

“Now I can do my part in protecting the environment, as a contribution to my son.”



NEW ENERGY AND  
DIVERSIFIED BUSINESSES

# eco-friendly choices.

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The ECO’s renewable energy initiative is underway, with the construction of a plant converting bio-oil into high-quality chemical products and fuel substitutes nearing completion

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The construction of our South East New Territories (SENT) landfill gas treatment facility has been completed, further actualising our sustainable development goals

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ECO’s pilot project converting agricultural waste into furfural and levulinic acid is anticipated to have significant implications for the nation’s environmental practices





# NEW ENERGY AND DIVERSIFIED BUSINESSES

*Towngas is environmentally conscious in all business considerations. Our research and development initiatives continue to cultivate clean fuel alternatives with considerable environmental benefits and economic potential. Looking forward, our innovative ventures are expected to contribute to a sustainable future for the Group and the environment.*

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Expected to commence by the end of 2017, our new facility in Zhangjiagang, Jiangsu province, will convert low-grade by-products of the oil refining process into valuable feedstock.

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## New ECO Energy

ECO Environmental Investments Limited (ECO) is the Group's new energy platform. With strong research and development in alternative energy, ECO has successfully introduced innovative technology turning low-grade waste materials into high-value energy products, bringing the

Group closer to its new energy vision. Currently, our product portfolio comprises clean fuels such as liquefied natural gas (LNG), methanol and other gasoline substitutes, with more high-value, environmentally-friendly energy, chemical and material products soon to be added. By building a diverse energy portfolio sourced

from indigenous low-value feedstock, ECO is defining a new route for mainland China to simultaneously meet its future energy demands and address its environmental concerns.

One of ECO's key strategies is to develop a robust LNG value chain. To secure our supply of LNG, we are converting various

types of feedstock abundant on the mainland, including coalbed methane. Our coalbed methane liquefaction facility in Jincheng, Shanxi province, converts 250 million cubic metres into LNG each year. Though depressed LNG market prices in the first half of 2016 presented a challenge, our operations have continued to run smoothly. Meanwhile, construction of another facility in Xuzhou, Jiangsu province, which converts coke oven gas, an industrial by-product of the coke-making process, into methane and LNG, is nearing completion. With this project expanding ECO's LNG production capacity, business is expected to improve in 2017, in tandem with recovering international crude oil prices.

Our coal-based chemical plant in Inner Mongolia employs clean coal technology to generate syngas, which is then synthesised into methanol. Production capacity of the plant was expanded to exceed 1,000 tonnes of methanol a day in 2016, and we also began construction of a facility to upgrade methanol into natural gasoline that can be used to substitute high-grade gasoline. The facility is currently undergoing operational trials, and is expected to be completed by mid-2017.



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By expanding ECO's refilling station network, we continue to drive the conversion from diesel to cleaner natural gas for vehicles across the mainland.

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In 2016, we launched another construction project at our Inner Mongolia plant to convert 40 per cent of the coal-based syngas into ethylene glycol, a high-value chemical product in great demand for the production of polyester fibres and antifreeze formulations. The project is expected to start trial production by the end of 2017, and marks significant progress in our efforts to transform the Inner Mongolia coal chemical plant into a downstream value-adding facility that uses our own state-of-the-art technology to turn coal feedstock into environmentally-friendly products of high economic value.

The construction of a plant to upgrade low-grade inedible bio-oil in Zhangjiagang, Jiangsu province, is proceeding as planned, with production trials set for the third quarter of 2017. Integrating ECO's proprietary technology for the highest efficiency and yield, the plant will have the capacity to convert up to 220,000 tonnes of palm acid oil per year into high-value fuel substitutes by extracting high-quality oleic acid and upgrading the residue into surfactant chemical products. Further research and development is underway to refine even purer forms of oleic acid and linoleic acid for greater added value.

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Our SENT landfill gas treatment plant will be commissioned in the second quarter of 2017.

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As an agrarian economy, mainland China produces an abundance of agricultural waste after harvest seasons annually, which ECO has targeted as an important source of raw material for our renewable initiatives. Traditionally, agricultural waste is burned on-site, causing severe smog pollution during harvest seasons. Using innovative technology developed in-house, ECO has launched a pilot project in Tangshan, Hebei province, converting agricultural waste into furfural and levulinic acid, which can be further upgraded into valuable clean fuel additives. It is expected to begin operational trials in the second half of 2017.

New energy vehicles are being championed worldwide in an effort to combat air pollution. Much research is being carried out to achieve a breakthrough in battery technology, which

dictates the performance of the vehicle. ECO has developed and patented a technology to produce high-grade pitch from tar oil. This pitch has the potential to produce high-quality carbon material products in bulk, including activated carbon with a high specific surface area, an essential material for supercapacitors, and mesocarbon microbead, the preferred material for high performance battery anode production. Both are crucial components of high performance power storage systems. Currently, ECO is conducting a mid-scale industrial test to ready the technology for commercial application. In addition, ECO is pursuing advanced development works to formulate silicon-carbon composite anode materials with even higher power storage capacity.

On the demand end of our LNG value chain, ECO is focusing on initiatives that drive the conversion from diesel to cleaner and less expensive LNG for heavy-duty trucks and marine vessels across the mainland. ECO currently possesses 62 vehicular refilling stations in operation, under construction or at the planning stage, forming an extensive network in provinces and autonomous regions including Shaanxi, Inner Mongolia, Ningxia, Shandong, Shanxi, Jiangsu, Henan and Liaoning. Our facilities are strategically stationed, for example, at depots and along the routes of Guangzhou's publicly operated waste disposal fleet. By expanding our network of refilling stations, we are forging a highly integrated LNG value chain in anticipation of expanding LNG fleets on the mainland.

In Hong Kong, ECO's major businesses – a facility supplying aviation fuel to Hong Kong International Airport, dedicated liquefied petroleum gas (LPG) vehicular refilling stations serving a network of taxis and mini-buses, and landfill gas utilisation projects, continued to operate smoothly in 2016.

ECO's aviation fuel facility provided a safe and reliable fuel supply to Hong Kong International Airport, with a total turnover of approximately 6.2 million tonnes in 2016, it continues to contribute a steadily growing return on investment. Despite depressed international oil prices over the past year, our five dedicated LPG refilling stations were able to reap a satisfactory profit margin and pass the benefit of lower LPG

prices on to customers at the same time.

ECO continues striving for wider utilisation of landfill gas – an otherwise wasted source of energy generated by the decomposition of municipal waste which, apart from a small portion used for on-site power generation, is typically flared off in a polluting manner. In 2003, ECO began its acclaimed project at the North East New Territories (NENT) site, one of Hong Kong's three strategic landfill sites, transporting treated landfill gas to our Tai Po gas production plant through a dedicated 19 km pipeline. Furthering our carbon emission reduction efforts in Hong Kong, ECO's second landfill gas utilisation project, located at the SENT landfill site,

was progressing smoothly and is expected to commission in the first half of 2017, marking the start of a new chapter in our green journey.

## Telecommunications

Towngas Telecommunications Company Limited (TGT) provides connectivity and cloud computing services to professional clients, such as telecommunications carriers, international network service providers and reputable corporations.

Our synergistic connection and comprehensive portfolio are tailored to meet customer demand with colocation, server hosting and various value-added services that have received high satisfaction ratings.



TGT now operates six data centres across Hong Kong and mainland China with a total capacity of 15,000 server racks.

This year, we expanded our capabilities by joining with strategic partners, including Hong Kong Broadband Network, to create two joint ventures, TGgo and Broadbandgo, which provide cloud computing, broadband and Wi-Fi services. We also continued our efforts to facilitate business application development on cloud technology, creating clouds for finance, gas utilities and more.

While seizing business opportunities in the Big Data Era, TGT is privileged to serve as Vice President of the Shenzhen Big Data Industry Association. This is a remarkable and beneficial opportunity for us to expand our business and establish our plans for long-term development on the mainland.

TGT was honoured with numerous international awards and recognitions this year. TGT Hong Kong Data Centre 2 was awarded

the ISO14001, ISO20000-1, ISO27001 and Level II security guidelines issued by the Hong Kong government, and TGT Dalian Data Centre 1 won the U.S. Green Building Council's LEED Core and Shell System Gold Level Certificate, among others.

### Information Technology

As a wholly-owned subsidiary of Towngas, S-Tech Technology Holding Limited (S-Tech) is responsible for software development, project implementation and system integration, all of which have successfully enhanced service quality and efficiency for the Group.

Currently, S-Tech has deployed its Towngas Customer Information System to 80 per cent of the Company's city-gas joint ventures on the mainland. By using cloud and mobility solution,

we developed applications such as Mobility Regular Safety Inspection, Mobility Meter Reading and Mobility Maintenance Service, saving management costs and improving customer service quality. To provide a more interactive and comprehensive service to Towngas customers, we leverage innovative technology to link up with several key service platforms, including an online service centre, payment gateway, smart metering and call centre system. S-Tech also invests in developing gas-specific Supervisory Control and Data Acquisition and Geographic Information System to further enhance operational safety while offering high-quality and efficient gas services.

### Civil and Building Services Engineering

U-Tech Engineering Company Limited (U-Tech), another

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The advanced Near Field Communication (NFC) residential gas meters developed by M-Tech offer more accurate gas consumption readings and allow for tariff prepayment.

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wholly-owned subsidiary, provides consultancy and engineering contractor services in Hong Kong and Macau. It specialises in utilities installation, infrastructure construction, trenchless technologies and civil and building services engineering for public and private projects.

2016 was an excellent year for U-Tech, with the successful completion of several landmark projects, including the supply and installation of electrical works and air-conditioning for the Manulife Tower in Kowloon Bay, the construction of a footbridge linking Tsing Yi North Bridge and Tsing Yi MTR Station, and the rehabilitation of seawater cooling mains for the Electrical and Mechanical Services Department in Central and Wan Chai. During the year, U-Tech secured several new contracts, including the installation of electrical works, fire services and air-conditioning for the Manulife Financial Centre in Kwun Tong, and the construction of 13 pedestrian elevators for the Civil Engineering and Development Department. U-Tech also won its first slope improvement contract from the Agriculture, Fisheries and Conservation Department.

In recognition of its high standards of quality and safety, U-Tech was awarded the Safety Performance Award – Construction from the

Occupational Safety and Health Council for the third consecutive year. U-Tech also received the HKCA Proactive Safety Contractors Award from the Hong Kong Construction Association.

## Manufacturing Businesses

Proprietary smart gas meter solutions are developed and marketed by our subsidiary, M-Tech Metering Solutions Company Limited (M-Tech). These gas meters incorporate Micro-Electro-Mechanical Systems (MEMS) technology to eliminate the effect of temperature and pressure towards meter accuracy, achieving a more accurate measurement in gas consumption. These features have driven down the cost of installation. We are planning to supply these solutions to all our city-gas businesses, as well as others in mainland China and overseas.

In 2016, M-Tech launched a new generation of NFC residential gas meters to meet the requirement for tier tariffs on the mainland. These meters allow for tariff prepayment, tier tariff settings and gas consumption records to avoid conflict during tariff adjustment. They also have several gas safety features, such as regular safety inspection alerts,

excess flow cut-off and external interference alarms. Committed to customer satisfaction, M-Tech developed an advanced small-scale commercial meter with MEMS technology to provide more options for metering solution.

To ensure the highest standards of quality across the supply chain, G-Tech Piping System (Zhongshan) Company Limited (G-Tech) supplies high-quality polyethylene (PE) pipes, supported by our joint venture with the UK-based Fusion Group, GH-Fusion Corporation Limited (GH-Fusion), which specialises in PE fittings.

Despite the relatively weak export climate in mainland China, the PE piping business expanded rapidly in 2016, reinforced by steadily increasing export opportunities. During the year, the business supplied approximately one-third of the Group's mainland markets and started developing business in other regions as well as markets outside the Group. To capture these opportunities, a second G-Tech PE pipe factory came into operation in Maanshan, Anhui province in the last quarter of 2016, doubling total production capacity and enabling a wider market reach on the mainland. GH-Fusion also developed a number of new PE fittings to address the needs of the market.



## 2016

### New Energy and Other Projects

#### New Energy Projects

##### COAL MINING

	Year of Establishment	Project Investment Rmb M	Registered Capital Rmb M	Equity Share %
Jiangxi Fengcheng	2008	1,100	236	25%
Inner Mongolia Erdos Kejian	2011	450	150	100%

##### COAL-BASED CHEMICAL

Jiangxi Fengcheng	2009	1,250	350	40%
Inner Mongolia Erdos	2009	1,170	867	100%

##### CNG/LNG REFILLING STATIONS

Shaanxi Xianyang	2008	12	12	100%
Shaanxi Huitai	2010	54	27	100%
Shaanxi Lueyang	2014	21	13	100%
Shaanxi Fengxiang	2014	30	15	100%
Shaanxi Shenmu	2015	60	38	100%
Shaanxi Baoji	2015	29	14	100%
Shaanxi Zhouzhi	2016	14	10	100%
Shaanxi Weinan Gushi	2016	15	11	100%
Shaanxi Weinan Tianshi	2016	21	14	100%
Shaanxi Hancheng	2016	47	41	90%
Shanxi Yuanping	2008	40	20	42%
Shanxi Lingshi	2013	25	20	75%
Shanxi Pinglu	2014	27	14	100%
Shanxi Xinzhou	2016	30	15	100%
Shandong Chiping	2010	30	15	100%
Shandong Jining	2010	11	8	100%
Shandong Dongping	2010	43	26	91%
Shandong Jiaxiang	2012	50	28	70%
Shandong Weishan	2014	58	29	100%
Shandong Shanxian	2014	28	14	100%
Shandong Linqing	2014	22	13	100%
Shandong Heze	2015	23	13	90%
Hebei Shijiazhuang	2014	65	31	100%
Xingtai (Gangxing)	2014	20	17	80%
Xingtai (Xinghua)	2016	24	23	80%
Henan Xinmi	2010	29	15	100%
Henan Anyang	2012	29	14	100%
Henan Kaifeng	2013	29	15	100%
Henan Linzhou	2013	30	20	100%
Henan Nanyang	2015	14	10	100%
Henan Luoyang Yanshi	2016	15	10	100%
Inner Mongolia Huhhot	2014	28	14	90%
Inner Mongolia Wulatezhong Qi	2015	11	8	100%
Inner Mongolia Xiwuzhumuqin Qi	2015	30	15	100%
Inner Mongolia Chifeng	2015	30	15	100%
Inner Mongolia Chaha'eryouyiqian Qi	2015	30	15	90%
Inner Mongolia Xilingol	2016	18	15	100%
Inner Mongolia Ulanqab Huade	2016	29	14	100%
Inner Mongolia Ulanqab Chahar	2016	15	6	100%
Inner Mongolia Bayannur Uradqian Qi	2016	15	7	100%
Inner Mongolia Bayannur Linhe	2016	15	6	90%
Inner Mongolia Bayannur Hanggin	2016	25	18	90%
Ningxia Guangwuxian	2015	15	11	100%

## New Energy Projects

### CNG/LNG REFILLING STATIONS

	Year of Establishment	Project Investment Rmb M	Registered Capital Rmb M	Equity Share %
Ningxia Qingtongxia	2015	21	15	100%
Ningxia Jinyintan	2015	28	14	100%
Ningxia Zhongwei	2016	18	12	100%
Ningxia Zhongwei Haixing Development Zone	2016	30	15	100%
Jiangxu Xuzhou	2015	40	20	80%
Anhui Maanshan	2006	15	11	30%
Jiangxi Pengze	2015	45	30	70%
Guangdong Guangzhou	2013	26	13	100%

### UPSTREAM PROJECTS

Shanxi LCBM	2006	600	200	70%
Jilin Tianyuan	2007	140	5	50%
Xuzhou COG	2014	453	151	80%
Heze COG	2014	450	150	90%

### COAL LOGISTIC PROJECT

Shandong Jining Jiaxianggang Logistic Port	2011	540	180	88%
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### BIOMASS

Zhangjiagang	2014	610	205	100%
Tangshan Yutian	2016	180	60	100%

## Oilfield Project

Phetchabun Province in Thailand	2012	USD 181M	USD 12,000	100%
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## Telecommunication Projects

Shandong Jinan	2008	80	40	90.1%
Shandong Jinan Chibo	2009	504	168	81.4%
Shandong Laiyang	2011	14	10	90%
Xuzhou Fengxian	2011	11	8	100%
Xuzhou Peixian	2012	13	9	100%
Liaoning Dalian DETA	2010	14	10	49%
Dalian Yida	2011	190	76	90%
Harbin	2013	158	63	80%
Beijing Zhongjing	2014	14	10	49%
Beijing Chibo	2014	14	10	97%
Dongguan	2013	240	80	60%
Shenzhen (Qianhai)	2014	59	29.5	100%
Shenzhen (Interlink Connectivity)	2015	99	40	30%

## Other Projects

Shenyang Sanquan Construction Supervisory	2011	4	3	60%
ECO Engineering Management (Xi'an)	2014	13	9	100%
Suzhou Industrial Park Broad Energy Services	2012	170	71	25%
GH Yixing Ecology	2013	184	184	100%
Dalian (New Energy Technology)	2015	USD 4.75M	USD 4.75M	100%
M-Tech	2011	60	30	100%
GH-Fusion	2001	87	43	50%
G-Tech	2012	77.5	31	100%
Towngas Technology	2011	30	21	100%
S-Tech (Zhuhai)	2014	7	5	100%
ECO Engineering Management (Shenzhen)	2014	30	15	100%
Towngas Lifestyle	2015	7	5	100%
Towngas Payment Technology (Shenzhen)	2015	50	28	100%
Hong Kong & China Gas International Energy Trading	2016	125	50	100%