	Tan Wei Liang, Jovan Yeo Rui, Kuan Yi Heng
Merit Award $500	Xingnan Primary School	Effect of the low cost phytohormone sources on the propagation of arsenic hyper-accumulating ferns	Nicolas Ian Blackburn, Chen Xinyu, Phyllis Loo Yun Yi, Ng Ying Liang
Merit Award $500	Xingnan Primary School	Cool chairs	Keane Wee Jin Yen, Afiqah Syalwani Binte Hamir, Nicholas Phoon Jing Zhi, Cheng Wan Ying
Merit Award $500	Lakeside Primary School	Act now-act fast	Ray Chua Yue Chern, Yong Yu Xuan, Rohit Rajesh Bhat, Pyae

			Phyo
Merit Award $500	Kuo Chuan Presbyterian Primary School	Nurture the neem	Jeslyn Ng Xin Yi, See Rei Yen, Maanasa Sri Ganesh
Merit Award $500	CHIJ Our Lady of the Nativity	OLN Science Resource E-book	Gladys Ho Yen Yee, Lydia Lim Yi Xuan, Judi Ng Kwai See, Vera Seah Shuen Min, Joan Danielle Toledo Rubiano
Encouragement Award $200	Shuqun Primary School	Self-sustaining' bottle garden	Tha Zin Aye, Ryan Ong, Joyce Ng Cuixian
Encouragement Award $200	North View Primary School	3R watering device	Teo Rui Fang, Lok Yee Ling, Andrade Ara Daniela Estrella, Kevin Lim Ern Kee
Encouragement Award $200	Fuhua Primary School	Fuhua "Go green" 3D-Game	Seah Jia Jun, Harish Vatsen, Christopher Anthony Simm, Zane Wong Yu Jun

(B) SECONDARY LEVEL

Prizes	School	Title of Project	Participants
1st Prize $6,000	Raffles Institution	Go Safe the Green Way	Dexter Sim You Kuan, Quek Boon King, Maurice Ng Tong Yi
2nd Prize $4,000	Hwa Chong Institution	Recycling Waste Coffee : From Trash to Cash	Rick Wong Tuck Jun, Ang Wei Jian, Auyok Sean
3rd Prize $2,000	Hwa Chong Institution	Piezoelectric generator	Lee Choon Kiat, Lim Jun Weng, Lee Choon Kiat
Merit Award $1,000	Raffles Institution	Making a brick out of unwanted sawdust	Nathan Siaw Seng Taat, Roy Soo Jiunn Jye, Flelix Yeoh Zhi Guang, Ken Oung Yong Quan, Elwin Sim Jun Yi
Merit Award $1,000	Dunman Secondary School	Shall we use it? Shell. We used it!	Dexter Choo Yun Zhang, Jovan Lee Hao Wei, Amri Bin Borhan, Daniel Kang Wei-En
Merit Award $1,000	Nanyang Girls' High School	Biodegradable Starch-based Plastic	Zou Yuhan, Du Xuesong, Liu Jiani
Merit Award $1,000	Xinmin Secondary School	Biodegradable Plastic	Willianto, Li Jing Yin, Shawn Hoo Yong Chuan, Justin Yeo Wei Min
Merit Award $1,000	Raffles Institution	Enviropolis	See Yong Xin, NathanielTan Rui Xian, Joseph Lee Wei En, Joseph Tan Yong Sheng
Commendation Award $500	Anglo-Chinese School (Independent)	Floating Garden	Choo Jia Le, Jonta Koga
Commendation Award $500	Raffles Institution	REGENERATE THE "R"s - The Children's Set to Environmental Awareness	Khasnavis Krishnakanth Puneeth, Ke Yuxuan, Shanmugam Saravanan, Vijay Periyannan
Commendation Award $500	Raffles Institution	Green Banners Merchandise	Bodi Chinnarao, Muhammad Azhar, Kalyanasundaram Ragavendra, Ravi Singaram

Commendation Award $500	Raffles Institution	Greenfeste! Environmental Sharing@RI 2010	Isaac Chong Yi Jie, Sudeep Agarwal, Ong Chuan Kai, Jonathan Ang Six Xian
Commendation Award $500	Nanyang Girls' High School	Green-O-romatherapy	Jamie Foo Jie Min, Ching Hui Qi, Chang Shin Yee, Rachel Ng Su Min
Commendation Award $500	Marsiling Secondary School	Natural Fabric Dye	Nurul Mutmaina Bte Noorzalan, Jewel Lim Wan Yan, Jesper Poh Yang Tze, Fitri Daniel Bin Muhamed Husaini
Commendation Award $500	Nanyang Girls' High School	Rain, Spin, Generate	Goh Jie Ying, Jolene Lee Shu Jun, Lim Hui Hong, Ong Wan Li, Tan Jing Yi

(C) JUNIOR COLLEGE / INSTITUTE OF TECHNICAL EDUCATION

Prizes	School	Title of Project	Participants
2nd Prize - $5,000	ITE College West	Wind generator to Electrical Supply	Muhammad Bin Mohd Jauhari, Ong Hui Li, Muhammad Abdullah B Hafazul
3rd Prize - $3,000	Hwa Chong Institution	The Pressure Sensitive Thimble	Selina Sia Xin Jie
Merit Award - $1,000	ITE College West	Auto PowerOFF	Muhammad Ashiq Ali Bin Abdul H, Sum Jun Hao, Wee Teng Yoong, Jamaludin s/o Mohamed Igbal
Merit Award - $1,000	Anglo-Chinese School (Independent)	Grass Paper	Nicholas Ngiam Jinghao, Lee Chiang Fong, Tong Nhat Duong
Merit Award - $1,000	ITE College Central (Yishun Campus)	Smart Fan	Ahmad Kamal Bin Azman, JOHNSON ONG JUN LIANG, Krystof Orlandus B. Ebarvia
Merit Award - $1,000	Anderson Junior College	CNT-mica Hybrid - A way to stop oil spills	Nickie Seoh Limin, Keith Chia Ruixiang, Avan Kwek Yao Xuan, Bernice Mok Shu Hui
Commend ation Award - $500	Yishun Junior College	Project RUSCO (Recycling of Used Cooking Oil)	Chin Wen Jie, Daryl Tay Hao Zhong, Poh Yi Fei
Commend ation Award - $500	ITE College Central (Yishun Campus)	Wind Power Charger for Vehicle	Alvin Lee Yu Qing, Kate Pauline Villon, Joann Christine Crespo, Liu Yang
Encourage ment Award - $200	Hwa Chong Institution	Hydraulic Dish Blockbuster! (HDB)	Wang Ying, Mak Yee Phon, Kong Ka Kay, Chen Qinyan
Encourage ment Award - $200	ITE College East	Development of biofilm filtration system for waste water used in home	Khoo Chia Loon, Chow Zi Xiang, Wang Wei Xuan, Tan Jing Ting
Encourage ment Award - $200	ITE College East	CEPAS - Enabled Power Socket	Norazlan B Suhaimi, Nazrul Shahrin B Saburudin, Ching Yulin

(D) TERTIARY LEVEL

Prizes	School	Title of Project	Participants
3rd Prize $4,000	Ngee Ann Polytechnic	Washing Machine Recycling Water System	Nur Aqilah Bte Muhammed Hashim, Li Kit Ming
3rd Prize $4,000	Temasek Polytechnic	CANs MEAN CAN!	Kristebella Lim Tianyu, Peggy Poh Pei Chi, Deborah Seet Ru Shan
Special Merit Award $2,000	Nanyang Technological University	Eco-line- A Green Integrated MRT System for the Future	Tai Ming Hang, Mo Yu, Kenny Tan Yi Ann, Ma Cong, Gao Yiben, Zhang Xiaojin, He Hanzhao
Special Merit Award $2,000	Singapore Polytechnic	Separating the Domestic Waste at Source - The Recycle Bin	Daryl Ng Zheng Yu, Muhammad Aidil Shuklan Bin Abdul Razak, Yu Huan
Special Merit Award $2,000	Ngee Ann Polytechnic	Solar Power Hydrogen Welding Torch	Lionel Seah Hao Feng, Leong Wei Jie, Navaneesvaran S/O Panjanathan, S. Athista Prabu
Commend ation Award $500	Ngee Ann Polytechnic	Wave Harnessing Structure	Jeremy Tay Gui Qiao, Chua Kwee Hong, Safwan Bin Slamat, Siti Khairunnisa Binte Jamaludin
Commend ation Award $500	Ngee Ann Polytechnic	Tidal - Energy Generator	Teo Jun Hao, Jackson Teo Eng Kiat, Malcolm Lee Jia Yi
Encourage ment Award $200	National University of Singapore	Rainwater Harvesting Technology via Novel Greenroof Configuration	Winnie Heng Yun Ni
Encourage ment Award $200	National University of Singapore	Vermicomposting of Organic Wastes in Singapore	Lam Yuen Sean
Encourage ment Award $200	Republic Polytechnic	Improve the efficiency of solar panels through hydro cooling	Deanna Yong Hui Lan, Cheong Liling, Muhammad Ali Hanafiah Bin Mohd Razif, Ravindran, Ma Lwin Mar Soe

(A) PRIMARY LEVEL

Prizes	School	Title of Project	Participants
1st Prize S$4,000	**Stamford Primary School**	**ER@Stamford**	**Lee Ming Hui, Yao Leyang, He Shiying, Wu Weiling, Riswana Begum, Glenn Ang Han Tong, Ang Lu Ling, Ang Lu Shing, Qu Mei, Ge Mingxuan, Tou Gimmy, Htat Wai Yan**
Project Summary	The seed for ER@ Stamford [Environmental Regenesis] was sown at the Green Wave Awards Presentation Ceremony 2009. Before embarking on this project, most of us had no prior experience in taking care of a living thing. Most of us have no pets or plants in our homes for various reasons: lack of parental approval, space or time to be responsible for another living thing. For some of us, the idea of being personally responsible for a living thing had never even entered our heads! We were therefore rather excited and keen to participate as 'paramedics' when given the rare opportunity to take care of a plant in school. Not just any plant, but a vulnerable or endangered plant indigenous to Singapore. Like the rest of the world, Singapore is fast losing its green/natural habitat to meet the demands of a rising population and rapid development. Once gone, THERE IS NO RETRY. We wanted to do our part to conserve the endangered indigenous plants in Singapore. Hence the idea of ER [as in Emergency Rooms] and the use of IV drips in saving these plants! The main objectives of this project were to help us become knowledgeable and educated about endangered plants through a hands-on approach so that we could be aware of the challenges faced in growing these plants and develop the necessary thinking skills to meet these challenges. In the process, we also hoped to develop the commitment to be responsible for another living thing. At the same time, we wanted to impart the message of recycling by reusing plastic bottles as pots and as a curtain of reminder to recycle. With a living wall of plants and a curtain of plastic bottles, we hoped to create a living dynamic learning laboratory at a void deck in our school where we students can have outdoor lessons on conservation. Eighty-two P4, P5 and P6 students took part in this project. As paramedics, we were each responsible for potting our plants and taking care of our plants by ensuring that the water bottles were refilled and monitoring their growth. We tried to understand the needs of the plant by taking readings of environmental conditions such as air temperature, light intensity, relative humidity, pH value of soil water and wind seed. Our teachers encouraged us to think of		

	ways to help our plants grow better. We shared our journey with our plants with the whole school community at an assembly period in the form a skit and Powerpoint presentation. We obtained very encouraging feedback on our presentation from 6 selected classes. 94% of these students [non-paramedics] surveyed indicated that they could do their part in conservation. 81% indicated that they would try to practice conservation. What is very heartening is that a comparison between the non-paramedics' and paramedics' feedback showed that a higher % of paramedics (97%) indicated that they would practice conservation. This suggest that having gone through the hands-on personal experience of caring for another living thing, the plant, paramedics are more open to the idea and practice conservation. We hope that what we have experienced and learnt in our journey with our own plants may be adopted by others in Singapore. If everyone of us takes up the challenge of growing one endangered indigenous plant in Singapore, we would all have played a part in the greening of Singapore, our garden city where all can 'live, work and play'.		
2nd Prize $2,000	**Corporation Primary School**	**Hydro-electric building (HEB)**	**Song Lizhi, Tay Yin Seng, Muhammad Fauzan Bin Fauzi, Yaw Qin Chang**
Project Summary	We are using resources faster than the Earth is providing us! Most of the time, fossil fuels are used to generate electricity. In a small country where we have limited natural resources and land, we have to think of solutions to the energy supply that is within our costs as well as the conservation issues in generating electricity. At the same time, we have to consider the constraints that our small nation is facing. Solar panels are too costly while using windmills to generate electricity requires large open lands so that the prevailing wind is not blocked. Generally, most of the lands in out country are low-lying. With a limited land area of about 710.2 square kilometers, we have to construct high rise buildings to house our population of about 5 million. We do not have fast-flowing rivers from where we can tap on the kinetic energy of running water to help generate electricity. Though our reservoirs do not provide us with sufficient supply of water, they can still supply us with some water to some extent. With the many constraints that we face and to alleviate the problem of energy supply, the team came up with the idea of having each tall building generate its supply of electricity with its own generator. We decided to make good use of the rainwater which can be collected at the top of the building and then harness the kinetic energy of the fast-flowing water sent down from a higher level to drive turbines of the generator placed at a lower level to generate electricity. The		

	electricity generated can be sent to each unit in the building. Unlike most power stations which make use of fossil fuels to generate electricity, the energy from the fast-flowing water is used to drive the turbines of the generator is virtually free. In addition, no water and pollution is produced. Our idea of hydro-electric building (HEB) is adapted from examples of generating electricity at a hydro-electric power station which is possible when there are fast flowing rivers to drive the turbines of a generator.		
3rd Prize $1,000	**Methodist Girls' School**	**The green tote**	**Lianne Chia, Audrey Koh, Kezia Lam Jia En, Megan Tay Wan Ting, Leong Jann En, Maltida Woo Pui Shan, Janette Soh Yingrui, Chloe Ang Si-En, Angelia Gan, Elizabeth Lynne Chee**
Project Summary	Our CCA group, the MG Environmentalists started the 'Green Tote Project' in 2009 and continued to date. To begin with we started collected plastic pouches (many of them aluminum bonded to plastic) from the pupils and staff of the school. This plastic pouches is on the rise because it is cheaper to produce, costing companies less, and is as hard plastic bottles are. However, it is not recyclable, thus, costing the public more in pollution and environmental damage. Our team used there plastic pouches to make fashionable tote bags. The procedure: • The plastic pouches were thoroughly cleaned and dried. • Then, the cleaned pouches were measures and cut into pieces according to the desired design. • The pieces were then jointed and assembled into a tote temporarily with scotch tape. • The joints were then machine sewn by our tailor and our 'Green Tote' was completed. These bags were sold during MGS ShowTime which is a fun raising concert in aid of the National Cancer Children Society (NCCS).		
Merit Award $500	**Yishun Primary School**	**Fruit-peel-wash**	**Bo O John Kobe Saludo, Soliven Janriel Stephen C, Liu Zhanghe, Tut Myat Bwar**

Project Summary	In the project, we soaked fruit peels in brown sugar solution for 3 months to allow fermentation in order to produce enzymes. The solution produced was used as cleaning agent, while the residue was used as soil fertilizer. We made good use of fruit waste from our school canteen and reduced the use of chemical washing detergents at home and in the school Enzymes produced from the fermentation of fruit peel is able to remove stains easily. The fruit-peel detergent is easy to make and is more environmentally friendly than chemical detergents. There is waste minimization and no chemicals produced that will pollute the environment. The residue from the fermentation process can also be used as organic fertilizers. The fruit peels are soaked in brown sugar solution for 3 months to allow fermentation to take place in order to produce enzymes. The solution produced is used as cleaning agent. The waste residue was mashed and mixed with water. This mixture was used to water a potted plant to find out its suitability as soil fertilizer. After a week or two, some cloudy yellowish-looking 'foam' appeared on the surface of the solution in the container of soaked Fruit-Peel-Wash. After stirring, that disappeared. An emitted smell resembled that of the red wine, depending on the types of fruit that are used. The brown liquid produced was able to remove stains on the walls our classrooms and toilets. Our plant which used the residue as fertilizer was also able to grow well.		
Merit Award $500	**Yew Tee Primary School**	**Homes in plastic...they're fantastic!**	**Tan Wei Liang, Jovan Yeo Rui, Kuan Yi Heng**
Project Summary	Urban expansion has caused wildlife habitats to decrease in numbers and size. This had caused many animals to lose their homes and adapt to life in cities. Moreover, increasing waste worsen the problem in which space is required for disposal. We are proposing that discarded plastic bottles be used to make "birdhouses" so as to get them more accommodating. They can also be used for observation by students and bird watchers. Our primary constraints in converting plastic bottles to 'birdhouses' are warping of the bottles after long periods in the sun, heat build-up causing stress and discomfort to the birds residing inside and accumulation of water that might cause potential breeding of mosquitoes. So we decided to brainstorm on a few designs taking the concerns above topmost and inculcate them into our final product. We came up with the agreement that the design suited our concerns most. Putting layers of aluminum foil and foam will prevent heat from warping the bottle and effectively cools the interior. Heat build-up is		

	dissipated whenever there is sunlight as the fan will be switched on. Wire mesh used will not cause any water to accumulate. Thus we begin to build our prototypes. We make a few amendments along the way to see whether the designs are really effective. Finally, we came up with a simple design in which we can 'mass-produced' for our friends to enjoy. It's simple and yet effective. Students will enjoy converting waste plastic bottles into 'birdhouses' in which we can see birds flourish.		
Merit Award $500	**Xingnan Primary School**	**Effect of the low cost phytohormone sources on the propagation of arsenic hyper-accumulating ferns**	**Nicolas Ian Blackburn, Chen Xinyu, Phyllis Loo Yun Yi, Ng Ying Liang**
Project Summary	Arsenic is a substance which is a serious threat to mankind. Around 140 million people around the globe are being poisoned by arsenic in their drinking water. According to The Straits Times, 31 August 2007, 'Arsenic in drinking water poisoning 140m people' new report, Me Peter Ravenscroft of Cambridge University says "Arsenic is a global problem present in 70 countries probably more." Arsenic exposure can result in a range of symptoms (The Straits Times, 27 March 2010, 'When all's not well…'). Swallowing or inhaling low levels of inorganic arsenic can result in stomach aches, nausea, vomiting and diarrhea. It can also result in decreased production of red and white blood cells which may cause fatigue, abnormal heart rhythm, blood-vessel damage resulting in bruising and impaired nerve function. Some of these effects only show up decades after first exposure. More than half these cases are in South and East Asia. According to Mr Allan Smith of University of California, "In the long term 1 in 10 people with high concentrations of arsenic in their water will die from it. This is the highest known increase of mortality from any environmental exposure." Fortunately the environment always has a solution for every problem. Studies have shown that plants have the ability to mediate contaminated soil or water (N.H. Lam, 2009). Plants, such as ferns, are known to take in large amounts of arsenic from the environment, storing it in their fronds (P.Ball, 2004). These ferns, such as Brake ferns and the Silver ferns which are native to the tropical and subtropical regions of the world, are also not known to suffer from toxicity of this harmful substance. Our findings showed that Brake ferns grow best in the formulation containing sugar cane water while Silver ferns grow best in the formulation containing coconut water. However, the growth of both Brake ferns and Silver ferns were inhibited in formulations containing potato and tomato. Coconut water is a well-established source of phytohormones		

	commonly used for in-vitro propagation of ferns. Thus, it is interesting from the research that Brake ferns respond better in the formulation containing sugar cane water than the formulation containing coconut water. The team recommends that more work be done to refine the formulation to identify the optimal level of M.S. Basal Salt and sugar cane water to eventually achieve a low-cost formulation that can ensure successful, rapid and economical propagation of Brake ferns. The team also recommends the optimum lighting needed to transform ferns into sporophytes be investigated.		
Merit Award $500	**Xingnan Primary School**	**Cool chairs**	**Keane Wee Jin Yen, Afiqah Syalwani Binte Hamir, Nicholas Phoon Jing Zhi, Cheng Wan Ying**
Project Summary	Majority of the households in Singapore have installed air-conditioners at home. Air-conditioners can cool us down quickly when the weather is hot. Hence, Singapore who experienced the hot weather will likely to jump to consider getting air-conditioners for their homes (Straits Times, 2010) However, the air-conditioner uses the bulk of the electricity in a home. A fan uses less than 1/10th the electricity used by an air-conditioner. E2 Singapore has encouraged people to use a fan instead of an air-conditioner to keep ourselves cool. (E2 Singapore, 2010) Our current problem in the school is that we feel hot in the non air-conditioned classrooms especially during the few weeks in February 2010 whereby Singapore experienced the highest temperature of 35°C (Straits Times, 2010). We feel even hotter especially after PE activities. Therefore, in this project, our team would like to explore the possibility of developing a practical way of making ourselves feel cool in the classroom that does not consume a lot of electrical energy. Our investigation would be based on our hypothesis that a metallic chair installed a fan would have a higher efficiency in heat loss to the surroundings that our current plastic chairs. The possible impact of our investigation is to reduce the amount of energy consumption used in the school as compared to using the air-conditioners. The speed for temperature to decrease will determine the ability of heat removal from the heat source by the prototype. Our investigation has proven that the metal surface with a fan is effective in allowing heat to flow out from the heat source easily. Our team would like to recommend some possible future		

	developments to our investigations such as to extend our investigation to different types of metal and to investigate on the effect of metal thickness of heat loss efficiency.		
Merit Award $500	**Lakeside Primary School**	**Act now-act fast**	**Ray Chua Yue Chern, Yong Yu Xuan, Rohit Rajesh Bhat, Pyae Phyo**
Project Summary	Fossil fuels were formed from vegetation and dinosaurs, deposited millions of years ago. Today, we are using these fuels at several million times faster than they are formed. At this rate, the people in the future will not have fossil fuels for their daily lives. There is a lot of energy wastage in the majority of homes today. Many people are taking it for granted that they can continue with this selfish lifestyle. We want to create a captivating video clip using some animation that will bring across the clear message of reducing energy consumption amongst our friends. Our new idea is the production of a captivating video clip (incorporating animation) that 'jolts' viewers into feeling guilty and become prepared to do something about reducing energy consumption as soon as possible.		
Merit Award $500	**Kuo Chuan Presbyterian Primary School**	**Nurture the neem**	**Jeslyn Ng Xin Yi, See Rei Yen, Maanasa Sri Ganesh**
Project Summary	The project aims to study the benefits of neem trees and the feasibility of preparing/developing products that are neem-based for various uses in our homes. Neem trees are known for their extremely high usefulness in the medicinal fields. In Swahili language it is called *Muarubaini* which means the tree of the 40, as it is said to treat 40 different diseases. With such a great reputation, we wanted to explore the possibility of using the various parts of the neem tree to prepare some products that can be used by us. These products are aimed as substitutes to other products which are chemical based while neem–based products are fully natural. We also wanted to leave a legacy of tree-planting in our school and hence decided to plant a neem sapling in our school for the benefit of future students of our school. Knowing the insect-killing ability of the neem tree and its parts, we also wanted to conduct an experiment with two plants that are infested with aphids. One of them was treated with neem-water and the other was left as it is. We have to confess that the project gave a very great insight into the various aspects of neem usage. Also, we learnt the valuable lesson		

	of team work and would like to thank our teachers and parents for encouraging us through the completion of the project.		
Merit Award $500	**CHIJ Our Lady of the Nativity**	**OLN Science Resource E-book**	**Gladys Ho Yen Yee, Lydia Lim Yi Xuan, Judi Ng Kwai See, Vera Seah Shuen Min, Joan Danielle Toledo Rubiano**
Project Summary	OLN Science Resource E-Book is an ICT package that has been created to instill informative and responsible values towards the environment. The Science Resource E-Book documents the authentic pictures of the OLN roof-top garden and the process of hand pollination that can be used as a teaching package in class to provide an educational platform of learning beyond the four walls of teaching and learning of the environment. This package also provides the element of fun and infused learning for pupils who had been selected to participate actively in the e-book making process. The package also encompasses the scientific concept, that is avoid wasting a lot of space and to promote energy, growing sufficient male and female plants for adequate natural pollination at the roof-top of the school. The Science Resource E-book has been designed to be like a picture book with videos embedded so that the scientific concepts can be made accessible to the young children. As the saying goes that a picture speaks a thousand words, this e-resource has been designed with that end in mind.		
Encouragement Award $200	**Shuqun Primary School**	**Self-sustaining' bottle garden**	**Tha Zin Aye, Ryan Ong, Joyce Ng Cuixian**
Project Summary	This is about making own self-sustaining bottle plants. Firstly, we heat a pin and poke holes on the cap of a 1.5litre PET bottle and around it. Then cut the bottles in halves. Fill the upper portion with charcoal, followed by soil. Then plant seeds or cuttings. Placed upper portion over lower portion. Water the soil and allows excess water to flow into the lower potion (reservoir). Then tape around the overlapping sides. It is mozzie-free, a simple way to recycle and conserve water. Water from reservoir, evaporates and condenses, flows back to bottle.		
Encouragement Award $200	**North View Primary School**	**3R watering device**	**Teo Rui Fang, Lok Yee Ling, Andrade Ara Daniela Estrella, Kevin Lim Ern Kee**
Project Summary	Due to the hot weather and the limited number of working days of the gardener, the hanging potted plants in school did not receive sufficient water and were withering. It was also very tedious to water the potted plants which are at different levels. To alleviate the situation, the team came up with a '3R Watering Device' which		

	recycles rainwater to water the plants. The device consists of a tank which is placed at the rooftop to collect rainwater. The brim of the tank is covered with a net to prevent breeding of mosquito. The tank is also connected to pipes. Using gravitational force, the rainwater flows through the pipes to water the plants. The pipes which are below the plants are drilled with holes and inserted with rubber tubing. The rubber tubing ensures that the water goes into the potted plant accurately. The volume of the water is controlled by the valves which are placed on the pipes. There are some restrictions of the prototype, mainly the maintenance cost and the heavy reliance for rain. Thus, 3R Watering Device should only complement the gardener and not replace the gardener completely.		
Encouragement Award $200	**Fuhua Primary School**	**Fuhua "Go green" 3D-Game**	**Seah Jia Jun, Harish Vatsen, Christopher Anthony Simm, Zane Wong Yu Jun**
Project Summary	Pupils in Fuhua Primary School are IT-savvy and engaged in learning with technology. Bearing this in mind, the team designed a 3D-game aimed at educating pupils on doing their part in keeping Singapore clean and green. Through an immersive and stimulating environment, pupils will learn about Singapore litter-free, waste minimization, energy conservation and developing Singapore into a city of gardens and water. Not solely limited to the computer labs, the game can be uploaded into the schools Electronic-Learning Platform and made available for all pupils to play.		

(B) SECONDARY LEVEL

Prizes	School	Title of Project	Participants
1st Prize $6,000	**Raffles Institution**	**Go Safe the Green Way**	**Dexter Sim You Kuan, Quek Boon King, Maurice Ng Tong Yi**
Project Summary	For our project, we retrofitted a self-assembled wind turbine onto the body of a car as a generator. Kinetic potential energy of moving airflow opposing the direction of motion of the car is harnessed when the vehicle is cruising, to produce electrical energy. This energy will power light strips lined along the bottom front and back of the vehicle to function as an adequate and ideal replacement for headlights in the afternoon when the excessively bright headlights are not necessary. It will enhance overall safety, turning on as the car moves to improve visibility, especially useful on rainy days. In short, we use green energy to increase traffic safety by preventing accidents. Excess energy generated is also stored to charge the vehicle's battery, creating an efficient, affordable ribbon safety running lights system. Basically, the idea behind our project sparked off an inclination to enhance safety for all road users. Through conducting some background research, we realized that poor visibility is one of the most distinct and major cause of traffic accidents on the road. In normal conditions, a driver can spot an obstacle such as an accident, a vehicle which has broken down or congested traffic, at a distance of at least 300 metres. However, when visibility is reduced, during bad weather such as fog for example, this distance can be less than 50 metres, which represents 6 times less visibility. Additionally, the braking distance increases when the road surface is wet. Rain also affects the driver's visibility due to the disturbance caused by water splashed by other vehicles, particularly during overtaking, which obscures the view through windows and increases the risk of excessive glare, but can also deposit dirt on vehicles' lights, thus reducing their effectiveness. Studies have shown that accidents are twice as numerous in rainy weather and 4 times more severe in foggy weather, and that 10% of fatalities were the direct result of inadequate assessment of weather conditions, primarily owing to excessive speed or failure to maintain a safe distance between vehicles. Since Singapore has an average annual rainfall of around 2,370mm which is relatively high, our team felt that it would be useful to develop a device which will improve visibility at any time in any environmental circumstance, whether dry or wet, during which the vehicle is moving. Additionally, to be friendly to our Earth, it will use green renewable energy which I clean and not chemical energy from batteries or any other source with its roots in fossil fuels to prevent adding to pollution and wastage of materials.		

	As such, we constructed a model upon which our system is imposed on, with the hope that the device will be able to reduce fatality rates and number of accidents on the road when manufactured for actual use.		
2nd Prize $4,000	**Hwa Chong Institution**	**Recycling Waste Coffee : From Trash to Cash**	**Rick Wong Tuck Jun, Ang Wei Jian, Auyok Sean**
Project Summary	Our project aims to recycle waste coffee into useful products which can be used in industries and at homes. For industrial use, oil was extracted form waste coffee which in turn was made into biodiesel, as green alternative fuel. The residue after oil extraction with hexane was used as absorbents for toxic metal ions as it was effective in absorbing copper, lead and chromium ions. It was also used to make compost which can boost plant growth. For domestic use, waste coffee was made into products such as air freshener and an organic insect repellent. In this way, we develop a holistic approach to recycling waste coffee. Coffee is one of the most popular beverages. According to the US Department of Agriculture, the world's coffee production is 16.34 billion pounds per year (Pumphrey, 2007). Large amounts of coffee grounds are discharged from food industries. Although part of them is reused as compost and animal feed, most of the coffee grounds are burned as waste, resulting in the production of carbon dioxide, a greenhouse gas. Recycling this spent coffee ground would be an economical and environmentally friendly idea. Depending on the type, coffee contains 11 to 20 wt % oil (Pumphrey, 2007). Since oil is insoluble in water, it is possible to extract the oil from waste coffee. The oil extracted can be further made into biodiesel, a green alternative fuel, via transesterification process.		
3rd Prize $2,000	**Hwa Chong Institution**	**Piezoelectric generator**	**Lee Choon Kiat, Lim Jun Weng, Lee Choon Kiat**
Project Summary	The ability to harness energy from the environment is essential technical advancement for prolonged use of many portable electronics devices. In our project, we investigate the use of piezoelectric generators to achieve this aim. Piezoelectric generators are power harvesters that produce energy when mechanical stress is applied to the material. This form of energy harvesting is easily available in the environment as vibrations can range from tiny sources like talking to larger ones like mechanical motion and vibration. Thus, Piezo-electric strips for our studies. Our concept is to generate power output based on proof mass mounted onto piezo-electric strips at different resonant frequencies, given a vibration of mechanical resistance, for various power consumptions. Our experiments consisted of an optimal proof mass with preset resonant frequencies which can produce the most power output		

	based on two different types of commercial-off-shelf piezoelectric generators. Through investigation of the optimal mass and resonance frequency, it allowed us to determine the relationship between proof mass and operating frequency and harness the maximum power output from the piezoelectric strip. In the investigation of mechanical and electrical resistance, we could also find out the resistance of the battery could take while being charged. Such power usage was equivalent to the power input from the generator. Armed with all the data, our team developed a small-sized and efficient powering solution of appliances and portable applications. These strips could also be mounted onto the body to harness body vibrations and movements to power up ECG circuits or LED lights for example.		
Merit Award $1,000	**Raffles Institution**	**Making a brick out of unwanted sawdust**	**Nathan Siaw Seng Taat, Roy Soo Jiunn Jye, Flelix Yeoh Zhi Guang, Ken Oung Yong Quan, Elwin Sim Jun Yi**
Project Summary	Bricks are common materials and thus frequently taken for granted. However, what many are unaware of is that the making of a brick harms the environment. Cement is non-renewable and its manufacture releases greenhouse gases. China alone produced 0.9 gigatons of cement produced in year 2004, followed by 1.3 gigatons of cement in 2007. That also means 1.2 gigatons of carbon dioxide produced in 2007. Our solution : a sawdust brick that minimizes the use of cement and thus reduces the impact of each brick on our environment. Sawdust is light and cheap while not being a weak material, whereas concrete is hard, thus making it an ideal material of choice in conventional construction. We hoped that the sawdust brick could encompass all this properties and obtain a brick that is light, cheap, sturdy and, last but definitely not least, helps to save the environment in its own way. The team decided to submit an environmentally friendly brick for this competition with the aim of reducing carbon emissions as well as improve quality of life in third world countries with more affordable temporary homes. At 2.5cm x 10cm x 5.8cm, this brick is a regular cuboid composed of 60% sawdust and 40% cement. Firstly, cement is non-renewable and the manufacturing of cement releases tons of greenhouse gases. By adopting our product, the percentage of cement in the brick is reduced by about half, directly affecting the manufacturing of cement and reducing carbon emissions which lead to global warming. Secondly, by recycling sawdust, we are clearing up space for other disposables in landfills, and reducing the harmful gases which are produced when sawdust is incinerated. Sawdust is a very useful element, and should be reused extensively.		
Merit	**Dunman**	**Shall we use it? Shell.**	**Dexter Choo Yun**

Award $1,000	**Secondary School**	**We used it!**	**Zhang, Jovan Lee Hao Wei, Amri Bin Borhan, Daniel Kang Wei-En**
Project Summary	Worldwide, tons of crab shell waste from restaurants and homes are discarded every day. While a lot of the crab shell waste (known as chum) ultimately ended up in landfills and in the incinerators, adding on to land and air pollution, a popular use of discarded crab shells is to use it as decorative art and craft items. Scientists have extracted the carbohydrate chitin and its derivative chitosan from crab shells and these useful items have been used to make cosmetic items, medical sutures and for cleaning oil spills. Our project main objective is to find out the uses of discarded crab shells. We are particularly interested in finding out whether it is possible to soften or disintegrate crab shells and turn them into useful products. We approached Jumbo Seafood Restaurant to donate their weekend's collection of discarded crab shells. Next, we used different types of acids that are commonly used in the science laboratory to soak the crab shells. After soaking in dilute hydrochloric acid or ethanoic acid (acetic acid vinegar) for more than a day, the shells were softened so that they could be folded without tearing. These softened shells were cut into our desired shapes and made into a small handbag, a pencil holder, bookmarks, lampshades and decorative items. We even had a batch of crab shells that were soaked for more than half a year and the texture, colour and hardness were very different from those soaked in dilute acids for a few days. The shells became so soft such that when pressed by fingers, they became powdery. The powdery substance was made into "erases", 'soil', and cement as environmentally friendly substitutes of the latex erases, real soil and real cement. With recycled crab shell products, we could help spread the message that everyone can innovate and turn trash into useful materials.		
Merit Award $1,000	**Nanyang Girls' High School**	**Biodegradable Starch-based Plastic**	**Zou Yuhan, Du Xuesong, Liu Jiani**
Project Summary	This project set out to fabricate a starch-based plastic material from household ingredients for making food packaging to replace petroleum-based plastics. In common preparations of biodegradable plastic, starch is mixed with petroleum-based plastics. However, the plastic produced by this method will only be partially biodegradable. As such, the project set out to find a method of making a fully biodegradable plastic.		

	In recent years, plastic has proven to be a versatile and durable material. However, environmental problems with manufacture and disposal of the material have become growing concerns. Plastic is a derivative of petroleum and as a by-product of petroleum, plastic consumes precious oil depleting at an uncontrolled rate. Other than that, disposal of plastics also posed a problem. Majority of disposed plastic bags ends up in landfills. Being biodegradable, they take up precious land space. Another alternative – incineration of plastics – leads to air pollution. As such, it is vital to find a quick remedy to the situation, which is the value of our experiments.		
Merit Award $1,000	**Xinmin Secondary School**	**Biodegradable Plastic**	**Willianto, Li Jing Yin, Shawn Hoo Yong Chuan, Justin Yeo Wei Min**
Project Summary	Our world is so wrapped up in plastic that they have become indispensable. Myopically, plastics seem to be the answer for everything. From food carriers to insulation material, there is no other material that is so durable yet so cheap and so easily mouldable. However, the real cost of using this wonderful material is unseen. The release of toxic pollutants, accumulation of non-biodegradable landfills and depletion of a critical natural resource – petroleum has created a prevalent threat to our environment. In this project, we propose an interesting and innovative solution to both the plastic and food waste problem. This involves the harnessing of existing natural polymers in kitchen food waste found in a typical Singapore household, to create plastic. Hence, we attempt to reduce the drain on the earth's natural resources by reusing and recycling kitchen organic waste into biodegradable plastic which could just be as useful and versatile as plastic made from petrochemical sources.		
Merit Award $1,000	**Raffles Institution**	**Enviropolis**	**See Yong Xin, NathanielTan Rui Xian, Joseph Lee Wei En, Joseph Tan Yong Sheng**
Project Summary	Our project entails the conceptualization, designing, and creation of a fresh and novel board game. The board game has been built up from scratch, with the artwork and game ideas done by our very own group members. The board game targets the current issue of higher demand of energy and higher prices of electricity amidst energy insecurity in the world as supplies of fossil fuels dwindle. The current situation in Singapore is one where demands are met by importing energy from countries and diversifying into other forms of alternative energy. Another major issue targeted is that of the high levels of air pollution which fossil fuel power plants bring about, which contribute to environmental degradation. It can be said that a large percentage of Singaporeans, particularly		

	teenagers in Secondary and Pre-university schools are apathetic towards energy conservation and living a 'green' lifestyle, despite prompting and encouragement from the education system. Hence, our board game aims to educate about alternative energy and our game is slanted in such a way where they will understand how beneficial it is to use alternative energy and how harmful some of the non-renewable resources such as energy from coal is to the environment. Our board game also serves to educate our target audience on the advantages that plants and forests play in reversing environmental degradation, and that every action they take actually consumes energy.		
Commendation Award $500	**Anglo-Chinese School (Independent)**	**Floating Garden**	**Choo Jia Le, Jonta Koga**
Project Summary	Plants needed to absorb nitrogen to grow, while excess nitrate produced by fishes will cause serious environmental issue such as eutrophication. By linking these two ideas together, we create floating garden which aims to use water bodies as a growing medium for the plants. By doing this, not only the plants will grow with the aid of nitrate in the water, it will reduce the harm caused by excess nitrate level in the water. In this land-scarce island, there is a need of a maximizing effort of land usage to sustain economy and development. Often enough, aesthetic and greeneries are brushed aside to give way to profitable matters such as office building or mall. Even though Singapore does not fit in the above description, the city still strive to maximize the amount of greeneries to sustain healthy living while not sacrificing the area for economy and community. We have come up with a new idea that used recyclable material to create space for the greeneries which used space of water surface which is unusable by other function. We are inspired by the heritage of Aztec civilization, which has floating garden on top of unusable marshy land and convert them into productive land. In modern Singapore context, we can integrate greeneries which can freshen our mind after daily stress and also harvest the goodness of oxygen produced by the plants planted in floating garden. Floating garden will definitely help Singapore to extend the area usage from dry land to the water surface to add in functions that will improve the way of living of the society.		
Commendation Award $500	**Raffles Institution**	**REGENERATE THE "R"s - The Children's Set to Environmental Awareness**	**Khasnavis Krishnakanth Puneeth, Ke Yuxuan, Shanmugam Saravanan, Vijay Periyannan**
Project Summary	Our aim for this project is to teach and impart messages of simple environmental protection to children. Our basic ideology is that for		

	good environmental habits to become part and parcel of one's lifestyle, they must be exposed to it at a young age, when their minds and attitudes are still malleable and while they are still growing up. Also, the message must be delivered in an attractive manner, catching the interest of children so that they will be actively engaged and absorb it. Our product : The Children's Set to Environmental Awareness (CSEA) aims to be an excellent medium to instill good environmental habits in children. By doing so, we can create a future generation of people who care for the environment, as part of their attitude and lifestyle. This will in turn result in future politicians and corporate leaders to do their part at high scale levels to promote environmental protection. The CSEA has 3 components : the activity book, rhyme video and the board game. The activity book carries simple yet important habits that children should include in their lifestyle. Accompanying illustrations help children to better understand and visualize the message that each page carries. They rhyme video was included in order to cover the visual and audio aspect of children's learning. We believe that the familiar tune of classic nursery rhymes will make it easy for children to relate too. The slideshow of pictures accompanying the music track appeals to the child's visuals and the subtitles on the video ensures that the child can sing-a-long. The board game is based on the idea that children are most active and learn best when they are having fun. Good environmental habits will give the player a boost up the board, while bad ones will move the player down. This spreads our message effectively.		
Commendation Award $500	**Raffles Institution**	**Green Banners Merchandise**	**Bodi Chinnarao, Muhammad Azhar, Kalyanasundaram Ragavendra, Ravi Singaram**
Project Summary	Many of the products we use nowadays are made out of precious resources. Resources which are non-renewable and available in limited quantities. This commercialized world, however, demands for such products to be continually manufactured. One such product is the banner. Be it for advertisement, marketing or other uses, banners are being used every day, many of them only having a one time usage – that is, they have no more purpose or use after being used for one show. Banner material, on the other hand, can be reused to make other merchandise. Throwing away these banners immediately after usage would only result in the wastage of resources. Recognizing this as a major issue that needs to be tackled, we have come up with an initiative to recycle products that are destined to the incinerator after little usage, focusing on banners. Our group had decided to do our part in trying to reduce wastage by innovative and practical reusing. Since it is not commercially and		

	financially practical to recycle banners, our group had researched for an alternative and gone one step ahead. We produced useful items such as pencil cases and tote bags from these old banners. Our main objectives were to create functional and practically design products from waste banner material and to comply with the principles of creating environmentally sustainable products with minimum negative environmental impact. We also wanted to initiate an effort to recycle waste materials and turn it into something of use, to promote sustainable use of non-renewable materials and to serve as an example to recycle and reuse waste materials in an innovate and creative manner.		
Commendation Award $500	**Raffles Institution**	**Greenfeste! Environmental Sharing@RI 2010**	**Isaac Chong Yi Jie, Sudeep Agarwal, Ong Chuan Kai, Jonathan Ang Six Xian**
Project Summary	When one talks about saving the environment, a whole arena of possible actions and thoughts come into the mind. Possible recycling initiatives, initiatives to clean or preserve the environment, along with other government-sanctioned policies or initiatives promoting a cleaner, and friendlier environment. Well, all this sounds pretty good, but here's the problem – it may not always be effective. It is often said that to solve a problem, one must first find, and eliminate the root of the problem, before taking other steps. As such, it is paramount that children be educated from young about the environmental issues being faced today, especially through mediums such as talks and sharing in school. It is only if an understanding and an interest is built into the future leaders that we will be able to notice an improvement in the policies of our government, and the initiatives that may further help to promote environmental awareness. When we started the project, we were faced with a variety of options on how to conduct an effective eco-awareness campaign targeted at young people. The decision was made to narrow the audience of the event to just secondary school pupils, since they would probably better understand the weight of the content, and take action regarding it. Our target group would be children who have little / no prior knowledge on how to save the environment through their little actions at home. For example, importance of turning off electricity when not needed what kind of things to buy and what not. The difference of this from other eco-camps is that we focus on day-to-day living, and not students when they grow up due to their own perceptions, misunderstandings and social background. Overall, our short-term goal is to prove that eco-camps such as this is possible and effective in shaping children's minds.		
Commend	**Nanyang Girls'**	**Green-O-romatherapy**	**Jamie Foo Jie Min,**

ation Award $500	**High School**		**Ching Hui Qi, Chang Shin Yee, Rachel Ng Su Min**
Project Summary	This project is titled 'Green-O-Romatherapy' for two reasons; the first being our aim in this project to do our part for conserving the environment by producing products made from used oil as an alternative to disposing them, thus going down the 'green' road; and the other, being the focus of the project whereby used cooking oil was purified to produce aromatherapy oil. Different used products are experimented with to produce a variety of aromatherapy oils. A portion of the each respective selected aromatherapy oil used was then made into soap. Two procedures were used in the purification of oil; ridding the oil of its odor and getting rid of the suspended particles in the oil. After obtaining the pure oil, various fruit peels, leaves and flowers were infused into equal portions of oil to produce various aromatherapy oils. From that, the oils with a suitable fragrance were selected and a portion from each type of oils was used to make soap. To rid the used cooking oil of its odor, finely chopped ginger was soaked in oil and heated till the oil starts to bubble and pieces of ginger float to the surface, after which the ginger was left to cool. Potash alum, dissolved in nitric acid and water, was then added into the oil and stirred thoroughly until the solution is mixed completely. It was then sealed thoroughly and left to stand for a week. By then, the oil had separated into two layers, the top being the purified oil and the bottom being the sediments. With use of a separating funnel, the two layers were separated in order to obtain the purified oil.		
Commend ation Award $500	**Marsiling Secondary School**	**Natural Fabric Dye**	**Nurul Mutmaina Bte Noorzalan, Jewel Lim Wan Yan, Jesper Poh Yang Tze, Fitri Daniel Bin Muhamed Husaini**
Project Summary	In the 21st century, many people have their own wardrobes which contain at least dozens of different clothing. Clothing is no longer just a protective covering for people but also a representative o status, taste, fashion, identity and personality. Our group's interest in the dyeing of clothes stems from how prevalent dyes are used in clothing and the possibility that some dyes are toxic. Most fabric dyes are not made from natural substances as synthetic dyes can be produced faster and are more economically viable. However, some of these synthetic dyes might contain toxic substances that are harmful to the environment and to the people wearing them. They dyes might contain carcinogens that can be absorbed into the skin and will be harmful for the use in the long run. Natural dyes are usually made from the colours of plants and fruits. They are seldom harmful to the environment and to people. One		

	other advantage of using natural dyes is that such dye can be done at home. As they produce rich colours, they are aesthetically pleasing. Considerate practices of natural dyeing allow them to be used in a much more environmentally friendly way than synthetic dyes. The investigation is made up of two parts. Firstly, to determine which plants and fruits are good sources of natural dye. Secondly, the investigation will determine which type of cloth is best able to retain the natural dyes. We discovered that dyes made from turmeric, red cabbage and onion skin will remain on cloth the best. Cotton and silk are the best types of cloths that should be used for natural dyeing as they retain the colours best.		
Commendation Award $500	**Nanyang Girls' High School**	**Rain, Spin, Generate**	**Goh Jie Ying, Jolene Lee Shu Jun, Lim Hui Hong, Ong Wan Li, Tan Jing Yi**
Project Summary	The purpose of the experiment is to find out the amount of voltage produced by the prototype (generator fitted in a modified household pipe) when different amounts of rain fall; and the amount of voltage produced by the prototype when water flows from different heights. The results show that the higher the rate at which water flows into the pipe, the more voltage produced and the higher the water flows from, the more voltage produced. These findings prove that more electricity is produced by the prototype during a heavy downpour as compared to a slight shower due to the increase in strength and speed of the rainfall. Furthermore, the households at the lower levels of high rise buildings would be able to obtain more electrical energy from this prototype. Rainwater travels a long distance down the building, accumulating kinetic energy which makes the turbine spin faster, thus producing more electricity. This electricity generated can be used to power electrical appliances.		

(C) JUNIOR COLLEGE / INSTITUTE OF TECHNICAL EDUCATION

Prizes	School	Title of Project	Participants
2nd Prize - $5,000	**ITE College West**	**Wind generator to Electrical Supply**	**Muhammad Bin Mohd Jauhari, Ong Hui Li, Muhammad Abdullah B Hafazul**
Project Summary	Global warming has become an issue around the world, as it triggers disaster like earthquake, flood, etc. And this disaster is being cause by emission from the power plant, deforestation, etc. And that's why nowadays people are doing their part by recycling paper, can, plastic and energy in order to cut down pollution to the environment and waste of resources. All over the world including USA, China, Singapore etc are looking into renewal energies. In Singapore, we have Newater and Solar cell in HDB estate, zero energy buildings, Green buildings to achieve Recycle, Reduce and Reuse (3R) of energies. Traditional windmill can only generate energy during windy time (day or night). It cannot generate any energy when there is no wind. In the business areas, there are many air conditional towers mounted on top of the office buildings. These air conditionals are switched on most of the time for at least 8-12 hours per day. That means that there is wind blowing away into the air. We call that the Unused wind. Our objectives are to create wind generator in the city or business areas, and does not depends on the weather. Generators that can be mounted on the air conditional tower and make use of the unused wind from the air conditional tower to generate electrical energy. By converting the unused wind energy to electrical energy, it can be used to support partial of the building lightings or feedback to the electrical grid so as to reduce or rebate of electrical energy used. So we decided to convert the traditional wind mill into a wind mill that can tap the unused wind to generate electricity. Our invention can recycle, reduce and reuse electrical energy. - Recycle the wind produce by the condenser unit to electrical energy - Reduce the wastage of the unused wind energy - Reuse the electrical energy back to the power grid or common lighting - We call our invention "Air-Tap". This air tap will generate electrical energy using the unused wind from the air conditional tower.		
3rd Prize - $3,000	**Hwa Chong Institution**	**The Pressure Sensitive Thimble**	**Selina Sia Xin Jie**
Project Summary	Water is a strong scarce resource in Singapore and the world. This project aims to help in the conservation of water through the reduction of its domestic usage. One of the measures Singapore has taken in attempt to lessen the domestic usage of water is the use of thimble		

	which helps to reduce the rate of water flow from taps thus cutting down the amount of water consumed. However, the problem with the thimble's current design is that it is not pressure sensitive, meaning that when the pressure from source is high, there will be excess water wasted. Conversely, when the pressure is low, the water flowing through the tap is insufficient. Thus the aim of the project is to create a pressure sensitive thimble which reacts accordingly to the pressure from the given source so as to ultimately release a consistent rate of water flow from the tap. The creation of this thimble is meant to make up for the flaw in the current design of the thimble. As a modification to the current thimble, a slightly concaved thimble-shaped object made from rubber will be attached to the tap. This modification will enable the restriction on the water flow to increase as the pressure from the tap is increased. Ideally, this aims to create a constant usable water flow, regardless whether the power of the tap is turned on higher. This will avoid water exceeding the optimum flow rate, which is 2 litres / minute at the wash basin for normal washing purposes, 4 litres / minute for sink / kitchen / wash and 7 litres / minute for shower taps. Based on experimental results, the creation of a pressure-sensitive thimble was successful. The max flow rate for the 2.5mm diameter holes thimble has a flow rate of about 6.8 litres / minute which is slightly lower than that recommended for shower head. The disc which have holes diameter 2.0mm has maximum flow rate of about 4.6 litres / minute. This would be suitable for a kitchen sink or tap. These thimbles are able to reduce water flow and limit it to the desired flows, thus surpassing PUB's thimble in terms of efficient water conservation.		
Merit Award - $1,000	**ITE College West**	**Auto PowerOFF**	**Muhammad Ashiq Ali Bin Abdul H, Sum Jun Hao, Wee Teng Yoong, Jamaludin s/o Mohamed Igbal**
Project Summary	Most of the electrical appliances such as LCD TV sets, DVD players etc. sold in the market do not have the means to cut off totally the AC power supply with the remote control units. Usually the users need to manually switch it off from the power sockets. As a result a small amount of energy is still consumed. Our gadget helps to overcome this limitation by providing automatic disconnection of AC power supply after a pre-determined period, once the appliance is being switched to standby mode with the remote control unit, hence saving energy and cost. Due to the recent increase in oil prices, the generation of electrical power becomes more expensive and the tariff for electricity by Singapore Power have increased from 19.28 cents in September 2009 to 23.56 cents per Kilowatt-hour from July 2010. Therefore, there is an urgent need to conserve energy and at the same time save cost.		

	The key feature of this project is that the device is able to detect in real time the active current of electrical appliance and disconnect the appliance automatically from the AC power supply after a pre-determined period of time once it is set to standby mode in order to conserve energy. Hence it is truly a zero power device. Most importantly, our device is light-weight, portable and user friendly.		
Merit Award - $1,000	**Anglo-Chinese School (Independent)**	**Grass Paper**	**Nicholas Ngiam Jinghao, Lee Chiang Fong, Tong Nhat Duong**
Project Summary	This project aims to investigate a novel original method to produce paper pump from grass, using more environmentally friendly chemicals in the pulping process, as well as being less energy intensive. Grass displays prolific growth in Singapore's tropical climate and cut-grass is often simply discarding. We aim to convert this "waste" material into a useful raw material, producing paper pulp to produce paper, in addition to investigating its potential in enhancing the quality of conventional recycled paper. If successful, we hope to be able to reduce the demand for wood in paper-making, easing the problem of deforestation. In conclusion, based on the date collated and process, grass does seem like a credible alternative to wood as a raw material for producing paper. The paper produced as shown earlier is of reasonable quality, with remarkably higher tensile strength than commercial paper. To further the study, we also attempted to add grass pulp into conventional recycled newspaper pulp and found that this further strengthened the paper and gave rise to even higher tensile strengths. It is hypothesized that the mixing of the fibres from grass and newspaper give rise to even more extensive cross-linking and hydrogen bonding that further strengthened the paper that was produced. However, it is acknowledged that while this paper can indeed be written on, it is not yet of printing quality. With the proper industrial setting, it is possible that further refinements to the process can be made to further improve the quality of the paper produced.		
Merit Award - $1,000	**ITE College Central (Yishun Campus)**	**Smart Fan**	**Ahmad Kamal Bin Azman, JOHNSON ONG JUN LIANG, Krystof Orlandus B. Ebarvia**
Project Summary	Many household in Singapore owned at least one electrical fan in their house. The weather is getting hotter in recent years. Our lifestyle has changed, we need a comfortable environment to think and work efficiently. Most of us will switch on the fan whenever the environment is warm in the room, but many of us will leave the room without switching off the fan. The reason for not switching off the fan		

	is either forgetful or laziness. The user maybe returning to the room shortly and does not feel the need to off the fan whenever the fan is not in use. In some cases, the users forget to switch off the fan before leaving the house! It can happen because an operating fan usually does not make audible noise or visual light. It may even start electrical fire in the house if the owner went for extended overseas trip. The Smart Fan is designed using electronic mean to prevent such scenario as described above from happening. The project makes use of sensor to detect human presence to turn on a fan whenever the room temperature is above a preset temperature set by the user. The fan speed is automatically adjusted according to the ambient temperature. When the ambient temperature dropped, the fan speed will follow suit. This will ensure efficient use of power without compromising comfort. The fan will turn off automatically when it detected no in is in the room. However, the fan can be switched to manual mode and turn on or of by mechanical switch. Pyro-electric Infrared (PIR) sensor is used to detect human presence in the room. When the PIR detected someone in the room, it will provide power supply to the fan and temperature sensing circuit. This will ensure minimal standby current lost when the fan is inactive. The project used precision temperature sensor LM335 to measure environment temperature. When the ambient temperature exceeded the present temperature and the PIR also detected someone in the room, the combinational logic will switch on the fan at the correct fan speed for the temperature.		
Merit Award - $1,000	**Anderson Junior College**	**CNT-mica Hybrid - A way to stop oil spills**	**Nickie Seoh Limin, Keith Chia Ruixiang, Avan Kwek Yao Xuan, Bernice Mok Shu Hui**
Project Summary	Our project aims to minimize the impact of oil spill on the environment, which if successful will have far reaching benefits, as the transporting of oil is an integral part of the world economy. Due to oil spills, marine animals, as well as residents leaving near coastal areas, were greatly affected. Marine animals may be poisoned; birds drown to death since they can't fly with their bounded wings. Humans on the other hand, may have long-term negative health impacts. As such, there is a need for us to research further on more viable ways to clean up oil spills, such that these marine animals no longer have to sacrifice for man-made disasters and innocent residents no longer have to put up with the harmful effects of these oil spills that may recur again in future. Our group has chosen to work on the Carbon Nanotube and clay hybrid, as the properties of the hybrid are relatively unexplored by the scientific community. Thus we made a new hybrid of clay, which Is		

	oleophilic and hydrophobic. This combination is desirable as it serves to further enhance the ability of clay in absorbing oil. Progressing towards this, the hydrophobic carbon nanotubes (cnt) were added to mica, which was pounded and mixed together. In conclusion, the hybrid is observed to exhibit effectiveness in clearing up oil spills. The compositions of the hybrid are of suitable materials to be used in the absorbing of oil (mainly the hydrophobic property of CNT and the oleophilic property of Mica). It is most effective when the ratio of Mica is to CNT is 2:1.		
Commendation Award - $500	**Yishun Junior College**	**Project RUSCO (Recycling of Used Cooking Oil)**	**Chin Wen Jie, Daryl Tay Hao Zhong, Poh Yi Fei**
Project Summary	Project RUSCO was a joint collaboration between the students of Yishun Junior College and North west Community Development Council, which was supported by Chong Pang City Merchant and Hawkers' Association, 3M Singapore and Alpha Biofuels Pte Ltd. The objectives of project RUSCO was to educate students from the N2 cluster schools and residents in the Chong Pang, Nee Soon Central and Nee Soon East constituencies on the importance of recycling, the need to protect and conserve limited resources as well as the benefits of biodiesel. Reusing cooking oil for cooking has been established to lead to harmful effects, as the repeated use of cooking oil generates HNEs, which are carcinogenic. Moreover, residents and hawkers usually dispose of used cooking oil by pouring them into sinks or drains, which can contaminate water resources and lead to clogging of the sinks and drains. Hence, inappropriate usage and disposal of cooking oil can have harmful health and environmental consequences. Also, it is widely known that fossil fuel resources are limited and fast running out. There is therefore a greater need to recycle our fuel resources. In addition, conventional fuels lead to greater pollution and emission of greenhouse gases, as compared to biodiesel which is a cleaner alternative. Unfortunately, much of these messages are not effectively transmitted and ingrained into the mindsets and everyday lifestyles of typical Singaporeans. Project RUSCO therefore serves to educate residents on the importance of recycling and the need to protect and conserve limited resources, so as to hopefully change the mindsets or even lifestyles of residents in the Chong Pang, Nee Soon Central and Nee Soon East constituencies. At the same time, the used cooking oil collected can be sold to vendors so as to raise funds for charitable causes.		
Commendation Award - $500	**ITE College Central (Yishun Campus)**	**Wind Power Charger for Vehicle**	**Alvin Lee Yu Qing, Kate Pauline Villon, Joann Christine Crespo, Liu Yang**
Project	At the opening of the World Urban Transport Leaders Summit 2010		

Summary	organised by the Land Transport Authority (LTA) Academy, Mr Raymond Lind, Singapore's minister for transport and second minister for foreign affairs, outlined the key plans to encourage the development and use of green technologies in Singapore. He introduced the theme for this year's summit as "Transforming Urban Transport for Liveable and Sustainable Cities". In his speech, Mr Lim shared that today's transport account for about 19% of global energy use and 23% of energy-related carbon dioxide (CO2) emissions, which these figures have been predicted to rise in the future. Based on given current trends, transport energy and use of CO2 emission are expected to increase by nearly 50% by 2030 and more than 80% by 2050. Cars with petrol driven internal combustion engines produce toxic waste products that pollute the air, damaging our health, animal life and the environment. According to a blog on green technology, there are a few options to save on petrol as more are getting wasted and used. One of which is the use of bio-fuel, follow by the use of solar panels for driving motors and making electricity. The third option is harnessing the wind power. In this project, we created our own wind power by building a wind generator. The project was conceptualization with the use of dynamos, which were used to harness wind power to create electrical energy. This electrical energy being generated by the wind power is channeled to the car battery (lead-acid type) for storage, as well as providing supply to the vehicle. Also, a simpler car charger circuit and regulator has been designed and implemented. This project report will discuss how petrol consumption can be reduced and hence the reductions of CO2, carbon monoxide and other toxic gas emission to the environment using wind power to charge car battery.		
Encouragement Award - $200	**Hwa Chong Institution**	**Hydraulic Dish Blockbuster! (HDB)**	**Wang Ying, Mak Yee Phon, Kong Ka Kay, Chen Qinyan**
Project Summary	In light of the environmental problems the society experiences today, this paper proposes one approach of utilizing the tropical weather conditions in Singapore, namely the abundant sunlight and high precipitation, to generate electrical energy. Such idea amalgamates solar panel and hydroelectric power generator, practical for both sunny and rainy days. Designed to be used in Housing and Development Board flats (HDB flats), the device is likely to gain high level of usage and popularity. Given this climatic advantages, we ought to tap on these readily natural resources to generate renewal energy so as to conserve our environment. Meanwhile, accompanied by the economic recovery a few months ago, Singapore's electricity demand has been skyrocketed. With 80% or more electrical energy generated from the local gas-powered plants, this surge again adds pressure on the consumption of natural gas. Hence, the aim of our project is to make use of the tropical climate in Singapore to curb the rising domestic electricity demand.		

	The course of doing this project has not been smooth sailing as we have met many problems and setbacks along the way. Researching extensively for the project has brought us to fields and ideas we never thought it would. Many of the knowledge this project required were beyond our school syllabus and were completely fresh and foreign to us, and hence, we have really gained much exposure. This project has indeed been an enriching and valuable experience for everyone of us. However, with more time, experience, relevant knowledge and further development of technology in the future, we are confident that we could come up with more innovative and useful ideas to tackle these problems and develop on our 'extensions' further. We aim to continue our research even after the completion of this project, so as to refine our ideas to make them more effective and feasible, in hope that we would be able to make a valuable contribution to environment conservation in Singapore in the future. Therefore, even as we conclude the report, we believe that our Green Wave journey does not end here.		
Encouragement Award - $200	**ITE College East**	**Development of biofilm filtration system for waste water used in home**	**Khoo Chia Loon, Chow Zi Xiang, Wang Wei Xuan, Tan Jing Ting**
Project Summary	During the period of the high economic growth in Singapore, people were seeking affluent lifestyles, and the demand for clean water jumped dramatically. In and multiple dwelling houses using this biofilm filtration installed at their homes, waste water from toilets or sinks can be used in home fish tanks or directed to aquacultural ponds in Singapore. This project reduces the water consumption used in homes as well as in agricultural industries. Biofilm filtration added an advantage of its compact sizes and easily installed at premises. The filtration system was made use of a group of nitrification bacteria to convert ammonia presence in the waste water to its least harmful byproducts that is suitable for aquarium purposes. It is also able to save costs as well as environmental – friendly by recycling waste water generated. This project investigates on the use of bio film for aquariums in homes using waste water on household domestic wastes through a special designed filtration system. The increasing number of families that result more waste water are being generated. Keeping fishes as pets is quite commonly found in families. This filtration system method is an effective ways to reduce water consumptions as well as protect the environment by recycling the water for the aquarium purpose.		
Encouragement Award - $200	**ITE College East**	**CEPAS - Enabled Power Socket**	**Norazlan B Suhaimi, Nazrul Shahrin B Saburudin, Ching Yulin**

Project Summary	In today's modern society which places great emphasis on environment-friendly lifestyle and living, numerous key initiatives have been undertaken by governments around the globe with the sole aim to crease an eco-friendly environment in their respective countries. Several of major green projects undertaken proved to be a huge success. The projects undertaken included but not limited to are "Eco-friendly World Expo 2010" in Shanghai, "The Beijing Olympics 2008" event and the "Solar-Powered Automobile". These projects not only contributed positively to resource enhancements, most importantly, it is sustainable without incurring huge costs on the governments. The idea of our project is to develop a power-socket with can only be activated through the tapping of CEPAS card. The purpose is to allow users at public premises to alternate the fair use of limited power-sockets without having any one user hogging the power socket for long hours. The power socket is preset to an hour for $1 of usage. The fee charged is deducted from the new ez-link card and /or nets flashpay card which complied with Singapore's new e-purse standard CEPAS. This new concept can be employed at public premises such as libraries, airports, schools, hospitals and etc.

(D) TERTIARY LEVEL

Prizes	School	Title of Project	Participants
3rd Prize $4,000	**Ngee Ann Polytechnic**	**Washing Machine Recycling Water System**	**Nur Aqilah Bte Muhammed Hashim, Li Kit Ming**
Project Summary	There is a shortage of water in Singapore. The media has emphasized on the importance of recycling and conserving water. However, our community does not really see the vitality of our natural resources that are slowly running out. Even a small bid in helping to conserve and reserve our resources will go a long way if everyone does their bid in the long run. Present day situations of wastage of our natural resources start from home. There is little water conservation in households in Singapore. This is because everyone is relying too much on the PUB tap water. The increase in tariffs still does not have much of an effect on Singaporeans. Currently, all outputs of water from the household goes straight to the drainage system and there is no automated system in homes itself where the output water is recycled. Thus we looked into this matter and realised that there is a possibility in recycling the output water from washing machines. The idea of using out Washing Machine Reycling Water System attempts to help the cause of conserving water in Singapore. Every household has a washing machine. Thus with our system, every household could do their part in helping to conserve water in Singapore. The usage of the washing machine in households is extensive considering that each week a household washes their clothes at least twice a week. The output water from the wash goes straight to the drain. Thus our system recycles the output water for the next rinse and wash. In our project, we have considered two different types of water that we can filter using our system. The first will be the recycled washing machine rinse water and the other is rainwater. Our filtering system is substantial in filtering out odor, chlorine, micro organisms and other unwanted particles. Referring to the attached quantity breakdown (Appendix 1), the estimated amount of water that could be saved is 10.8925 litres per household for a 5kg load washing machine.		
3rd Prize $4,000	**Temasek Polytechnic**	**CANs MEAN CAN!**	**Kristebella Lim Tianyu, Peggy Poh Pei Chi, Deborah Seet Ru Shan**
Project Summary	Turbidity (cloudiness of water) is often caused presence of negatively charged fine solid particles (colloids). High turbid water prevents light from reaching planktons which will kill the plants and ultimately, the sea creatures which depends on planktons for food. Copper waste (Cu^{2+}) is often not recovered but precipitated, filter-pressed out and		

	then dumped at landfills. Coagulants are used to neutralized the negative surface charge of the colloids so that they can come together to form bigger size settleable solids. However, proprietary coagulants are very expensive (>$20/kg). Coagulated copper is also not salvageable and with copper price at >$5000/tonne, this is very wasteful. This project makes use of waste materials (Cu^{2+} waste solution, metail cans, etc.) to produce Fe^{3+} coagulant. Fe^{3+} coagulant produced is studied for its effectiveness against conventional coagulant and if proven useful, used to reducethe operational cost of the waste water treatment line. Food cans are mostly made of steel (which is often opened at homes and then discarded into the rubbish bins). Most waste water from the electronic industries contains sizable amount of copper ions (Cu^{2+}). Treating waste water to remove Cu^{2+} (using flocculent/filter press) is expensive, detrimental to the environment as well as wasteful as Cu^{2+} , as a commodity, is costly (>$7000 ÷ tonne). In this project, steel food cans are used to extracts Cu^{2+} from waste water from the electronic industries. $Fe - 2e \rightarrow Fe^{2+}$ Standard electrode potential (E°) = -0.44 V $Cu^{2+} + 2e \rightarrow Cu$ Standard electrode potential (E°) = 0.3394 V Fe^{2+} (ferrous ion) generated is then converted to Fe^{3+} (ferric ion) by oxidation process (air bubbling, etc.). Fe^{3+} [in the form of $Fe_2(SO_4)_3$] is a useful flocculent and can be used in the treatment of waste water for removal of colloids (reduction to ENV's legal limit of 400 ppm), replacing or complementing proprietary flocculants which are often expensive (≈$20 ÷ kg). The benefits are plenty and are listed below in the next section.		
Special Merit Award $2,000	**Nanyang Technological University**	**Eco-line- A Green Integrated MRT System for the Future**	**Tai Ming Hang, Mo Yu, Kenny Tan Yi Ann, Ma Cong, Gao Yiben, Zhang Xiaojin, He Hanzhao**
Project Summary	Acceleration of industrialisation and economic blooming has always been perceived as the key elements in driving a country forward. Today, a different perception has arisen, following the rising concerns of energy depletion and land scarcity involving rapid development. Singapore, as one of the most industrialised and densely populated country, is withstanding doubled the pressure to overcome these crisis.		

	Our project 'ECO-line' answers these challenges by providing a 'green' solution towards sustainable design. ECO-line is an integration of mass rapid transit (MRT) system with algae biodiesel manufacturing. The proposed idea aims to develop a self-sustaining MRT system in terms of energy and water usage. Energy is derived from algae biodiesel process while water is conserved through rainwater harvesting. The design will encompass a land-saving MRT stations-based cultivation of microalgae with an effective transfer system for cultivated algae biomass. ECO-line also includes a generic rainwater harvesting system aapplicable to respective stations. ECO-line adopts a closed-loop system with biodiesel and anaerobic digester plants providing main energy sources. Biodiesel and methane gas extracted from harvested algae and algae biomass respectively are supplied to the power plant, where electricity generated will be used to power-up the MRT stations. This technology eliminates the need for external energy input generally derived from fossil fuel burning. The closed-system also takes into account the reuse and recycling of by-products from each plant, either as carbon source or nutrients for algae cultivation. Circulation of energy and by-products within the MRT system ensures minimum waste flow into the environment, thus prserving and conserving our Mother Nature. Individual MRT stations comprise of modern multi-function rooftop and well-designed algae cultivation system. The rooftop serves as both rainwater harvester and a platform for algae photo-bioreactor. It has basic hexagonal shape, combined into nine windmill-like shapes spanning over a total rooftop area of 4200 m^2. Each 'windmill' is properly angled for maximum rainwater collection efficiency. Collected rainwater is channeled through pipes, passing first flush device before being stored in a cistern for subsequent usage. Culturing of algae involves using *Botryococcus braunii* species due to their ability to produce huge amount of biodiesel yield. The algae are filled in photo-bioreactors made from fiber glass. With proper design considerations for optimum growth, the photo-bioreactors made from fiber glass. With proper design considerations for optimum growth, the photo-bioreactors are installed in two main sections, namely level 2 and ground level. The algae are pumped from two feeding pipes (towards both level) connected to a feed tank located at second level. Another tank is also set-up for collecting algae biomass, waiting to be transported away. This system employs a continuous algae harvesting operation on top of 7 days cultivation period. Application of this operation cycle maximises the efficiency of technical control aspects, besides ensuring continuous matured algae supply to the biodiesel plant. A thorough design has also been made on algae transportation into and out from the MRT stations. Algae transporting is carried out daily during late night by deploying freight train. The freight train carries

	fresh algae from the terminal factory to be offloaded at each MRT station. Concurrently, the biomass tank containing matured algae will be uploaded and be transported to the biodiesel plant. The collection process employs the hauled container system throughout the entire ECO-line. Generally, MRT system sustainability in terms energy and water is achieved through integration of 4 renewable technologies namely microalgae cultivation, biodiesel extraction, anaerobic digestion and rainwater harvesting system. The strength of ECO-line lies on its self-sustaining ability which operates on renewable energy. Cultivation of algae and their production into biodiesel has proven to be environmentally friendly with minimum carbon footprint. This move opens up a new sector for Singapore government to tap into, judging by its potential to reap high profits through selling of extra generated electricity. ECO-line will also be a new 'green' landmark for Singapore, highlighting the country's emphasis on environmental sustainability.		
Special Merit Award $2,000	**Singapore Polytechnic**	**Separating the Domestic Waste at Source - The Recycle Bin**	**Daryl Ng Zheng Yu, Muhammad Aidil Shuklan Bin Abdul Razak, Yu Huan**
Project Summary	The idea we thought of is to have a compact bin that have sliding tracks to allow 4 handle bars with rollers to hold 3 colour coded plastic flexible dividers, which would hold 3 clinch-on removable plastic bags to keep three common types of recyclable wastes separately. While the three different types of wastes may come in different quantities at any period, the bags are self adjustable with their own flexibility in the bin, therefore no wasted or extra space will be needed as compared to using the traditional 3 fixed size compartmental recycling bins. Our bin design therefore will occupy less space at the collection points. The trash bags could be the used bags from supermarkets. As long as the bin is fully filled, these bags could be the used bags from supermarkets. As long as the bin is fully filled, these bags could be replaced immediately all at once or removed indivdually. The filled bags will be tied up and the segregated recyclable wastes could then be transferred to the bulk bin elsewhere or handed over to the recycling collector directly. To contain the possible odour and to abate the unpleasant sights of the wastes in the bin, the dividers could be opened or closed by the sliding movements of the handles ; the three bags could then be opened individually to allow for the entry of the recyclables and be closed to conceal the wastes. An additional top sliding cover is provided to cover the bin fully to keep the contents of the bin out of sight when it is not in use. To avoid the potential squeezing and rupture due to unbalanced weights between the bags when they are filled with different types of		

	recyclable wastes, a pair of rotatable weight retention bars is fixed at the centre position of the bin to prevent the bags from entangling with one another. In order to further enhance the space efficiency of our bin, we have also designed a simple yet effective bottle and can compactor which will be incorporated with the bin at the bottom, the volume of empty plastic bottles and aluminum cans could be further reduced by this compactor which is operated by foot power before being disposed into the recycle bags, hence increase the holding capacity of the bin.		
Special Merit Award $2,000	**Ngee Ann Polytechnic**	**Solar Power Hydrogen Welding Torch**	**Lionel Seah Hao Feng, Leong Wei Jie, Navaneesvaran S/O Panjanathan, S. Athista Prabu**
Project Summary	The objective of our project is to design and make an eco-friendly system that allows welding process to be done with the use of hydrogen produced by an Electrolyzer which is powered by solar energy. Basically the electrolyzer, powered by batteries, produces hydrogen which is used for brazing brass. The batteries are charged using solar panels. Safety has been an important factor for us as we are dealing with flammable gas like hydrogen. Therefore we have various components to improve the safety features. These include charge controllers, circuit breakers, flashback arrester etc. to help prevent any leakage or circuit fires. The purpose of this project is to help the welding industry turn green to do their part in saving the environment. And to help our purpose we have installed various components and used various sources to as to keep as green as possible. Acetylene and oxygen are the regular gases used in industries for welding operations. However, we are replacing these gases with solely Hydrogen alone. And we are obtaining Hydrogen from water itself with the use of an electrolyser. Thus, making this an environment-friendly factor. We are powering our electrolyser with green enery using solar panels. We are storing the energy in two gel type batteries and the solar panel are not attached to the system. Therefore, the system is portable. The system (without the solar panel) weighs 60 kg. This includes the wooden block placed on top of the system so as to aid the user as a		

	makeshift workspace. On the average the electrolyser produces 0.3 litres/min of hydrogen. The flame has a tmperature of 700 – 800 degree Celsius. Thus, enabing it to melt Brass.		
Commendation Award $500	**Ngee Ann Polytechnic**	**Wave Harnessing Structure**	**Jeremy Tay Gui Qiao, Chua Kwee Hong, Safwan Bin Slamat, Siti Khairunnisa Binte Jamaludin**
Project Summary	This is a design-and-build project that converts wave energy to usable energy for powering. It integrates principles of offshore engineering, mechanical and electromagnetic designs. The design concept hopes to demonstrate and propagate the idea of harnessing wave energy for powering in Singapore coastal waters. The Wave-Harnessing Structure (WHS) model demonstrates the feasibility and practical application of the concept with due considerations of the operating environment in Singapore coastal waters. The concept integrates a new mechanical disign wiht a commercial-off-the–shelf (COTS) electromagnetic induction and energy storage. This environmental-friendly maritime project demonstrates that useful sustainable energy could be harnessed from these waters with minimal impact to the environment.		
Commendation Award $500	**Ngee Ann Polytechnic**	**Tidal - Energy Generator**	**Teo Jun Hao, Jackson Teo Eng Kiat, Malcolm Lee Jia Yi**
Project Summary	The work described herein was to design and construct an energy generative device using tidal energy which will suit the environmental conditions of Singapore water. This project exhibits clean and renewable energy by using tidal harnessing concept which are more predictable than wind or solar energy. The prototype demonstrates that useful sustainable energy could be harnessed from the sea with minimal impact to the environment. The tidal energy that the prototype is targeting to capture will be the kinetic energy of the tidal current. When the flowing current caused by the tides enter the prototype inlet, the blades of the turbine which is connected the shaft rotates, will transmit power through the gear-driven generator, thus converting the energy produced by the flowing current into electrical energy which can be used to power different types of applications.		
Encoura	**National**	**Rainwater Harvesting**	**Winnie Heng Yun Ni**

gement Award $200	**University of Singapore**	**Technology via Novel Greenroof Configuration**	
Project Summary	The problems of flash flooding and inability to ensure stormwater management have been crucial issues closely tied to highly urbanised cities like Singapore. The use of green roof is one of the stormwater best management practices available among others for cities with limited land constrain. Despite the various environmental benefits green roof brings, little attention is paid to the quality of runoff. The quality of roof runoff which largely depends on the roof's configuration and maintenance is a problem that has been overlooked. In an attempt to an innovation green roof using natural materials, the objective of this project is to identify and evaluate a low cost biomaterial (i.e. crab shells) for the removal of contaminants present in roof runoff utilising a viable technique (i.e. biosorption). Fundamental research consisting of single metal batch experiments were carried out to investigate and evaluate the ability of crab shells as a biosorbent to remove 12 different contaiminants such as heavy metals (i.e. copper, cadmium, nickel, zinc, lead, cobalt, aluminium, iron, manganese, chromium, and arsenic) and nutrients (i.e. phosphates). Experimental data collected are then modelled against both the Langmuir and Freundlich isotherms to compare the removal effectiveness of each heavy metal against other contaminants. High values for maximum uptake, Q_m & affinity constant, b, for each each heavy metal obtained signifies that crab shell is a desirable and effective biosorbent. SEM-EDX analysis further proves that heavy metal removal is through biosorption onto the surface of crab shells. Applied research which i then carried out to treat rainwater green roof runoff with crab shells showed a generally high contaminant removal efficiency of about 95%. In view of a practical application, a layer of crab shell is proposed to be added to ensure that green roof acts as a sink for contaminants. This drastically improves the quality of roof runoff by reducing the cost for downstream treatment ; while fully utilising the environmental benefits green roof brings and alleviating the problems of flash floods.		
Encouragement Award $200	**National University of Singapore**	**Vermicomposting of Organic Wastes in Singapore**	**Lam Yuen Sean**
Project Summary	Vermicomposting - a combination of biological processes, designs and techniques used to culture large quantities of earthworms to accelerate the stabilisation of organic waste materials – could be an answer to the problems posed by the increasing solid wastes generation, and thus, this project aims to assess the effectiveness of vermicomposting of organic wastes in Singapore as a multi-pronged approach to achieve environmental sustainability. Solid wastes are known to pose multifarious impacts to our		

	environment. Approximately 70% of Singapore's municipal solid waste consists of compostables and paper products, and there are plenty of rooms for recycling efforts to be made in these organic waste streams. The Iministry of the Environment and Water Resources (MEWR) has identified several long-term objectives for sustainability, namely, increasing the overall waste recycling rate, and extending the lifespan of both incineration plants and landfill. The vermicomposting process can help to meet these waste management targets, as it executes three concurrent beneficial functions : (i) rduction of organic wastes ; (ii) vermicompost production ; and (iii) culturing of earthworms for vaious subsequent uses. Vermicomposting is capable of increasing the overall recycling rate of organic wastes, aiding Singapore in achieving the "Towards Zero Landfill'' campaign. Furthermore, the stabilised vermicompost produced can be used for sustainable land restoration practices. Having a sound integrated solid waste management (ISWM) is essential in Singapore, and vermicomposting of organic wastes could be a major component of this ISWM in striving towards environmental sustainability. The engineering of biiological systems to efficiently and economically process large volumes of wastes has only recently been refined to the ppoint of commercial viability. The feeding habits and reproductive cycles of certain earthworm species should be utlised, allowing large facilities to operate and economically compete with other waste disposal methods. Relevant recommendations and various issues will be discussed in order to implement and promote vermicomposting in Singapore.		
Encouragement Award $200	**Republic Polytechnic**	**Improve the efficiency of solar panels through hydro cooling**	**Deanna Yong Hui Lan, Cheong Liling, Muhammad Ali Hanafiah Bin Mohd Razif, Ravindran, Ma Lwin Mar Soe**
Project Summary	Fossil fuels are continually used to supply most of the man's energy needs despite the environmental harm they cause and their contributions to global warming. In recent research, it was observed that there was a rapid rise of carbon dioxide emission from burning of fossil fuels, and a fast depletion of fossil fuels from the Earth. Although alternative energy has not yet gained popularity with most parts of the world, many countries have started to adopt alternative energy in a bid to preserve fossil fuels and to stop contributing to global warming. Alternative energy sources like solar energy, wind power and hydro power, have zero carbon emission unlike fossil fuels. These alternative energy sources are also found naturally in the environment and are renewable resources. The climate of Singapore was tropical, being hot and humid all year round with only a slight variation in temperature between monsoons.		

	It's a known fact that Singapore does not have any form of natural resources, so why not tap on the tropical climate to make full use of a renewable resource such as sunlight to convert into electricity with the help of solar panels. Solar energy can be converted into electrical output by the use of photogoltaic cells. However the performance of the solar panels can be affected by the avaliability of solar irradiation and the temperature of the solar panels. When solar irradiation was low or when the solar panel gets hot, the solar panel's voltage output will be poor, decreasing its efficiency. The objective of this project was to investigate the effects of this project was to investigate the effects of increasing the efficiency of photovoltaic cells by submerging the panels in quarry water. The granite quarry in Pulau Ubin was disused and the vast amount of water's potential was not be being fully utilised. However before the experiment was actually carried out in a quarry, it was experimented in Republic Polytechnic's roof top using an inflatable swimming pool. The purpose of submerging the photovoltaic cells in water was to cool them down, allowing them to maximise their efficiency. A total of three panels were used, two of which were submerged and one acted as a control on dry ground. The height between the submerged panels and the surface of the water were varied day to day, to determine if depth affects the efficiency so that we could determine which was the best depth to place the panels in future at P. Ubin. Results showed that the panels were best placed 5.5 cm below t he surface of water to achieve best Open Circuit voltage. Due to cloudy weather and frequent rain, there wasn't enough time to obtain data to conclusively show that cooling the panels in the inflatable pool could improve its efficiency. However with this result we could now place the panels 5.5 cm below the surface in the P. Ubin quarry.