



Bluetech Award



3rd Bluetech Technology Manual

December 2017

Organizer

Clean Air Alliance of China

Co-Organizers

Innovation Center for Clean-air Solutions

Zhongguancun International Environment Protection Industry Promotion Center

Beijing Municipal Research Institute of Environmental Protection

China National Investment and Guaranty Corporation

Supporting Organizations

Foreign Economic Cooperation Office, Ministry of Environmental Protection	Asia Society (USA)
Center for Environmental Education and Communications of Ministry of Environmental Protection	The administrative committees of the Zhongguancun Science Park
Energy-saving Technology Promotion Committee of China Energy Conservation Association	China Council for Industrial Environmental Protection
Chinese Research Academy of Environmental Sciences	Energy Foundation China
China Association of Environmental Protection Industry – Committee of Exhaust Control	Energy and Environment Branch of Chinese Society For Environmental Sciences
China Association of Environmental Protection Industry – Committee of Vehicle Emission Control	Beihang University
Beijing Global Village Environmental Education Center	Research Institute of Environmental Science and Engineering, Tsinghua University
VOCs Pollution prevention and control Specialized Committee, All-China Environmental Federation	Shanghai Environmental Monitoring Center
IE expo	



Contents

Bluetech Award Introduction	4
Process	4
Approach	5
Assessment	5
Highlights of Bluetech Award	6
3rd Bluetech Award Categories	13
Category 1: Diesel engine emission reduction technologies & clean energy substitutes	13
Category 2: Coal combustion emission control & clean energy substitutes (non-power sector)	14
Category 3: VOCs substitution and pollution prevention	14
Category 4: Indoor air pollution control	15
Category 5: Advanced pollution source and air quality monitoring	15
Bluetech Future Star	16
Bluetech Winners	18
Catalytic Candle Filter (CCF) Technology for Multi-Pollutant Exhaust Emissions Control	19
Comprehensive Utilization Technology of Low Temperature Waste Heat Recovery of Blast Furnace Slag Flushing Water and Steam	21
Integrated Condensing Gas Boiler Technology	23
Improved Vapor Recovery Unit	25
Fast, Multi-point Magnetic-sector Mass Spectrometry VOCs Online Monitoring System	27
Environmental Air Quality On-line Monitoring System	29
Bluetech Future Star Award	31
Particle Agglomeration Inducer (PAI)	32
Large Straw Biological Anaerobic Fermentation System	33
Copper/Zinc Energy Super-Storage Batteries	35
Hexa-Cover	36
Phage-Based Chemical Sensor Networks-VOC	38
Real-time Multi-scale Dynamic Traceability Analysis and Decision-supporting System	39
Finalists	40
Previous Winners	71

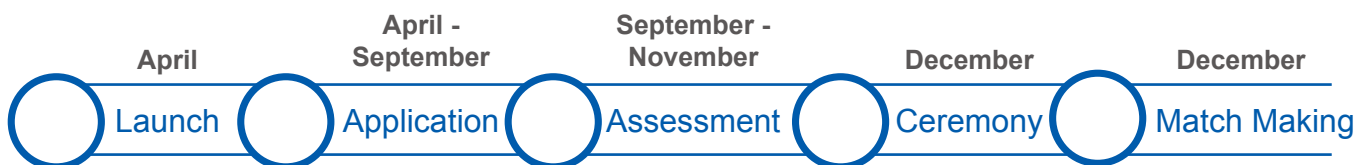
Bluetech Award Introduction

The Bluetech Award is launched by the Clean Air Alliance of China to seek and promote high-quality international clean air technologies. Technologies that submitted will undergo a standardized evaluation process that verifies practical results, where the selection committee will examine environmental benefits, technical performances and financial advantage. The winners will receive ample support from the CAAC and its partners to expand their ability to create a blue sky for everyone.



- International: We seek technologies from leading countries around the world, work with international experts in our selection process, and leverage international media coverage.
- Objective and Scientific Process: We use a uniform, systematic assessment methodology to examine all technologies for practical, real-life results. Our methodology includes document review, expert analysis, on-site examinations and lab tests.
- Result-oriented: Our procedure focuses on real-world results.
- Systematic Dissemination: Participants get featured dissemination at the Bluetech Forum, and through our official website, custom local matchmaking sessions, video releases, WeChat platforms, and media partners.

Process



Approach

Gathering clean air technologies from China and overseas, the Bluetech Award provides a platform for technologies to validate and demonstrate core competencies. The Award uses the Clean Air Technology Assessment Methodology to examine real-world results, analyzing environmental benefits, technological performances and financial viabilities to find breakthrough potentials.

Assessment

1

Form Bluetech Assessment Expert Panel

Includes international clean air technology experts, industrial and testing experts.

2

Preliminary Assessment Plan

Design preliminary assessment plan for each category to carry out essential technology screening for advanced assessment.

3

Preliminary Assessment

Using preliminary assessment plan to conduct quick evaluation based on technology or product performance data as provided by the applicant.

4

Advanced Assessment Plan

Design specific assessment plan for every technology to assess its breakthrough potential in environmental, technical, and financial fields.

5

Advanced Assessment

Using advanced assessment plan to assess technology which includes document review, on-site investigation and laboratory testing.

6

Assessment Conclusion and Reports

A full assessment report and simplified assessment report are issued for each assessed technology.

7

Publicize Assessment Result

The assessed technology will be recorded into Bluetech Platform.

Highlights of 3rd Bluetech Award

Award Categories Match the Need to Support Local Implementation

The Bluetech Award aims to promote best available clean air technologies to help tackle China's air pollution problems. Air pollution is a very complex issue. Different cities face very different sources of pollution due to varied economic development levels, energy structures, and urban modes. How to help cities to develop their own clean air action plans with reference to the most advanced technology is key to accelerate the pace of restoring blue skies. CAAC was launched 10 local clean air pilots since 2014. This year's bluetech categories are closely linked to the technology needs from these pilots.

Beijing-Tianjin-Hebei: Air pollution in Beijing, Tianjin and Hebei (Jing-Jin-Ji) Region and its surrounding areas has attracted significant attentions all over the world. It is estimated that if the coal burning pollution in rural areas during winter can be eliminated, the PM_{2.5} concentration can be reduced by 20% in Jing-Jin-Ji, and 40% for Beijing alone, which is more than the emission transportation sector and power plants combined. Hence, the coal pollution prevention and control for non-power sector is also selected as a technology category for 2016 Bluetech. Winners in this category will have opportunities to support the development of the Technological Guidance of Jing-Jin-Ji Household Coal Pollution Control, and participate in the local technology demonstration projects.

Shenzhen: Shenzhen is China's leader in clean air efforts, who has already achieved the national PM_{2.5} standards and committed to achieving EU level PM_{2.5} standard by 2020. As the 3rd largest container terminal in the world, one of the biggest challenges for Shenzhen is the emission control for port, which contributes to 13% of Shenzhen's total PM_{2.5} emission. 2016 Bluetech Award Campaign has selected diesel engine emission reduction & clean energy substitutes to call for advanced technology in the related field to help Shenzhen tackle this problem.

Changzhou: VOCs and its secondary products are toxic and cancerous, harming public health. The 13th Five Year Plan listed VOCs as important contaminants, pushing some major cities and provinces to create their own VOCs control plans. For Changzhou, one of China's most important chemical manufacturing bases, VOCs is one of its major contaminants. The emission amount of VOCs in Changzhou is about 51,540 ton per year. Bluetech Award Committee selected VOCs substation, monitoring and pollution prevention as one of the technology categories in Bluetech Award this year to control VOCs emission and ultimately

protect public health.

Shanxi, etc.: Shanxi and Inner Mongolia are facing a significant challenge to control and prevent coal-burning pollution due to a large amount of coal produced. With the development of Ultra-low emission technology apply in coal-fired Power plants, the treatment pressure shifts to the non-electric industry. So, the 'Bluetech'also focus on the coal-burning pollution treatment in the no-electric industry. April 2017, Shanxi issued the 'action plan for air pollution' aims to concern the coal-burning pollution and the treatment of VOCs in major industries. Bluetech, as a platform to collect the VOCs substitution and treatment technology will provide the technical support to control the VOCs in Shanxi.

Global Award

Three Bluetech Award assessed almost 200 technologies. These applicants came from 16 countries including China, USA, France, Germany, UK, Japan, New Zealand, Australia, Malaysia, Switzerland, Denmark, Holland, Sweden, Isrel, Norway and Canada.

We have received strong support from many cooperative agencies in the past three years. Those agencies are listed below.

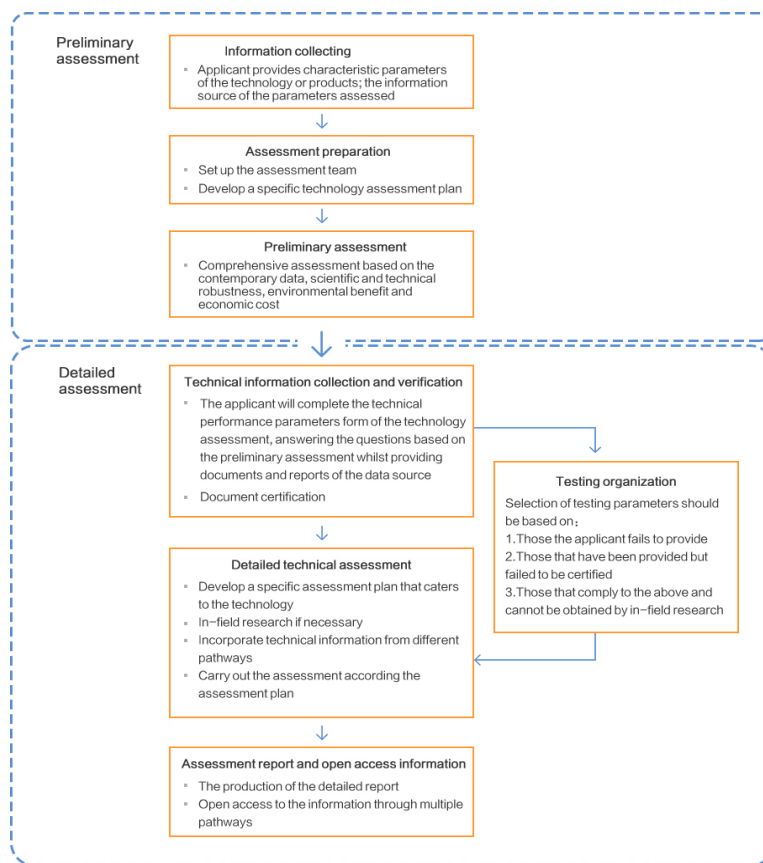
- Energy Foundation China
- China Culture Desk (Austria)
- IE Expo
- China Highway And Transportation Society
- Japan External Trade Organization
- State of Green(Denmark)
- bio.china-nengyuan.com
- China Energy Net
- TEDA Low-carbon Economic Promotion Center
- Canada-China Business Association
- International Fund for China's Environment
- China-Britain Business Council
- China Association of Private Equity
- New Zealand Trade & Enterprise
- China Machinery & Environmental Industry Development Center
- The Chemical Industry and Engineering Society of China- Water Borne Coatings Committee
- IVL Swedish Environmental Research Institute Beijing Representative Office
- Sino-Sweden innovation& Entrepreneurship center
- ESCO Committee of China Energy Conservation Association
- Xiamen Environment Protection Vehicle Emission Control Technology Center
- China Electric Vehicle Charging Technology and Industry Alliance
- European Union Chamber of Commerce in China
- China Association of Environmental Protection Industry – Committee of Vehicle Emission Control
- China Association of Environmental Protection Industry – Committee of Vehicle Emission Control
- UK Trade & Investment
- Clean Air Alliance UK
- US-China Clean Tech Center
- VERT Association (Swiss)
- Air & Waste Management Association (US)
- Swiss Chinese Chamber of Commerce
- Clean Cluster Denmark
- Swiss clean technology association
- World Future Council (Germany)
- France Chamber of Commerce and Industry
- Japan International Cooperation Agency
- Italian Chamber of Commerce
- US-China Energy Cooperation Program
- International Laboratory for Air Quality and Health (Australia)
- Commonwealth Scientific and Industrial Research Organization (Australia)
- China Council for Industrial Environmental Protection (CIEP)
- International Council for Local Environmental Initiatives (Korea)
- Korea Association of Energy, Climate Change and Environment
- 3iPET International Platform for Environmental Technology
- Green Finance Committee of China Society for Finance and Banking
- Chambre de Commerce et d'Industrie Française en Chine
- Beijing Global Village Environmental Education Center
- Chinese Society of Environmental Sciences – Professional Committee for Pollution Prevention and Control of Volatile Organic Compounds
- China Association of Environmental Protection Industry – Committee of VOCs Pollution Control

Professional Assessment

Bluetech technology assessment is a tool that supports the relevant performance of the clean air technology with systematic assessment. It uses real-world application results as the core basis of evaluation, adopts and combines methods such as document review, technical analysis, expert review, on-site surveillance, and laboratory testing, and eventually tackles the environmental benefit, technical performance and economic feasibility of these technologies.

To guarantee the objectivity and professionalism of the assessment, Innovation Center for Clean-air Solutions has organized experts to edit the following documents:

- *The Outline of Bluetech Clean Air Technology Assessment*
- *Bluetech Clean Air Technology Assessment: Methods and Procedure*
- *Bluetech Clean Air Technology Assessment: Technical Performance*
- *Bluetech Clean Air Technology Assessment: Environmental Benefit*
- *Bluetech Clean Air Technology Assessment: Economic Cost*



Systematic Promotion

Technologies participating in the assessment of the Bluetech Award will have the opportunity to participate technology exhibition, technology demonstration, project cooperation and all-around promotion, to grow more rapidly on the *Bluetech* platform.

Technology exhibition

The technologies winning Bluetech Award will perhaps be exhibited at the “Bluetech” Conference. The Bluetech Conference will witness presence of about 300 to 400 people every year, including more than 100 representatives from local environmental protection departments, over 100 representatives of technology companies, and over 50 media representatives. Representatives of the technologies winning the award will be able to directly communicate with authoritative experts both from China and overseas, obtain promotion support of domestic and overseas media agencies, to enlarge the popularity and influence of their technologies across the globe.

Technology demonstration

Technology companies will be able to demonstrate their technologies in cooperation with the organizers of Bluetech Award, including:

- ◎ Contacting with enterprises and government departments that have relevant demands, to establish pilots for application demonstration of the technologies.
- ◎ Participating in the technology demonstration, verification and promotion projects led by provincial and municipal government departments, which will facilitate following through with new environment standards and policies, and realizing selection, demonstration and promotion of new and excellent environmental protection technologies.
- ◎ The demonstration projects that pass the evaluation phase, will also be selected by the online demonstration platform of Bluetech for exhibition.

Project and Resource Cooperation

The Alliance organizes and coordinates 15 to 20 seminars, local conferences for cooperation, technology investigation, among other activities, each year, to facilitate Bluetech technologies in better participating in the environmental governance of both the central government and local regions, and cooperating with industrial resources more effectively.

- ◎ Industrial seminar: based on the specific needs of the state, provinces and cities in

improving air quality, relevant departments, experts and representatives of industrial organizations and technology companies are invited to convene industrial seminars on topics such as VOCs prevention and control and clean development of motor vehicles.

- ◎ Conference for (the) cooperation of meeting local demands: technology companies are organized to carry out exchange and cooperation with the environmental protection department and enterprises that have relevant demands, based on the environmental protection demand of each province and city.
- ◎ Investor salon: helping enterprises with access to capitals and resources, to pick up the speed of their development based on the characteristics of technologies, enterprises and industries.

Promotion

Technologies participating in the assessment of Bluetech Award will have the opportunity of gaining a systematic promotion:

- ◎ We-media platform: The technologies winning the award can enjoy systematic demonstration, promotion and spreading on we-media platforms such as Bluetech's website, public WeChat accounts and email promotion via the Alliance.
- ◎ Bluetech media seminar: The "Bluetech" clean air media seminar refers to a series of activities launched by the Center for Environmental Education and Communications under the Ministry of Environmental Protection and the Innovation Centre for Clean-air Solutions (ICCS), which aims to deal with important issues such as air pollution prevention and control and carry out idea sharing and in-depth exchanges. The technologies winning the award will perhaps be able to take part in (the) seminar.
- ◎ Bluetech's Remark: Bluetech's Remark is a promotion brand introduced by ICCS, which releases researches in the clean air field through interviews and by partnering with the media, and provides excellent technologies with the opportunity of systematic demonstration.
- ◎ Promotion through cooperative media: Bluetech has established in-depth cooperation with renowned media agencies both in China and overseas, to jointly promote the advanced technologies.
- ◎ International promotion: Bluetech has established cooperation with 60 institutions in 20 countries, and the technologies winning awards will be promoted across the globe under the support of our partners. Besides, the Alliance is building the California-China

Acceleration Partnership with the partner in California, with an aim to promote these technologies and enlarge their global influence via the clout of Silicon Valley.

Bluetech Acceleration

In order to facilitate a rapid application and development of excellent clean air technologies, the Alliance has partnered with several parties to set up the *Bluetech Acceleration Platform* which promotes the application of advanced clean air technologies and improves of air quality.

The modules of Bluetech Acceleration Platform include:

- ◎ Business acceleration strategy: according to the characteristics of technologies and enterprises, roadmaps customized for enterprises are created to boost their development both in the Chinese and international markets, and also to facilitate them in setting development goals and implementing accelerated development strategies.
- ◎ Pilot demonstration: helping technology companies obtain the opportunities of present pilot demonstration of technologies by use of Bluetech's platform resources.
- ◎ Policy promotion: carrying out relevant policy research to analyze the policy bottlenecks and opportunities faced by the technologies; and organizing media conference, we-media promotion and cooperative media communications, among other activities, for the research achievements.
- ◎ Intellectual property strategy: helping innovation-driven enterprises to develop intellectual property strategies that cater their specific needs; helping the management of enterprises to correctly understand the strategy of intellectual property rights; guiding intellectual property strategy departments of enterprises to flexibly use appropriate tactics in practice; and helping to supervise the quality of the accomplishments of intellectual property agencies.
- ◎ Investment cooperation: helping enterprises to cooperate with appropriate capitals and resources to achieve rapid development.
- ◎ Promoting influence: promoting the spreading of advanced technologies and their application cases via media platform.

3rd Bluetech Award Categories

Category 1: Diesel engine emission reduction technologies & clean energy substitutes

Over the past few years, China is driving at an increasingly faster pace: in fact, the country is ranked first globally in terms of vehicle amount increase rate over the past five years. China is also driving longer distance: the average mileage of passenger vehicles in Beijing today is approximately 44 km per day, twice as much as that in the EU. Additionally, most cars are driven in developed areas, which subsequently concentrate air pollution in urban regions. In China's megacities like Beijing, Shanghai and Shenzhen, vehicle emissions have become the top local polluter of PM_{2.5}, contributing to nearly 30% of all local PM_{2.5} emissions.

Diesel vehicles are believed as the most significant problem, as they are responsible for up to 70% of all vehicle NO_x emissions, and up to 90% of all vehicle particulate matter emissions. Furthermore, diesel powered non-road vehicles, such as ships, port machinery, agricultural machinery and general engineering machinery and so on, their emissions are also believed as significant problems due to lack of control. Some advanced cities like Shanghai and Shenzhen have already begun to employ new energy (e.g. LNG) and emission control retrofit (e.g. DPF) technologies in their policy making to control non-road vehicle emissions.

We are looking for the following types of diesel engine emission control technologies:

- ◎ Fuel treatment technologies, such as diesel fuel treatment, clean energy (e.g. LNG) etc.
- ◎ Engine combustion optimization technologies, such as Exhaust Gas Recirculation, fuel injection optimization techniques, etc.
- ◎ Engine emission control technology, such as Diesel Oxidant Catalyst, Particulate Oxidation, Catalyst, Selective Catalytic Reaction, Diesel Particulate Filter, etc.

Category 2: Coal combustion emission control & clean energy substitutes (non-power sector)

Coal is the major energy source in China. It contributes approx. 60% of the primary energy and has become one of the main pollution sources. Thanks governmental policy support, emission control for coal fired power plants have been conducted in many places. However, emissions from non-electrical coal combustion should not be underestimated. The PM_{2.5} source apportionment analysis for Jing-Jin-Ji region shows that coal-fire emission has contributed about 25% of local PM_{2.5} emissions. In order to meet the national goal for air pollution improvement, the Municipal Research Institute of Environmental Protection along with Innovation Center for Clean-air Solutions have conducted a project to collect emission control technology for non-electrical coal combustion and list the advanced technologies into *Clean Coal Combustion Technical Guidebook*.

We are looking for the following type of Emission Control Technology for Non-electrical Coal Combustion:

- ◎ Alternative clean energy & renewable energy technologies.
- ◎ Advanced heating technology, such as waste heat recovery technology, etc.
- ◎ Other related technology.

Category 3: VOCs substitution and pollution prevention

VOCs is one of the main primary pollutants in various regions throughout China and is one of the major precursors for secondary PM_{2.5} and ozone. VOCs and its secondary products are toxic and cancerous, harming public health. As the China launches the official *war on pollution*, the 13th Five Year Plan listed VOCs as an important contaminant, pushing some major cities and provinces to create their own VOCs control targets

We are looking for the following type of Emission Control Technology for VOCs monitoring and control technologies:

- ◎ Leak Detection and Repair (LDAR) related technologies, such as leak detection technology, leak repair technology, etc.

- ◎ VOCs end of pipe control technologies, such as VOCs recycling technology, VOCs destruct system, etc.
- ◎ Low VOCs substitutes, such as low VOCs paint, low VOCs solvents, etc.
- ◎ Other technologies that address VOCs pollution.

Category 4: Indoor air pollution control

People spend, on average, 70% of their time in indoor environment and therefore are potentially more exposed to indoor air pollutants. In addition to outdoor pollution infiltration, there are also many pollution sources in indoor environments, which causes high indoor air pollution that are often more severe than the outdoor air. As people are becoming more aware of air quality and health, concerns on the indoor air quality have also been raised.

We are looking for the following types of indoor air purification technologies:

- ◎ Indoor air quality monitoring and control technologies.
- ◎ Central HVAC system purification technologies.
- ◎ Decentralized purification technologies, such as indoor air purifiers, vehicle air purifiers, etc.

Category 5: Advanced pollution source and air quality monitoring

In order to effectively conduct air pollution prevention work, it is essential to know the specific air pollution characteristics of the area and its major pollution sources. Advanced monitoring technologies are able to provide real time, accurate and comprehensive air quality data, which can support air quality management, policymaking and strategic planning. Hence, the Bluetech Award has selected the advanced pollution source and air quality monitoring as one of the technology categories.

We are looking for the following types of advanced monitoring technologies:

- ◎ Ambient and indoor air quality monitoring technologies.

- © Pollution source monitoring technologies, such as online monitoring devices, portable devices.

★ **Bluetech Future Star**

As the effort of making our skies blue again continues, a growing number of start-up tech companies have joined the alliance making their contribution to fight the air pollution. This year's award added Bluetech Future Star Award, hoping to leverage Bluetech platform resources to help and accelerate outstanding high-tech clean air start-ups.

- © Technology category not limited to the five categories mentioned.
- © Applicant own intellectual property.

3rd Bluetech Winner & Award Finalists Introduction

The Third Bluetech Award officially began in April 2017, and gathered 63 technologies until September. The applicants come from China, USA, France, Germany, Italy, the United Kingdom, Australia and Malaysia. The Bluetech Award looks for breakthrough potential from these technologies in terms of environmental benefits, technical performance and economic feasibility. This year, we are excited to announce that 17 Bluetech Award finalists, 6 Winners and Future Stars that take the lead in developing high-quality, innovative technologies to tackle China's air pollution!

Disclaimer

Innovation Center for Clean-air Solutions (ICCS) undertook the mandate to organize the *Bluetech Award* Clean Air Technology Schemes. ICCS organizes this event in accordance with relevant laws and regulations and also based on the principles of objectivity, fairness, and justice. In order to ensure the seriousness and scientificity of the award, we have clearly required all participating entities that:

1. The intellectual property of the technologies that participate in the event of *Bluetech Award (Participating Technology)* shall belong to the participating entity, or the participating entity shall be legally granted a license to use the Participating Technology and shall have the right to submit the Participating Technology to the event of "Bluetech Award".
2. The participating entities shall truly disclose the information related to the Participating Technologies, include but not limited to inventors, applicant, technical parameters, legal status, etc.

ICCS hereby acknowledges that the award of *Bluetech Award* shall be based on the information, data and documents provided by the participating entities and we have only conducted onsite verification for a few technologies which had applied for the technology assessment. Hence, we are not able to guarantee the authenticity and accuracy of all information, data and documents. ICCS does not take responsibilities for any un-authorized use of relevant technology information in any form of distribution in the internet. ICCS reserves the right of final interpretation to the above statement.

Bluetech Winners

In the 2017 Bluetech clean air technology campaign, 6 technologies from 4 countries win the Bluetech Award. The winners include 3 technologies from Coal combustion emission control & clean energy substitutes (non-power sector) category, 1 technology from VOCs substitution, monitoring and pollution prevention category and 2 technologies from Advanced pollution source and air quality monitoring category. The technologies and applicants are listed below.

Technology/Product	Applicant
Coal combustion emission control & clean energy substitutes (non-power sector)	
Catalytic Candle Filter (CCF) Technology for Multi-Pollutant Exhaust Emissions Control	Dürr Paintshop Systems Engineering (Shanghai) Co.,Ltd.
Comprehensive Utilization Technology of Low Temperature Waste Heat Recovery of Blast Furnace Slag Flushing Water and Steam	Beijing IVYQUEN Energy Saving Technologies Ltd.
Integrated Condensing Gas Boiler Technology	Suzhou Boehmer Thermo Products Co.,Ltd.
VOCs substitution, monitoring and pollution prevention	
Improved Vapor Recovery Unit	SYSTEM ENG SERVICE CO.,LTD. Japan
Advanced pollution source and air quality monitoring	
Fast, Multi-point Magnetic-sector Mass Spectrometry VOCs Online Monitoring System	Thermo Fisher Scientific Inc.
Environmental Air Quality On-line Monitoring System	ShangHai DST Technology Co., Ltd.

Catalytic Candle Filter (CCF) Technology for Multi-Pollutant Exhaust Emissions Control

Category:

Coal combustion emission control & clean energy substitutes

Applicant:

Dürr Paintshop Systems Engineering (Shanghai) Co.,Ltd.

Country:

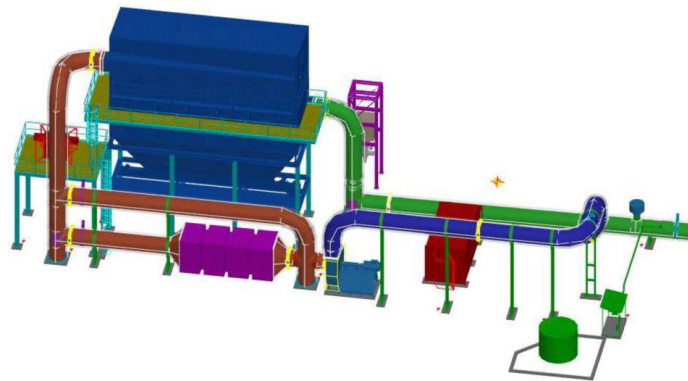
Germany

Technology Overview:

- ◎ Catalytic candle filter is a new type of device that removes multiple pollutants (both dust and heavy metals) in a single unit. Acidic gases (HCl and HF), SO_x, NO_x and other pollutants could also be removed through the addition of catalysts and slaked lime.
- ◎ The main filtering element of the unit is ceramic fiber filter rod, which has the advantages of high corrosion resistance, high mechanical strength, and high tolerance to temperature and thermal impact.
- ◎ The unit could be applied under high temperature (<550 °C) conditions.



System Diagram



CCF System Diagram

Environmental Features:

- ◎ High efficiency in removing dust (outlet PM concentration <math>< 2\text{mg}/\text{Nm}^3</math>), heavy metals and acidic gases (HCl and HF).
- ◎ SO_x removal rate > 80%.
- ◎ NO_x removal rate > 90%.

Financial Features:

- ◎ Investment due to differences in project. The technology combines dedust, deNO_x and de SO_x into one unit. These technologies can be provided separately or as part of a complete turnkey system solution.
- ◎ Overall cost of catalytic candle filter (CCF) is lower than electrostatic precipitators and SCR.

Implementation Status:

- ◎ Has been applied in Germany and China.

Comprehensive Utilization Technology of Low Temperature Waste Heat Recovery of Blast Furnace Slag Flushing Water and Steam

Category:

Coal combustion emission control & clean energy substitutes

Applicant

Beijing IVYQUEN Energy Conservation Technology Co., Ltd.

Country:

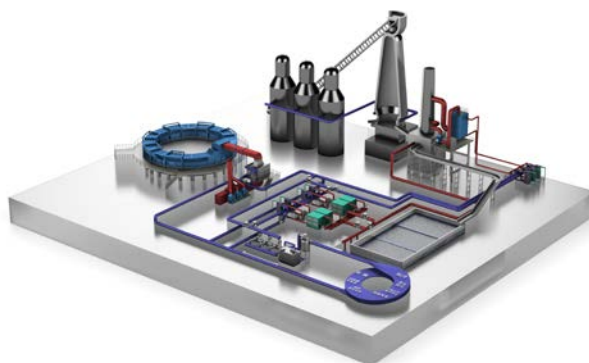
China

Technology Overview:

- ◎ The technology recycles heat from slag-washing water of blast furnace and slag-washing vapor, which supplies the heating for the factories and residents nearby and it can also be used for heating, cooling, power generation and seawater desalination in other seasons.
- ◎ Main processes include purification of slag-washing water from blast furnace, and efficient thermal exchange between washing water and softened industrial water. Cooled washing water is then reused in blast furnace, and heated industrial water to support heating and other production processes.
- ◎ Efficient circulation system for waste heat recovery from slag-washing water, integrated with high-precision filtration unit, high-efficiency thermal exchanger, smart operation systems and monitoring and control instruments.
- ◎ Adopts advanced techniques, such as high-efficiency thermal exchange, precise filtration, and self-cleaning, to achieve stable and efficient waste heat recovery from blast furnace slag-washing water.
- ◎ Utilizes titanium materials and nano-coating technology to improve corrosion resistance to face the challenge of complex water quality.

Environmental Features:

- ◎ In combination with the heat demand of northern China, recovering waste heat from slag-washing water and vapor is beneficial for reducing coal and natural gas combustion, as well as cutting emissions of relevant pollutants and greenhouse gases.



Low Grade Waste Heat Recovery System Diagram

Financial Features:

- © The investment payback period of the whole system is 1-2 years depending on the distance between heat recovery site and the users.

Implementation Status:

Over 40 projects, regarding heat recovery from slag-washing water and vapor, have been applied in the Beijing-Tianjin-Hebei region in recent years, involving over 70 blast furnaces.

Case Name	Blast Furnace Number	Blast Furnace Capacity (m3)	Time	Waste Heat Use
Minmetals Yingkou Medium Plate Co., LTD Project	6	5050	2011-2015	Heating
HBIS GROUP SHISTEEL Company Project	3	1530	2012-2013	Heating
GUOFENG IRON AND STEEL Project	8	1250	2016	Heating
SHANDONG XIWANG SPECIAL STEEL COMPANY	2	1080	2016	Heating/Refrigeration
ZhongYang steel co., LTD	3	1280/1780	2016	Heating
DELONG STEEL	1	1080	2016	Heating/Power Generation
CANGZHOU ZHONGTIE EQUIPMENT MANUFACTURING MATERIAL CO.,LTD	4	2500	2016	Sea Water Desalination
Jianbang Casting Co.,Ltd	2	380/240	2017	Heating

Integrated Condensing Gas Boiler Technology

Category:

Coal combustion emission control & clean energy substitutes

Applicant

Suzhou Boehmer Thermo Products Co.,Ltd.

Country:

China

Technology Overview:

- ◎ Integrated gas-fired condensing boiler can recover thermal energy in flue gas in depth, recovering sensible heat in flue gas and latent heat of water vapor condensation, reducing heat loss from fuel combustion, improving thermal efficiency and cutting fuel cost.
- ◎ Condensating water from fuel gas is beneficial for collecting harmful materials, and reducing emissions of acid substances and other pollutants to the atmosphere. Combined with low nitrogen combustion technology, the discharge of NO_x can be further controlled.
- ◎ The boiler applies enhanced heat transfer techniques at the fuel gas end, adopting special designed condenser, to improve heat transfer efficiency.
- ◎ Self-cleaning through the special designed condenser, which encourages washing and flushing of the heating surface by both flue gas and condensed water.
- ◎ Improves resistance to condensate corrosion by applying 316L stainless steel to the boiler convective heating surface.
- ◎ Adopts single loop furnace design to lower flame temperature, minimize the generation of thermal NO_x , shorten the gas flow route, reduce total fuel gas pressure and cut the power consumption.



Boiler Diagram

Environmental Features:

- ◎ High energy efficiency: the integral design of the gas-fired boiler could reach condensation state within wide scope of working conditions and make the best of waste heat from flue gas. Test report shows that thermal efficiency of the boiler remains at 97%-105% when the power output of the boiler changed from 30%-100% output, which saves fuel and reduces carbon emissions.
- ◎ Low NO_x emission: as a result of the integrated design, emissions of NO_x can reach 47.83mg/m³ without low nitrogen burner according to the test report.

Financial Features:

- ◎ Investment: initial investment for the equipment is 20-30 Yuan/m² and initial investment for the system is 40-50 Yuan/m².
- ◎ Payback period: for equipment is 1-2 years, and for the system is 3-5 years.

Implementation Status:

- ◎ In 2016, 4 BW2800 boiler were applied in Jinan University for heating. NO_x emission is less than 50mg/m³. Thermal efficiency achieved 105.03%.
- ◎ In 2016, 2 WNS8-1.25-Q and 1 WNS10-1.25-Q boiler applied in Guangdong Shaoguan Guorun Tobacco Factory. Natural gas consumption for a tone of steam: 74Nm³/m².
- ◎ In 2017, 6 BW2800 was applied to Ji'nan Greenland international city for Residential heating.
- ◎ In 2017, 3 BW7000 was applied to Beijing Xinzhuang for Residential heating.
- ◎ In 2017, 4 BW2800 was applied to Shanxi for Residential heating.

Improved Vapor Recovery Unit

Category:

VOCs Substitution and Pollution Prevention Technology

Applicant

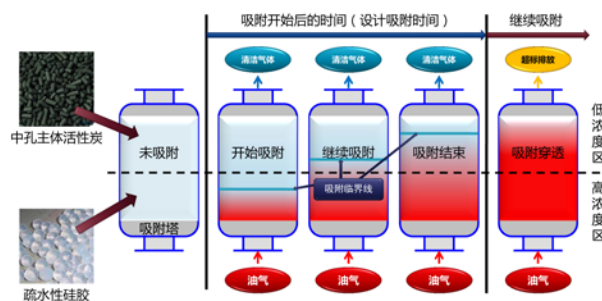
SYSTEM ENG SERVICE CO.,LTD. Japan

Country:

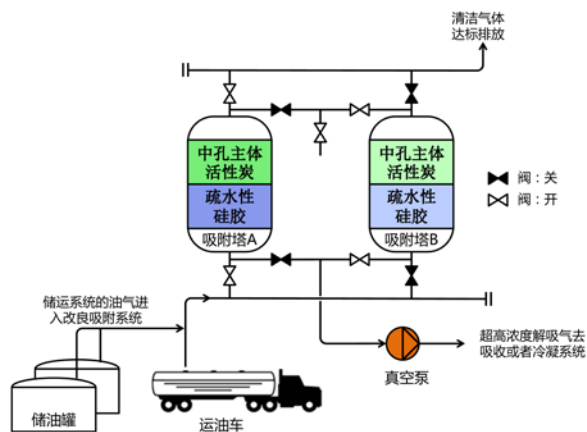
Japan

Technology Overview:

- ◎ Utilizes custom-made, noncombustible adsorbent (hydrophobic silicon) for selective adsorption of VOCs, and separation of vapor components.
- ◎ VOCs components captured on the adsorbent could be released through the process of vacuum pressure swing adsorption (VPSA), which uses vacuum pump to decompress the adsorption tower, and then be liquefied for recycling and reuse. The vapor gases with VOCs components removed can be discharged (reach emission standards) or be reused.
- ◎ Hydrophobic silicon is noncombustible, which reduces safety risk on site. Comparing with activated carbon, silicon possesses higher hardness and more stable crystal structure.
- ◎ The adsorbent is hydrophobic silicon, utilizing special preparation process to remove silanol groups on the surface, which enhances its affinity to oil and gas and reinforces the strength of crystal structure.
- ◎ High heat capacity, low temperature rise by heat adsorption, and great adsorption ability under high VOCs concentration.
- ◎ Two layers of adsorbents are filled in the adsorption bed, with the upper layer of active carbon and lower layer of silicon. The silicon layer contacts the gas vapor first, fully utilizing its advantages of low temperature rise and great VOCs adsorption capacity under high concentrations. Placing active carbon on the top layer helps to slow the temperature rise, increase vapor adsorption at low concentrations and extend service life. In case of higher safety requirements, active carbon could be replaced with meso- or micro-porous silicon, which further lowers the safety risk at site while maintaining capture capacity.



Double layer filling method Diagram



Schematic diagram of the recovery system in oil depot

Environmental Features:

Removal effect in a case

Item	Input Concentration (mg/m ³)	Output Concentration (mg/m ³)
Non-methane Hydrocarbon	987.2	3.8
N-hexane	881.4	Less than the lowest detection concentration
Ethyl Acetate	207.4	3.7
Non-methane Hydrocarbon	1587.4	6.9
N-hexane	135.9	3.8
Ethyl Acetate	414.6	8.1

Financial Features:

In view of the unit for gasoline vapor recovery

- The investment cost is about 3.8 Million Yuan for the unit with processing ability of 400m³/h.
- The investment cost is about 1.5 Million Yuan for the unit with processing ability of 100m³/h.
- The investment cost is about 2.5 Million Yuan for the unit with processing ability of 200m³/h.
- The investment cost is about 3.2 Million Yuan for the unit with processing ability of 300m³/h.

Implementation Status:

- PetroChina Henan Sanmenxia Oil Depot
- SinoPec Fujian Senmeishuibei Oil Depot
- SinoPecZhejiang Tongxiang Oil Depot
- SHAANXI YANCHANG PETROLEUM Yanan Refinery
- TIANJIN COSMO POLYURETHANE CO.,LTD (TCPC)
- Qingdao Lidong Chemical Co., Ltd.

Fast, Multi-point Magnetic-sector Mass Spectrometry VOCs Online Monitoring System

Category:

Advanced pollution source and air quality monitoring

Applicant

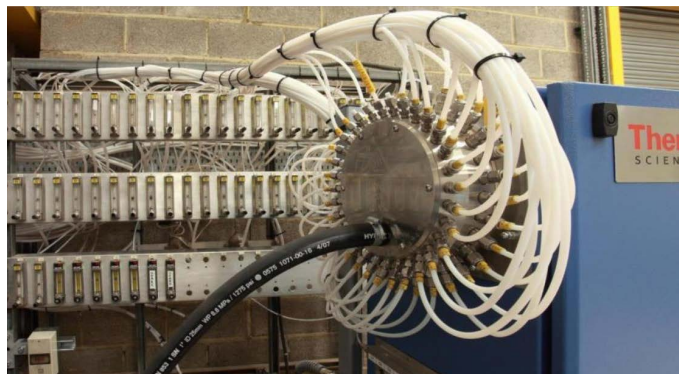
Thermo Fisher Scientific.

Country:

United States of America

Technology Overview:

- Online monitoring magnetic mass spectrometry system (Sentinel Pro) for VOCs produced in rapid multi-point production process is mainly to carry out online detection on unexpected leakage of VOCs during production processes especially for poisonous, harmful, flammable and explosive gases and other gases with potential safety risks.
- The core of Sentinel Pro is scanning magnetic sector mass spectrometer, which provides rapid, reliable and accurate identification for a large variety of components.
- Unique multi-flow sampling system meets the requirements of both sampling speed and stability; one set of spectrometer can connect with multiple sampling systems.
- Monitoring locations should cover all production areas, including concentrated areas of valves (high leaking risk), uncontrolled outlets at room temperature and pressure, and production units and factory boundaries.
- Mainly covers 3 to 5 key pollutants at the factory's choice, depending on the production process.
- Detection limits varies with targets, which could be as low as ppb level.
- Monitors hundreds inlets from various sampling locations, and sets priorities at the clients' demand.
- Almost maintenance-free. The system could be up running for 99.6% of the time and only 2 hours are needed for maintenance every year.



On-site picture of Sentinel Pro

Financial Features:

- Not Provided

Implementation Status:

Application in China

- Three set of Sentinel Pro are in operation in Ningbo Formosa Plastic Group.
- More than 30 sets of Sentinel Pro are operating in Taiwan.

Application in abroad

End User Company	Country
Alberta Environmental Center	Canada
Braskem	Brazil
Braskem	USA
Copes	Brazil
Enichem	Italy
Exxon	Netherlands
Petrobras	Brazil
Petrogal	Portugal
Petroineos	France
PVDSA	Venezuela
Qatar Petroleum	Qatar
Repsol	Spain
Vinythai	Thailand
YNCC	Korea

Environmental Air Quality On-line Monitoring System

Category:

Advanced pollution source and air quality monitoring

Applicant

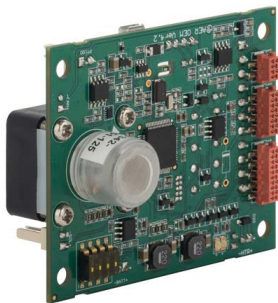
Shanghai DST Technology Co., Ltd.

Country:

China

Technology Overview:

- ◎ Ozone Sensing Module, based on WO_3 materials, possesses great selectivity (by eliminating cross interferences from NO_2), and very low detection limit (ppb level) for O_3 .
- ◎ A special designed zero cycle compensates for sensor drift and interference effects from humidity.
- ◎ Automatic clean mode prevents particles accumulation on the surfaces of lens, detectors and other optics.
- ◎ Sampling inlet Dynamic heating system to increase the inlet temperature, keep the sample dry, and eliminate the interference of humidity on particle measurement.
- ◎ Automatic zero calibration mode to control zero drift and clean optical chamber by purging 0.5 L of air once every 12 hours.
- ◎ Automatic pumping system to control the accurate sampling flow rate, and constrain the flow error below a few mL/min.
- ◎ Special designed self-diagnosis mode to determine system malfunction automatically, by escaping measuring path, and directly connecting the light source and detector through fiber optics.



Sensor Module Diagram

Financial Features:

- ◎ Monitoring system based on the different needs and parameters. Cost range is 150000-250000 RMB for a unit.

Implementation Status:

- ◎ Urban environment fine management monitoring project, Shaoxing EPB
- ◎ Wuzhen air quality online monitoring project, World Internet Conference 2015
- ◎ Meteorological observation tower vertical monitoring project, Beijing EPB
- ◎ Mogao Grottoes air quality online monitoring project, the Dunhuang Research Academy.

Bluetech Future Star

Six technologies from 4 countries won the prize of 2017 Bluetech Future Star Award. Bluetech Future Star Award hopes to boost the development of clean air technologies that have great potential but are not yet commercialized or in the early stages of commercialization. This award covers all areas of clean air technology. The technologies and applicants are listed below.

Technology/Product	Applicant
Particle Agglomeration Inducer (PAI)	PEMRED AG
Large Straw Biological Anaerobic Fermentation System	Tsingtao CASHT Energy & Engineering Co., Ltd.
Copper/Zinc Energy Super-Storage Batteries	Cumulus Energy Storage Ltd
Hexa-Cover	TopOasis (Beijing) Environmental Technology Co., Ltd.
Phage-based Chemical Sensor Networks	BioInspira, Inc.
Beijing Viready Technology Co., Ltd.	Beijing Viready Technology Co., Ltd.

Particle Agglomeration Inducer (PAI)

Applicant

PEMRED AG

Country:

Switzerland

Technology Overview:

- ◎ Particle Agglomeration Inducer (PAI) utilizes special designed exhaust pipes with variable diameters to create changes in flow velocity, resulting in collision and coagulation of particle matters with various sizes, and therefore easy capture.
- ◎ In combination with DOC and POC, PAI captures and treats particulate matters, avoids the use of DPF, and spares the regeneration unit. The combination also decreases the total resistance and only increases the back pressure by 10%-15%.
- ◎ PAI has no requirements for gas types nor qualities, which broads its range of engine applications, comparing to DPF. PAI also has no limits on original emission, which is more suitable than DP for non-road machinery modification.
- ◎ Emission reduction effect passes through VERT certification.

Environmental Features:

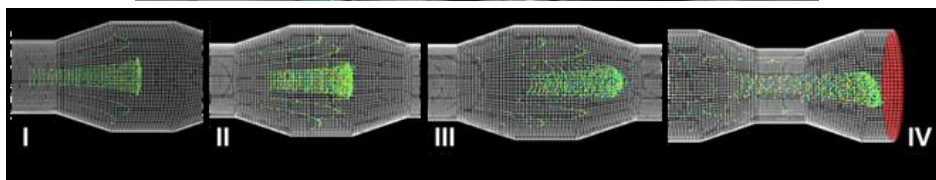
- ◎ Test results of PAI-DOC-POC system shows the emission reduction of $PM_{2.5}$ up to 71.4%.

Financial Features:

- ◎ Low cost: \$20 per set for mass production model, and \$100 per set for small batch production model.
- ◎ No maintenance needed basically, and its service life is the same as exhaust pipe.

Implementation Status:

- ◎ It is applied in the case of Yellow Label Car Transformation Project in Ningbo port.



Particle Agglomeration Inducer



Top View of Plant Area



Purification Site

Environmental Features:

- ◎ Design Capacity of Tsingtao Large biomass projects: consume 70000 ton/a of corn stalk, consume 40000 ton/a waste vegetables.
- ◎ Bio-natural gas production rate: 20000m³/day, solid organic fertilizer production: 24,000 ton/a, liquid organic fertilizer production: 22,000 ton/a.

Financial Features:

Name of Project	Land Area	Investment Cost	Operation Cost	Yearly Benefit	Payback Period	Service Life of CSTR Reactor
Project of Large Stalk Bio-natural Gas in Nancun Town of Pingdu of Qingdao	90 Mu	167.7513 Million Yuan	16.0228 Million Yuan/Year	39.3657 Million Yuan	8.75 Years	20 Years

Financial Features:

Large straw biological anaerobic fermentation project in Tsingtao Nancun.

Copper/Zinc Energy Super-Storage Batteries

Applicant:

Cumulus Energy Storage Ltd.

Country:

United Kingdom

Technology Overview:

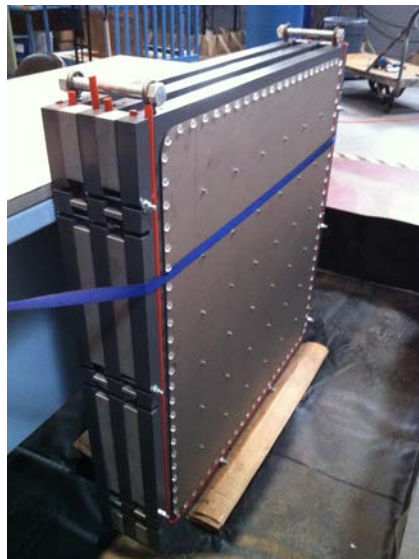
- ◎ Based on the principle of copper zinc battery, the improvement lies in the separation of copper electrode from zinc electrode by proton membrane.
- ◎ The battery technology derives from mature and reliable metallurgy technology, which operates under normal temperature with very low safety risks.
- ◎ Electrolyte can be used in circulation and it does not cause secondary pollution.
- ◎ Raw materials are abundant and the cost is low.
- ◎ Experiment AC/cycle efficiency of AC charge and discharge is more than 80%.

Financial Features:

- ◎ The lowest levelised cost of energy in the early stage (LCOE: Levelised Cost Of Energy) is \$180/MWh, which falls to \$100/MWh after mass production.

Implementation Status:

- ◎ Feasibility study on 100MW and 400MW projects are being carried out in Ireland.



Battery Prototype

Hexa-Cover

Applicant:

TopOasis (Beijing) Environmental Technology Co., Ltd.

Country:

China

Technology Overview:

- Hexa-Cover aims to reduce the emission of VOCs and odor from storage tanks and sewage pools in petroleum and chemical industry, which adopts multiple covers of hexagon structure to form a *Floating Cover* over the liquid surface.
- Each cover is designed to be a hexagonal shape with both sides of symmetry. Edge of the cover is spiral fan, making them interlocked to form an integrated matrix.
- Main technical parameters: the lowest density of 0.36g/cc; weight of 285g/piece; diameter of 215.90mm; and working temperature is $-40\text{ }^{\circ}\text{C}$ - $100\text{ }^{\circ}\text{C}$.
- Coverage rate increases with the increase of the diameter of storage tank, and coverage rate is about 98% when the diameter is 20m.
- Flame retardant and static dissipative, which prevents static accumulation.
- Installation time: 2.5 hrs for a 5000m^3 storage tank.
- Reduces the emission of VOCs and odor, minimizes heat loss and steam quantity produced by water vapor, and lowers humidity of liquid surface.

Environmental Features:

- Reduction rate of VOCs and odor: 60-95%.

Financial Features:

- Service life of floating cover: 20 years.
- Unit price of the equipment: 1,500-5,900 Yuan/ m^2 .

Implementation Status:

- It has been used in tens of thousands of storage tanks and wastewater pools in Canada, the United States, China, South America, Europe and other countries and regions.

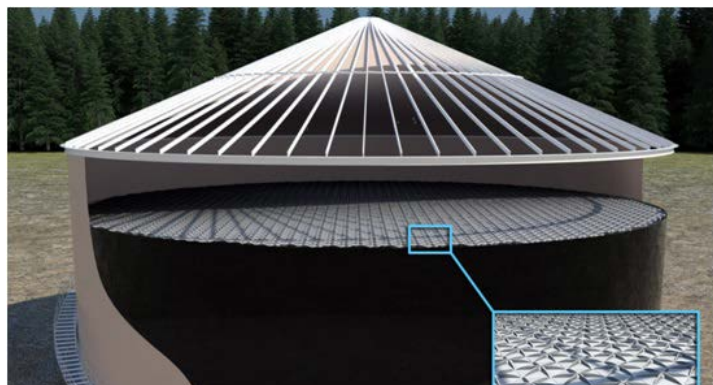
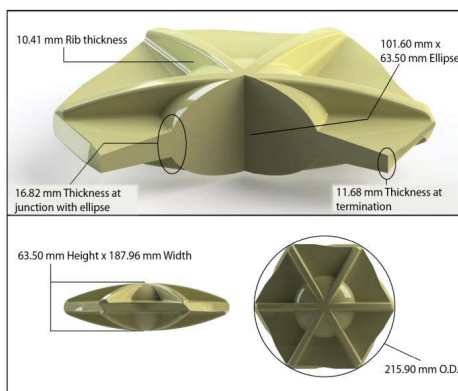
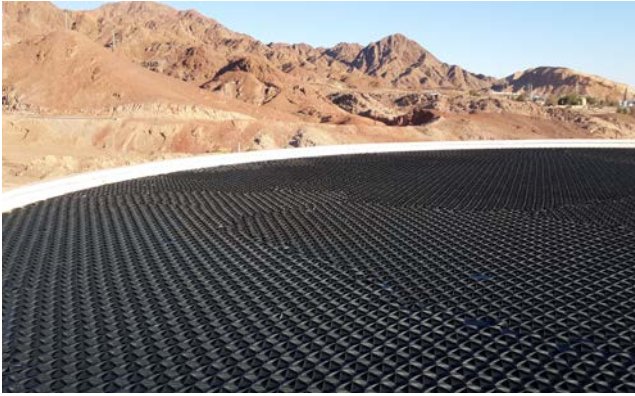


Diagram of Hexa-Cover



Application Case

Phage-Based Chemical Sensor Networks

Applicant:

BioInspira, Inc.

Country:

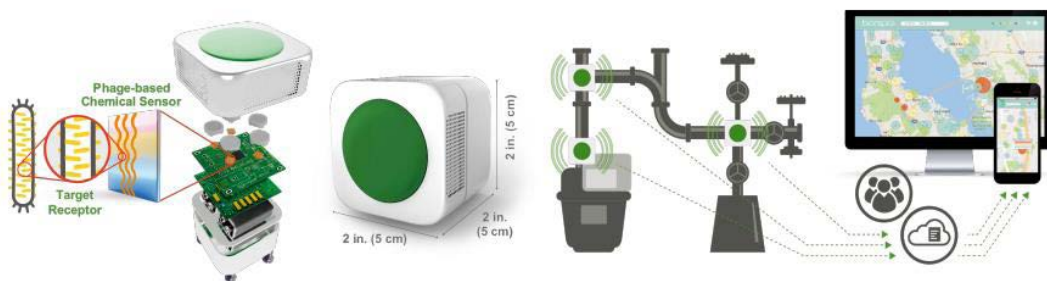
United States of America

Technology Overview:

- BioInspira sensors are highly sensitive receptor sensors manufactured with phage engineering technology. Derived from drug research and tumor cell targeted therapy, the sensor application has expanded to pollutant detection in the air.
- Engineered phage express special proteins, which adsorb different VOCs after certain processing, and show different colors depending on the types and concentrations of the gases.
- This technology uses coloring characteristic of the protein on VOCs gases to fabricate miniaturized sensor array.
- Sensitivity, selectivity and power performance are all superior to that of the existing semiconductor sensors.
- The influence of temperature and humidity is limited.
- Detectable substances are methane, ethane, hexane, ethanol, methanol, formaldehyde, benzene, toluene and xylene.

Financial Features:

- The cost will be lower after mass production.



Technology Diagram

Real-time Multi-scale Dynamic Traceability Analysis and Decision-supporting System

Applicant:

Beijing Viready Technology Co., Ltd.

Country:

China

Technology Overview:

- ◎ Grid monitoring on VOCs, NH₃, odor (such as H₂S) and SO₂ pollutants in industrial parks.
- ◎ Provides evaluation on source intensity, diffusion tendency, source appointment, regional total discharge, statistical analysis on emission data, GIS display and other functions.
- ◎ Adopts monitoring technology of IOT and sensor array to provide higher space-time resolution, and the better overall accuracy(>50%). Sampling duration is 1 minute.

Financial Features:

- ◎ The price for a single set of equipment is 100k-200k Yuan, depending on the monitoring targets. The cost difference for software acquisition, source appointment and modeling should not be ignored either.

Implementation Status:

- ◎ It has entered into the second phase since the actual monitoring project was carried out in the Second Industrial Zone of Jinshan District of Shanghai in 2016. Stability, accuracy and user friendliness of hardware and software of the system are further deepened through the summary of application experience and performance improvement of the first phase of the project.



Pollution Tracing System



Case Picture

3rd Bluetech Award Finalists

Seventeen technologies are 2017 Bluetech Award Finalists including 4 technologies from diesel engine emission reduction category, 4 technologies from coal combustion emission control & clean energy substitutes (non-power sector) category, 4 technology from VOCs substitution, monitoring and pollution prevention category, 3 technologies from indoor air pollution control category and 2 technologies from Advanced pollution source and air quality monitoring category. The technologies and applicants are listed below.

Technology/Product	Applicant
Diesel engine emission reduction technologies & clean energy substitutes	
Diesel Vehicle Exhaust Gas Post Treatment Device	Best Purifying Equipment Limited
DYNTEST System	CPK Automotive GmbH & Co. KG
Deposit Control Enhancement Technology for Automobile Fuel	Beijing Changxin Wanlin Technology Co., Ltd .
Blume Distillation Biorefinery: Waste to Energy	Blume Distillation LLC
Coal combustion emission control & clean energy substitutes	
Low Temperature Flue Gas Simultaneous Desulfurization Denitrification and Dust Removal Technology	Central Research Institute of Building and Construction Co.,Ltd.
Electrical Heating Energy Storage System Based on the Microstructural Composite Phase Change Heat Storage Material	Nanjing Jinhe Energy Material Co.,Ltd.
Dall Energy Biomass Furnace	Dall Energy
High Effective Ozone Oxidation Denitrification Technology	Air Liquide (China) Holding Co., Ltd.
VOCs substitution, monitoring and pollution prevention	
Complete Control Technology of VOCs in Coking Plant	BEIJING CHENXI ENVIRONMENTAL PROTECTION ENGINEERING CO.,LTD.
Certified Ultra-low Emission Burner	ECO-TEC ASIA (BEIJING) CO., LTD.
Rcuperative Oxidiser + Rotor Concentrator	SUZHOU KELAN ENVIRONMENT TECHNOLOGY CO.,LTD.
Activated Carbon Cynergistic Medium Pore Adsorbent	Nanjing Special Bo Environmental Protection Technology Co. Ltd.
Indoor air pollution control	
A Consumable-less Air Purification Product Based on IFD Technology	Shandong Xuesheng Environmental Engineering Co., Ltd.
Thinpair Nano Photocatalyst Air Purification Disinfecter	Dalian Thinpair Technology Co., Ltd.
Ceiling Mount Indoor Re-circulating Air Purifier D-Breath 4	MayAir Technology (China) Co., Ltd.
Advanced pollution source and air quality monitoring	
The Monitoring and Control Technology of Odor in the Regional Environment	Ninghe Environmental Technology Development Co.,Ltd.
Solar Occultation Flux (SOF)	FluxSense AB

A. Diesel engine emission reduction technologies & clean energy substitutes

Diesel Vehicle Exhaust Gas Post Treatment Device

Applicant:

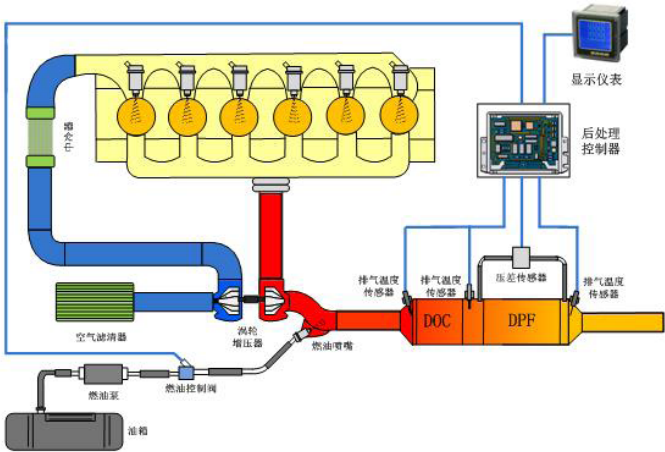
Best Purifying Equipment Limited

Country:

China

Technology Overview:

- The exhaust treatment device is a DPF system. The regeneration mode activates fuel injection assisted-regeneration combining with catalytic coated filter material (CDPF).
- Fuel injection nozzle is installed on exhaust manifold in the front of DOC system. Fuel is injected during the regeneration. The oil and exhaust mixture is oxidized in the DOC where the temperature is increased to the regeneration level.
- The new generation injection nozzle has faster response time, higher injection accuracy. The injection has different stages including guiding injection, main injection and delayed injection.
- Monitoring platform is on-line and customized. Users can monitor vehicle data and geological location in real time. The platform can provide customized and personalized service according to customers need.



Exhaust Gas Post Treatment Device Diagram

Environmental Features:

- ◎ The exhaust treatment device is able to improve vehicle emission from National Phase III to National Phase IV (European IV). The exhaust optical absorption coefficient will be less than $\leq 0.5\text{m}^{-1}$ after installing the device.
- ◎ DOC: Conversion efficiency of hydrocarbon HC is higher than 80% when the inlet temperature is at 230°C .
- ◎ CDPF: Filtration efficiency $> 95\%$.

Financial Features:

- ◎ DOC+CDPF for 6L engine is 8,100 RMB.
- ◎ DOC+CDPF for 10L engine is 10,500 RMB.

Implementation Status:

- ◎ The system is applied in diesel engine vehicle retrofit project in Ningxia, Shenzhen and Hong Kong.
- ◎ Dongfeng commercial vehicles are equipped with related equipment.

DYNTEST System

Applicant:

CPK Automotive GmbH & Co. KG

Country:

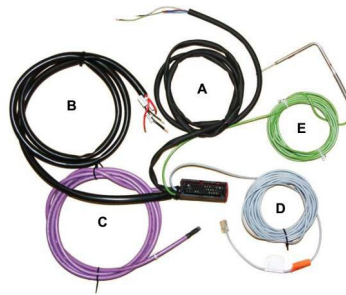
Germany

Technology Overview:

- DYNTEST SYSTEM is a third-party exhaust emission monitoring system that can monitor and record emission data in real time, such as NO_x and PM concentrations, and operation status of the engine.
- Remote diagnostics permit more efficient on-the-spot repairs and maintenance and also enable user to take immediate remedial action.
- NO_x detection limit: 2ppm; monitoring temperature: ≤ 800 °C ; monitoring pressure: ≤ 600mbar.



Control Unit



Sensor Unit



Display Unit

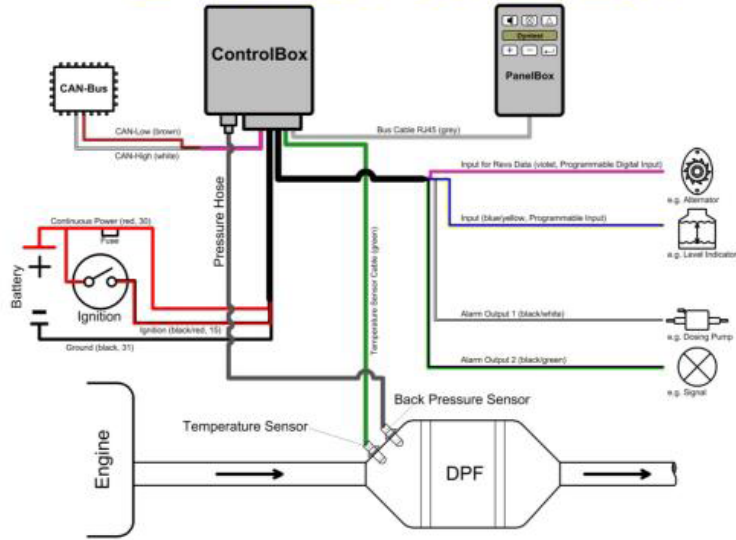
Financial Features:

- Basic cost of the system: € 350-450
- Additional unit and service depend on different project, price range is € 1300-1800/set for the additional unit and service

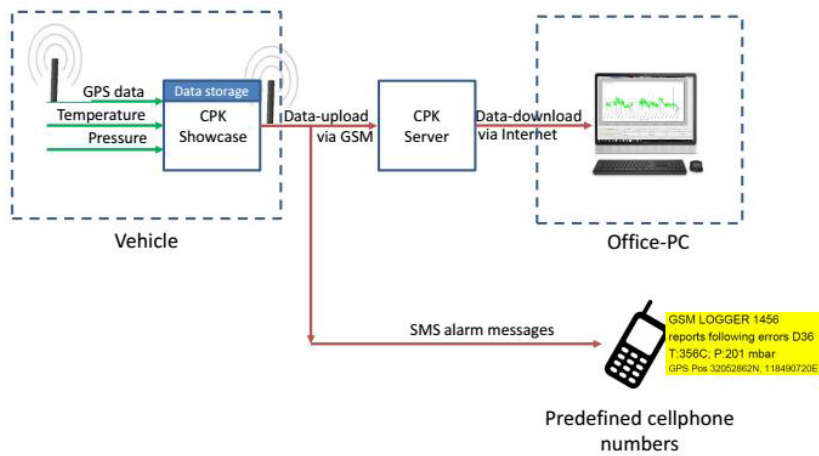
Implementation Status:

- 100000 sets of the system have been installed all over the world.
- Application international: DPF evaluation project in Bogota (Colombia), Mexico City, California (Revision of Regulation of CARB Non-road Machinery) of the United States, and San Diego (Chile).
- Application in China: Sino – Switzerland DPF testing and assessment project in Nanjing.

DYNTTEST SYSTEM



DYNTTEST System Diagram



DYNTTEST System Remote Monitoring Mode

Deposit Control Enhancement Technology for Automobile Fuel

Applicant:

Beijing Changxin Wanlin Technology Co., Ltd

Country:

China

Technology Overview:

- ◎ MAZ combustion improver is a fuel additive which can improve combustion, clean carbon deposit and lubrication. The main material of the improver is nitro-compound.
- ◎ The additive can produce free radicals in combustion to increase combustion rate, and combustion efficiency.
- ◎ Polyether material and other lubrication materials contained in the formula can inhibit and remove sediments in fuel system, nozzles and the engine. It also can reduce carbon deposit in combustion chamber, increase engine life and reduce emissions.
- ◎ This product can increase power output of the engine and improve Cetane number of diesel fuel.

Environmental Features:

- ◎ Pollutant reduction: PM: 14.58%, NO_x: ≤ 5.70%, THC: 28.30%, black smoke: 24.96%.

Financial Features:

- ◎ Average fuel saving: 2.21%.
- ◎ Economic cost: 0.13 Yuan/L.
- ◎ Profit for customer: 0.05 Yuan/L (calculated according to oil-saving rate of 3%, retail price of diesel 6 Yuan/L).

Implementation Status:

- ◎ Zhangye Bulk Oil Depot of PetroChina in Lanzhou
- ◎ Bulk Oil Depot of Jiuquan Area

试验前内窥镜拍摄图像:



试验后内窥镜拍摄图像:



经过4000h含MP2等添加剂磨合试验，发动机进气门、气门位置的积碳明显减少。

Image of engine endoscope

Blume Distillation Biorefinery: Waste to Energy

Applicant:

Blume Distillation LLC

Country:

United States of America

Technology Overview:

- ◎ The technology is a biological process transforming organic and food waste resource into 105 octane bioethanol and other valuable by-product.
- ◎ By-products include fertilizer, eutrophic irrigation water and food grade carbon dioxide.



Environmental Features:

- ◎ Utilizes renewable resources and wastes to produce fuels and valuable by-products. The technology can reduce emissions of greenhouse gas at the same time.

Financial Features:

- ◎ Estimate cost is \$0.09/L at 19 million liter production scale.

Implementation Status:

- ◎ Not provided

B. Coal combustion emission control & clean energy substitutes

Low Temperature Flue Gas Simultaneous Desulfurization Denitrification and Dust Removal

Applicant:

Central Research Institute of Building and Construction Co., Ltd.

Country:

China

Technology Overview:

- ◎ Based on the mechanism of recirculating fluidized bed reactor, this method is a low temperature, dry process for high efficiency desulfurization, denitrification and dust removal, through the catalyzed oxidation of NO, and multiple cycles of adsorption to extend the contact time between flue gases and adsorbents.
- ◎ With lime or lime hydrate as the absorbent, this method achieves simultaneous desulfurization and denitrification at low temperature (suitable for flue gas with temperature < 150°C) , and maintains high removal efficiency even at relatively low Ca/(S+0.5N) mole ratio.
- ◎ Treatment process includes catalyzed oxidation (from NO to NO₂), desulfurization and denitrification (SO₂ and NO_x to react with lime or lime hydrate in the reaction tower), and dust removal (through pulse bag dust collectors), where a portion of the adsorbents captured by the dust collectors cycles back to the fluidized bed reaction tower.

Environmental Features:

- ◎ Removal efficiency: SO₂ 85 ~ 98%, NO_x 60% ~ 85%, Outlet dust concentration (with the equipment of pulse bag dust collector) < 30mg/m³, SO₃, chloride and fluoride > 90%.
- ◎ Low CaSO₃ content in the by-products, which are of great economic value.

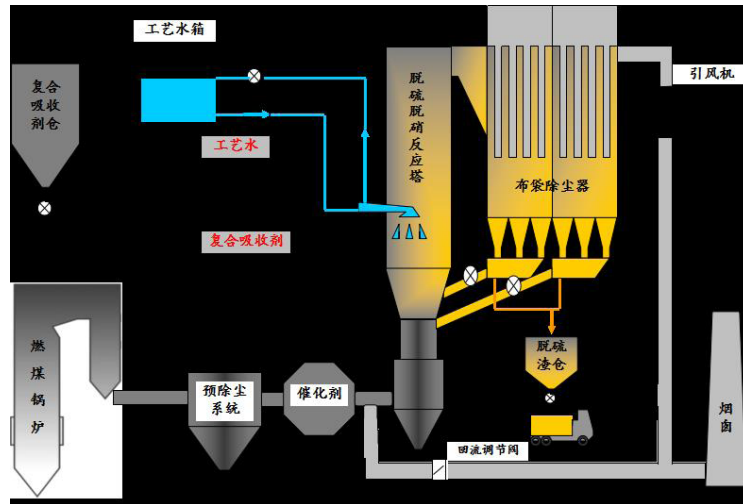
Financial Features:

Not provided.

Implementation Status:

- ◎ Desulphurization, denitrification and dust removal project for flue gas of 58MW corner tube boiler at Yanzhou Juyuan Thermal Electricity Co. Ltd.
- ◎ Desulphurization, denitrification and dust removal project for flue gas of sludge drying boiler in Hailaer.

- ◎ Renovation project for ultra-low flue gas emission of three 220t/h boilers in Nantun Power of Yancon Group.
- ◎ Renovation project for ultra-low emission of coking boiler of Yancon International.



Process Diagram



Project of Desulfurization and Denitrification of Flue Gas for 58MW Chain Boiler of Shandong Yanzhou Juyuan Thermal Electricity



Project of Desulfurization and Denitrification of Flue Gas for 58MW Chain Boiler of Shandong Yanzhou Juyuan Thermal Electricity

Electrical Heating Energy Storage System Based on the Microstructural Composite Phase Change Heat Storage Material

Applicant:

Nanjing Jinhe Energy Material Co., Ltd.

Country:

China

Technology Overview:

- ◎ The boiler utilizes microstructural composite phase change materials to store heat from abandoned wind power/off-peak electricity, and releases the stored energy for heating through heat exchange between warmed pressurized air and circulating water during ordinary and peak power periods.
- ◎ Main components of composite phase change heat storage materials include polymers, mineral salts and inorganic porous oxides.
- ◎ Inorganic porous oxides with high temperature resistance are adopted as skeleton material, and polymers and mineral salts are evenly distributed in the pores of the carrier to prevent material loss and maintain functional integrity at the occurrence of phase change.
- ◎ The composite phase change heat storage materials are manufactured with the process of planetary ball milling, wet kneading, cold pressing molding and stepwise sintering by controlling the particle sizes of phase change materials and their carriers.
- ◎ Compared with the traditional iron magnesia bricks, the heat storage capacity of composite phase change materials are 1.5-3 times higher ($\leq 900\text{kJ/kg}$), while the volumes shrink 30%-50%.
- ◎ Latent heat of phase change: 126.01 J/g ; specific heat capacity: $1.187\text{-}1.390\text{ J/(g}\cdot\text{K)}$ (temperature range: -600°C to room temperature).
- ◎ Direct access to 10kV power grid reduces the cost of voltage transformer and power loss, and improves energy efficiency.

Environmental Features:

- ◎ Two sets of 3000kW (10kV) electric heat storage boilers harvest about 10 million kWh abandoned wind power every year, save about 4000 tons of standard coal, and cut emission of carbon dioxide and other pollutants.

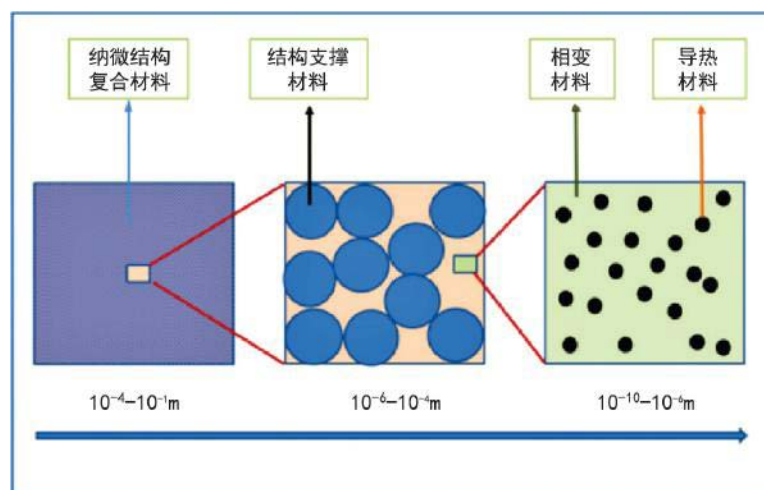
Financial Features:

- ◎ The actual application case referred to shall be as follows

Name of Project	Capacity	Investment Cost	Operation Cost	Net Income in Each Heat Supply Season	Investment Return Period	Service Life of Heat Storage Material
Demonstration Project of Wind Power- supported Clean Heating in Aletai of Sinkiang of China General Nuclear Power Group	50000 m ²	20.67 Million Yuan	3.33 Million Yuan/Year	3.94 Million Yuan	5.2 Years	20 Years

Implementation Status:

- © Demonstration Project of Wind Power-supported Clean Heating in Aletai of Sinkiang of China General Nuclear Power Group: provide heat source for heating for No. 3 Middle School of Aletai and its surrounding residence communities.



Structure Diagram of Composite Phase Change Heat Storage Material

Dall Energy Biomass Furnace

Applicant:

Dall Energy

Country:

Denmark

Technology Overview:

- Dall Energy biomass furnace utilizes wood, garden waste and branches as fuel, with lower operation cost comparing to other boilers.
- Fuel is implemented with pyrolysis and gasification at the bottom of the boiler, and the generated flue gas combust at the top of the boiler. The boiler operation is divided into five phases from bottom to top: ash burning, carbon oxidation/gasification, pyrolysis, drying and gas combustion.
- The boiler adopts upflowing pneumatic gasifier, and the limited flow velocity of gases at the top of gasifier ($< 1\text{m/s}$), reduces the dust content in flue gas ($30\text{-}40\text{mg/Nm}^3$).
- The temperature of flue gas is controlled by adding water or water vapor to the phases of material drying, thermal pyrolysis, and gas combustion in order to prevent formation of NO_x .
- The boiler is equipped with heat exchange unit which is connected to the energy extraction equipment used to generate electricity or provide district heating. Flue gas with high content of water vapor is cooled down to make the water vapor condensed, and the heat of flue gas is recovered so as to further improve the utilization efficiency of energy.

Environmental Features:

- Concentration of pollutants at outlet of the boiler: dust: $10\text{-}20\text{mg/Nm}^3$, NO_x : $100\text{-}150\text{mg/Nm}^3$, CO: $< 9\text{mg/Nm}^3$, and carbon content in fuel ash: $< 0.5\%$.

Financial Features:

- Compared with similar biomass boilers, the operation cost is 50% lower. After Danish Bogense installed the boiler for centralized heating, the heating price decreased by over 40%.

Implementation Status:

- Centralized Heating of Bogense (8MW)
- Centralized Heating of Sønderborg (9MW)
- Degradation of VOCs in Ventilation Air of Coating Workshop of Warwick Mills (2MW)

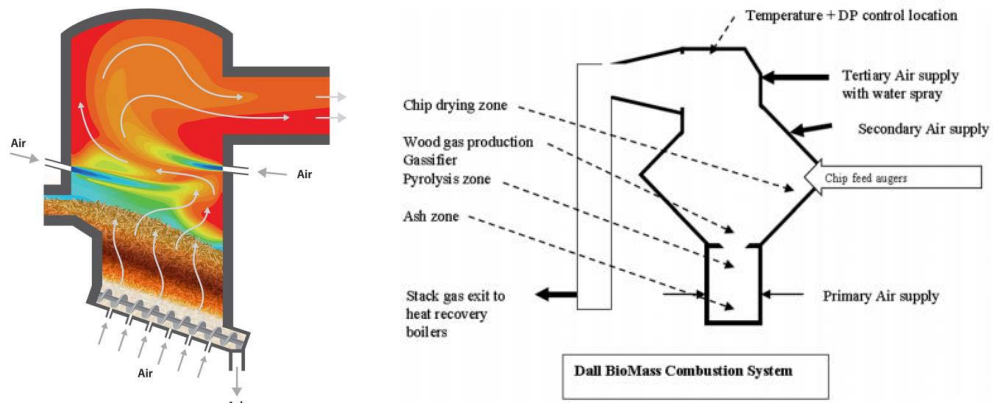
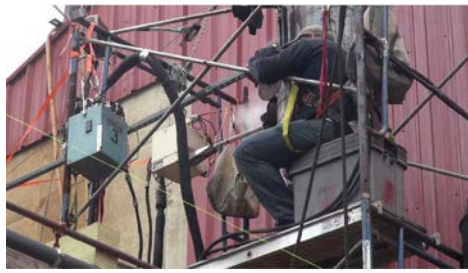


Diagram of Operation Structure of Furnace



Bogense: 8MW



Søndersborg: 9MW



Warwick Mills: 2MW

High Effective Ozone Oxidation Denitrification Technology

Applicant:

Air Liquide (China) Holding Co., Ltd.

Country:

France

Technology Overview:

- ◎ The device can be applied to the low temperature ozone denitrification process within wet desulphurization and water wash tower. The actual oxygen consumption is calculated based on the actual working conditions and emission requirements of boiler or furnace, which optimizes the equipment selection, reduces initial investment cost and further improves the performance of ozone denitrification process.
- ◎ This device mainly includes liquid oxygen supply system, ozone generator and ozone distributor.
- ◎ The ozone distributor has short mixing distance and excellent mixture performance, which minimizes the length of flue channel modification applies to flue channel less than 10m (from induced draft fan to desulfurization tower), reduces operation cost and improves the denitrification efficiency.
- ◎ The ozone distributor adopts spiral ejection of ozone vertical to the flue gas flow, which improves the mixing performance and prevents clogging from flue dust.
- ◎ The ozone distributor is adjustable, which adapts a broad range of working conditions, and avoids the extra cost of new equipment.



Liquid Oxygen Supply System



Ozone Generator



Ozone Dosing Distributor

Environmental Features:

- ◎ Removal efficiency: $\text{NO}_x > 90\%$.

Financial Features:

- ◎ Operation cost: 20-30 Yuan/Kg NO_x (based on electricity of 0.8 Yuan/kWh, and oxygen of 1-1.4 Yuan/r).
- ◎ Lot size: 200-500 m² per unit

Processing Object	Flue Gas Volume	Requirements for Desorption of NO _x	Investment Cost	Operation Cost
3 Sets of 75t/h Circulating Fluid Bed Boiler:	300,000Nm ³ /h	200mg/Nm ³ →100mg/Nm ³	3 Million Yuan	648 Yuan/h

Implementation Status:

It has been applied for ozone denitrification at Tianjin Xitong Electronic Equipment Co., Ltd.



System Diagram

C. VOCs substitution, monitoring and pollution prevention

Complete Control Technology of VOCs in Coking Plant

Applicant:

BEIJING CHENXI ENVIRONMENTAL PROTECTION ENGINEERING CO.,LTD.

Country:

China

Technology Overview:

- ◎ Complete control technology for VOCs treatment in chill drum section, crude benzol section and ammonium sulfate section of coking process.
- ◎ Process for VOCs treatment in chill drum section: VOCs flue gas collection - initial cooling filtration - oil washing pretreatment – acid pickling - alkaline cleaning-cooling and dehumidification- adsorption, desorption and recovery - multistage oxidation hydrolysis process.
- ◎ Process for VOCs treatment in crude benzol section: VOCs flue gas collection -initial cooling filtration - oil washing pretreatment – rinsing- cooling and dehumidification-adsorption, desorption and recovery - multistage oxidation hydrolysis process.
- ◎ Process for flue gas treatment mainly NH₃ and acid) in ammonium sulfate section: flue gas collection - liquid condensation - acid pickling - alkaline cleaning –filtration and defogging process.
- ◎ Core technology is catalytic oxidation reactor and high efficiency oxidation reactor. Catalytic oxidation reactor is able to absorb and oxidize VOCs with catalyst modified activated carbon. High efficiency oxidation reactor consists of an ion generator and an oxidizing tower.

Environmental Features:

Case study for pollutants desorption

Name of Section	Name of Pollutant	Input Concentration	Output Concentration
Chill Drum	Benzopyrene	1.3 $\mu\text{g}/\text{m}^3$	0.26 $\mu\text{g}/\text{m}^3$
	Phenolic Compound	102 mg/m^3	29.8 mg/m^3
	Non-methane Hydrocarbon	260 mg/m^3	45.3 mg/m^3
	Hydrogen Cyanide	9.23 mg/m^3	0.94 mg/m^3
	Ammonia	164 mg/m^3	8.9 mg/m^3
	Sulfuretted Hydrogen	9.72 mg/m^3	0.89 mg/m^3
Crude Benzol Section	Benzene	21.6 mg/m^3	4.64 mg/m^3
	Non-methane Hydrocarbon	274 mg/m^3	47.2 mg/m^3
Desulfurization and Ammonium Sulfate Section	Ammonia	176.2 mg/m^3	9.4 mg/m^3
	Sulfuretted Hydrogen	11.3 mg/m^3	0.86 mg/m^3

Financial Features:

- Total investment in chill drum section, crude benzol section and ammonium sulfate section is 4.8 Million Yuan in the case of one Coking Plant in Tangshan.
- Operation cost: 1800 Yuan/Day for chill drum section; 1800 Yuan/Day for crude benzol section and 1640 Yuan/Day for ammonium sulfate section.

Implementation Status:

- It has been applied to one VOCs treatment project for Coking Plant in Tangshan and several other VOCs treatment projects are under sonstruction.



Case Picture

Certified Ultra-low Emission Burner (CEB)

Applicant:

ECO-TEC ASIA (BEIJING) CO., LTD.

Country:

China

Technology Overview:

- ◎ The burner removes VOCs through combustion while reducing the emission of NO_x and other pollutants.
- ◎ The combustion head contains Bekinit fabric, a patented product of Bekaert woven with FeCr alloy fiber, to create large number of complex gas channels to increase combustion efficiency and minimize pollutant emission.
- ◎ Startup time is about 1 minute.
- ◎ Explosive gases go through combustion directly without dilution, and the operation is smokeless and flameless.

Environmental Features:

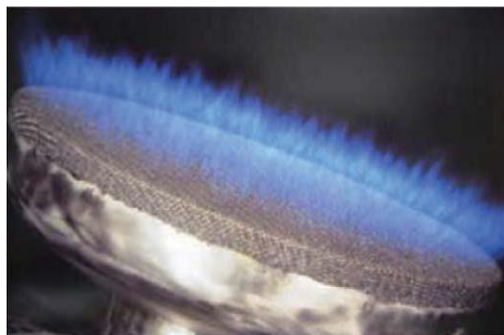
- ◎ Output Concentration of VOCs: 50mg/m³ at the lowest.
- ◎ Output Concentration of NO_x: ≤15ppmv (calculated based on 3% oxygen).
- ◎ Output Concentration of CO: ≤10ppmv (calculated based on 3% oxygen).
- ◎ Treatment Efficiency of VOCs: treatment efficiency ≥ 99.99%.

Financial Features:

- ◎ Service Life of combustion head: ≥10 years.

Implementation Status:

With application experience for 15 years, it has provided the corresponding burners to over 100 customers in 16 countries.



Ultra-low Emission Burner (CEB)

Recuporative Oxidiser + Rotor Concentrator

Applicant:

SUZHOU KELAN ENVIRONMENT TECHNOLOGY CO.,LTD.

Country:

China

Technology Overview:

- ◎ The technology is based on VOCs combustion, which can be applied to printing, coating, overlying and impregnation/injection process.
- ◎ Rotary concentration utilizes continuously rotating rotor (made from hydrophobic zeolite) to adsorb organic matters, and uses waste heat from oxidation device for desorption.
- ◎ Temperature in the oxidation furnace: 750-800°C; flue gas retention time in the furnace: 1-2s; high heat utilization efficiency in the system .
- ◎ Heat recovery system of oxidation unit can be used to heat air, water, oil, steam and adsorption cooling equipment.
- ◎ Applicable flow range: $\leq 200000\text{Nm}^3/\text{h}$.
- ◎ Applicable flue gas temperature: $< 40\text{ }^\circ\text{C}$.
- ◎ Enrichment concentration ratio: 1:20.
- ◎ Procedures for process: flue gas - adsorption of zeolite runner (part of flue gas adsorbed enters into heat exchanger of the oxidation device) - pollutants are desorbed and enriched by the air heated from the heat exchanger –preheating of enriched flue gas - direct combustion to remove volatile organic compounds.

Environmental Features:

Pollutants treatment result in a case

Pollutant	Concentration mg/m^3	Flow Rate kg/h
Benzene	3.79×10^{-3}	3.85×10^{-4}
Toluene	0.732	0.074
Xylene	0.705	0.072
Butanol	0.539	0.055
Isopropyl Alcohol	0.623	0.063
Non-methane Hydrocarbon	9.17	0.932
Particulate Matter	5.90	0.600

Financial Features:

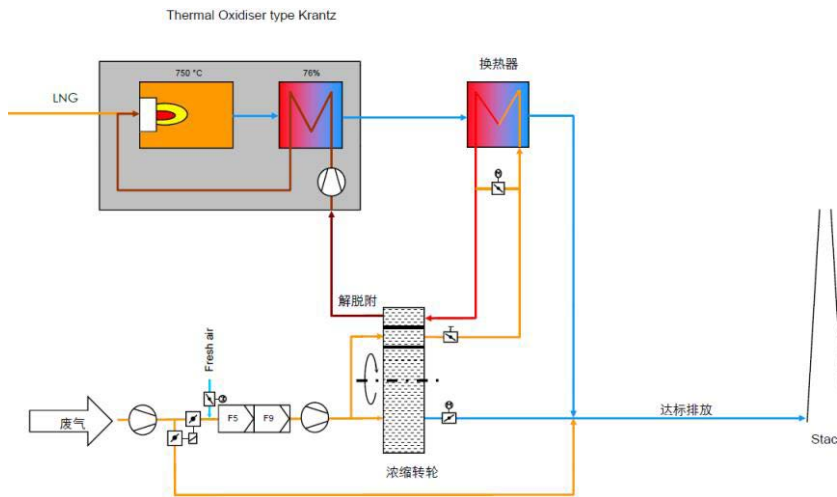
Investment and Operation Cost in a Case:

Capacity	Concentration of VOCs	Construction Cost (Ten Thousand Yuan/Ten Thousand Nm ³)	Operation Cost (Yuan/Ten Thousand Nm ³ /h)
100000Nm ³ /h	200-1000mg/Nm ³	85	<20

Service life of roter concentrator: 5-8 years.

Implementation Status:

Treatment of Exhaust Gas from Paint Production Line of Jiaxing Minhui Automobile Parts Co., Ltd.



Process Diagram



Application in a auto part factory in Jiaxing

Activated Carbon Cynergistic Medium Pore Adsorbent

Applicant:

Nanjing Special Bo Environmental Protection Technology Co. Ltd.

Country:

China

Technology Overview:

- ⊙ Composited with nano materials, the method creates a new type of adsorber from active carbon, with mesopores counting for over 80% of the total pore volume.
- ⊙ This product captures dioxin molecules through physical adsorption, and modifies and bonds with large dioxin molecules through chemical adsorption, locking dioxin and other similar pollutants within the pore channels.
- ⊙ Application temperature > 1000°C. the average pore diameter 2-20nm; mesopore structure > 80% of the total pore volume, and the pore volume > 0.2cm³/g.
- ⊙ The absorber contains 90% of inorganic mineral nano materials, resulting in high safety level.

Environmental Features:

Testing result in application case

Case	Effect
Municipal Waste Incineration Power Plant in Foshan, Guangdong	Adsorption effect is superior to micropore activated carbon.
Municipal Waste Incineration Power Plant in Shenzhen	Adsorption effect is superior to micropore activated carbon.
Jiangsu Nantong Industrial Hazardous Waste Treatment Co., Ltd.	Emission concentration of Dioxin is <0.5ng I-TEQ/m ³ which meets the standard.
Wuhan Hanyang Medical Waste Incineration Plant	Emission concentration of Dioxin is <0.5ng I-TEQ/m ³ which meets the standard.
Heavy Metal Adsorption	Heavy metal concentration in emitted flue gas meets the standard.

Financial Features:

- ⊙ Low cost with activated carbon synergy mesopore adsorber of 3800 Yuan/ton.

Implementation Status:

- ⊙ Municipal waste incineration power plant in Foshan, Guangdong

- Municipal waste incineration power plant in Shenzhen.
- Jiangsu Nantong Industrial Hazardous Waste Treatment Co., Ltd.
- Wuhan Hanyang Medical Waste Incineration Plant.

D. Indoor air quality monitoring and air purification

A Consumable-less Air Purification Product Based on IFD Technology

Applicant:

Shandong Xuesheng Environmental Engineering Co., Ltd.

Country:

China

Technology Overview:

- ◎ ifD (Intense Field Dielectric) purification technology achieves adsorption of charged particles and sterilization of bacteria and microbes, through the strong electric field generated by dielectric materials.
- ◎ Corona discharge occurs at the edge of the channel and at the tip of the needle electrode, which charges the dust particles and bacteria particles when air flow through, resulting in their capture on the inner surface of hollow channels by the strong electrical field at the dust collection unit.
- ◎ Dielectric materials consist honeycomb of hollow channels, with low flow resistance; negative ions produced are effective for sterilization.
- ◎ No consumables, filter screen can be washed and used multiple times.

Environmental Features:

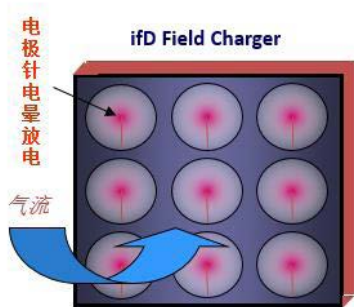
- ◎ High PM_{2.5} purification efficiency, with 98.1% for DX600 and 98.9% for SX350.
- ◎ Ozone emission is way below National Standard.

Financial Features:

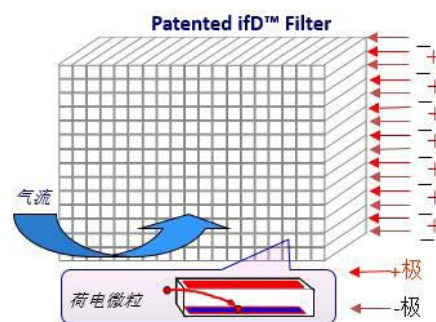
- ◎ Power Consumption: 3W per set of purification module.
- ◎ Consumables: the filter screen can be washed and used repeatedly. The cost for cleaning service is 100 Yuan each time.
- ◎ Service life of ifD filter screen > 5 years.

Financial Features:

It is applied in many domestic hotels, commercial buildings and school institutions.



微粒荷电



微粒吸附



ifD Technology Introduction Diagram

Thinpair Nano Photocatalyst Air Purification Disinfectant

Applicant:

Dalian Thinpair Technology Co., Ltd.

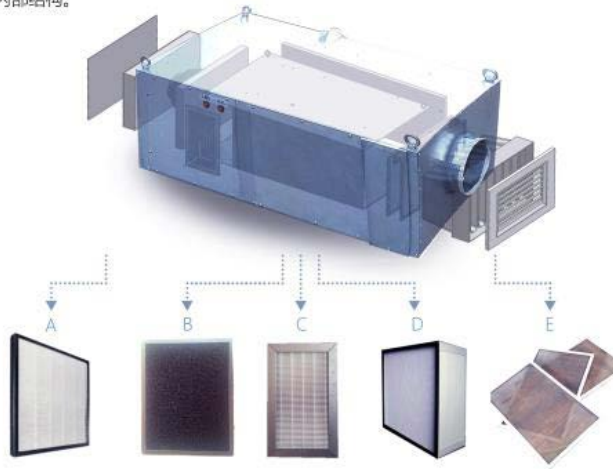
Country:

China

Technology Overview:

- ◎ Suitable for air sterilization and purification indoor and in public areas.
- ◎ Based on photocatalysis of TiO_2 materials, the sterilizer kills bacteria, and viruses in the air, and decomposes formaldehyde and other harmful substances.
- ◎ Take full advantages of air circulation of central air conditioning system for continuous purification and sterilization, when installed at the air inlet/outlet.
- ◎ Particle size of TiO_2 : 3nm-10nm; adhesion rate: 95%- 99.99%, air resistance: about 3Pa.
- ◎ Highly efficient HEPA filter adsorbs fine particles; cellular activated carbon eliminates odors; aluminum alloy filter screen captures large particle dust, which can be washed repeatedly.

XPAP-001 吊顶式空气消毒系统, 可根据房间大小与需求, 设计产品风量与内部结构。



- A 初效过滤器 (主要用于过滤 5 μm 以上尘埃粒子)
- B 活性炭过滤器 (主要用于吸收明显气味儿)
- C 中效过滤器 (主要用于过滤1- 5 μm 以上尘埃粒子)
- D 高效过滤器 (主要用于过滤 0.5 μm 以下尘埃粒子)
- E 光触媒材料 (主要用于分解挥发性有机物、病毒细菌)



Product Picture

Environmental Features:

- Sterilization rate: 60%-99.99%.
- Formaldehyde removal rate >70%.
- Benzene removal rate > 46%.

Financial Status:

- Market price: 4,800-30,000 Yuan.
- Service life of photocatalyst: > 8 years (4 hours per day).

Implementation Status:

- Huarentang in Zhongnanhai
- Peking Union Medical College Hospital
- The People's Hospital of Liaoning Province
- Dalian University Affiliated Xinhua Hospital
- Guangzhou Yuanda Pharmaceutical Co. Ltd.
- Olympia 66in Changshu of Jiangsu andin Dalian of Liaoning
- Longxishunjing Villa in Beijing
- Emerson Network Power Co., Ltd.
- Li Ning Operation Center
- The 306th Hospital of PLA
- The 309th Hospital of PLA

Ceiling Mount Indoor Re-circulating Air Purifier D-Breath 4

Applicant:

MayAir Technology (China) Co., Ltd.

Country:

China

Technology Overview:

- ◎ Ceiling-mounted internal circulation purifier (D-Breath 4, MayAir), composed of the fan, primary filter, High efficiency particulate air (HEPA) filter, gaseous molecular contaminant filter and plenum chamber, is used for indoor air purification and harmful gases removal in the commercial field.
- ◎ The purifier filter is compounded by antimicrobial substances and special fiber, which can remove bacteria, viruses and PM_{2.5} in the air.
- ◎ The filter adsorbs formaldehyde, which can be oxidized into carbon dioxide and water through catalytic oxidation unit of the purifier.

Environmental Features:

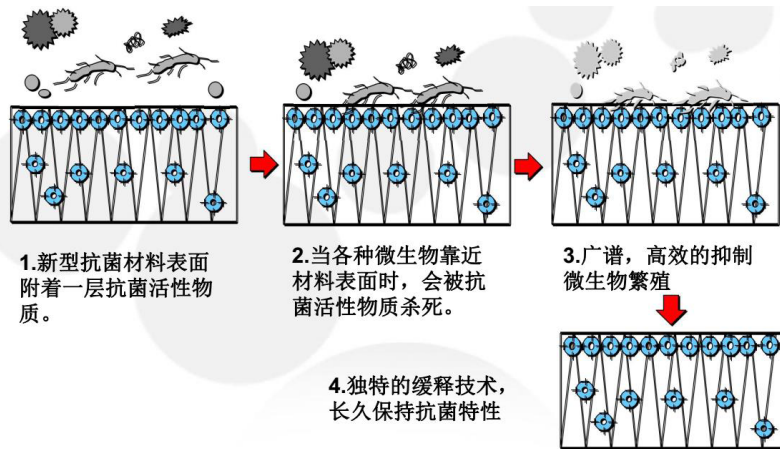
- ◎ Removal efficiency of PM_{2.5} 99.7% (20min, initial concentration of 0.889mg/m³).
- ◎ Removal efficiency of microorganism: 92.0% (3h, initial concentration of 9989 cfu/m³).

Financial Status:

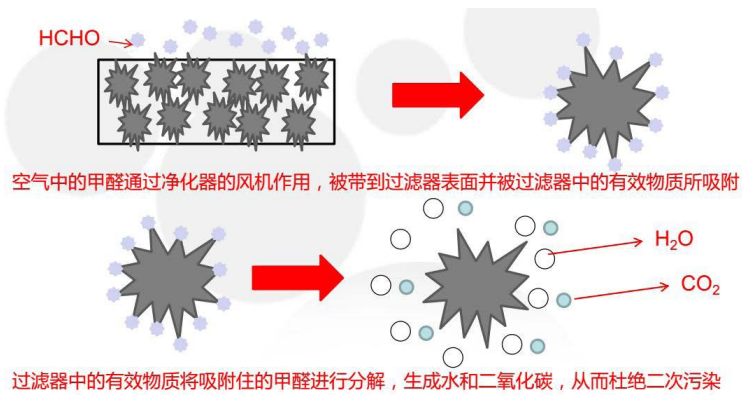
- ◎ Cost of consumables: 2,500 Yuan/set

Implementation Status:

- ◎ Bank of China, Haiying Building, 40 sets.
- ◎ Beijing Office of Hony Capital, 9 sets.
- ◎ Jiaming Maple Park, 42 sets.
- ◎ 5 office buildings of Beijing Dongsi, Tianyin Mansion, Xishan Yingfu of China Telecom.
- ◎ Wangjing Building, 12 sets, installation time.
- ◎ Office Building of State Grid of Jiangsu (19 buildings).
- ◎ Beijing QYD Kindergarten, 15 sets.
- ◎ Beijing Zhongguancun No. 2 Primary School.
- ◎ Office of Huawei



Anti-microbial filter



Formaldehyde removal filter



Ceiling-mounted Internal Circulation Purifier D-Breath 4 of MayAir

E. Advanced pollution source and air quality monitoring

The Monitoring and Control Technology of Odor in the Regional Environment

Applicant:

Ninghe Environmental Technology Development Co., Ltd.

Country:

China

Technology Overview:

- ◎ Utilizing odor electronic nose RQ BOX AW as core element, the intelligent bionic electronic device converts to and detects target gases from electrical signals.
- ◎ Odor electronic nose RQ BOX AW consists information acquisition system, signal processing system and pattern recognition system.
- ◎ Sensor array is composed of five electrochemical sensors (EC), one photo Ionization detectors (PID) and six metal oxide sensors (MOS).
- ◎ The technology applies *Internet+* technology to achieve regional odor diffusion monitoring (including chemical industrial areas and factories), to build supervise big data platform and to establish joint mechanism for prevention and control of regional comprehensive environmental quality.
- ◎ Working temperature of odor electronic nose: -5-45°C; working humidity: 95%.
- ◎ Monitoring range of sensors:

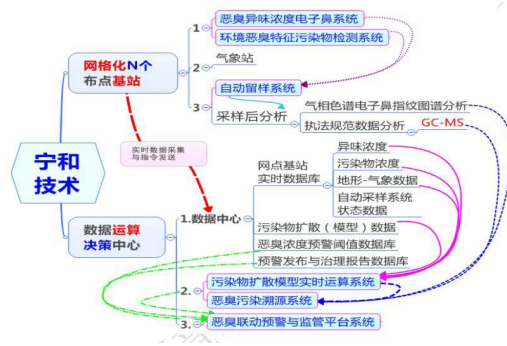
Substance	Range (ppm)	Detection Limit (ppm)
H ₂ S	0-50	0.05
NH ₃	0-25	0.5
TVOC	Environmental Detection Point: 0-20 Pollution Source: 0-2000	Environmental Detection Point:0.01 Pollution Source: 0.5

Financial Status:

Service life of odor electronic nose:5 years.

Implementation Status:

- ◎ Old Port Area of Shanghai-waste landfill site, Online Odor Warning Associative Platform of Old Port Area
- ◎ Odor monitoring project in Jiading Industrial Park of Shanghai to install systems in three key pollution sources to strengthen supervision and control for odor-emitting factories.
- ◎ Sewage plant project in the Second Industrial Zone of Jinshan District of Shanghai.



Technical Logic Relationship Diagram



Application

Solar Occultation Flux (SOF)

Applicant:

FluxSense AB

Country:

Sweden

Technology Overview:

- ◎ Solar occultation flux remote sensing monitoring technology can be used for measurement of the total emission amount of alkanes, alkenes, aromatic hydrocarbon and VOCs in a particular area, monitoring of distribution status, screening of key emission sources, and internal VOCs control and audit of within the enterprises.
- ◎ This receptor can be installed on vehicles, utilizing solar infrared spectrum to track sun light, measuring hydrocarbon infrared absorption from smoke emission through Fourier infrared spectrometer, inversely calculating the distribution of column concentration of the detected gas, and monitoring the column concentration distribution (mg/m^2) and mass emission rate (kg/h) of detected gas by combining wind speed and GPS positioning.
- ◎ Detects aldehydes, alkanes, ammonia, CO, ethylene, acetylene oxide, HF, HCl, NO_2 , SO_2 , propylene, terpenes, vinyl chloride and other gases. Spectral retrieval is based on the method of multivariate analysis.
- ◎ Eliminates the interference of H_2O , CO_2 and other gases through advanced algorithm.
- ◎ Spectrometer can be controlled by supporting software and GIS systems, and assessment, display and analysis of online data can be conducted.
- ◎ Fast Response.

Financial Features:

- ◎ Mainly provides service due to the complexity of satellite systems.
- ◎ The costs of equipment, personnel and monitoring report range from 200,000 Yuan to 300,000 Yuan per week.

Implementation Status:

- ◎ Detection of alkane and alkene emission in eight refining systems and one shale refinery systems of Sinopec in 2014.
- ◎ Sweden-China science and technology cooperation project- *Study on Photochemical Smog of China*, completed the emission monitoring on VOCs and other photochemical reaction precursors in typical regions in 2016.
- ◎ VOCs monitoring in one petrochemical plant and port in Tianjin in June, 2016.

Previous Winners

1st Bluetech Award

The First Bluetech Award officially began in April 2015 and gathered 60 technologies from 8 countries. After the assessment and evaluation, 21 technologies became the finalists and 5 of them were the award winner.

Winners:

Technology	Applicant
Diesel Engine Pollution Control Technology	
Multi Functional Diesel Performance Additive	Total Petroleum (Shanghai) Co., Ltd.
Diesel Particulate Filter System	Wuxi Weifu Lida Catalytic Converter Co., Ltd.
VOCs Pollution Control Technology	
Low Emission Control Technology for Valves	Garlock Sealing Technologies (Shanghai) Co., Ltd.
Indoor Air Purification Technology	
Mayair Electric-Pocket Technology	Mayair Technology (China) Co., Ltd.
EKEAIR™ MKJ-4000 Air Purification Disinfectant	Jiaying Sanyin Environmental Purification Technology Co., Ltd.

2nd Bluetech Award

The Second Bluetech Award officially began in April 2016 and gathered 54 technologies from 16 countries. After the assessment and evaluation, 23 technologies became the finalists and 6 of them were the award winner.

Winners:

Technology	Applicant
Diesel engine emission reduction technologies & clean energy substitutes	
Air Powered Start-up System	Shanghai ShenZhou Vehicle Energy Saving & Environmental Protection Co., Ltd.
Ammonia Storage and Delivery System (ASDS)	Faurecia China
Ultra-low emission control for coal-fired power plants	
The deep desulphurization technology of flue gas by slurry atomization and swirl flow field	Beijing Chutian ruiping Environmental Technology Co.,Ltd
Coal combustion emission control & clean energy substitutes (non-power sector)	
Zeta Electrode Boiler	Beijing Zeta Energy Technology Corp.
Indoor air quality monitoring and air purification	
Intermetallic compound Parer-like membrane air purification technology	Internet Techonology Chengdu Co., LTD.
Escaping current particle measurement	Pegasor Oy

Clean Air Alliance of China

Founded by ten research institutions, Clean Air Alliance of China is China's leading platform for cities and provinces working to achieve clean air. The Platform promotes innovative ideas, best practices, technologies and tools, while facilitating cooperation and collaboration across provinces and cities, research institutions, and technologies companies. CAAC works towards the vision of promoting clean air across cities and provinces, improving public health. Members include research institutions, provinces and cities, and relevant non-profit organizations and companies.

Ten Founding Institutions: Chinese Academy for Environmental Planning, Appraisal Center for Environment & Engineering of MEP, Tsinghua University, Nanjing University, Renmin University of China, Beijing Normal University, Chinese Research Academy of Environmental Sciences, Peking University, Fudan University, Vehicle Emission Control Center of MEP



Innovation Center for Clean-air Solutions

(Secretariat for Clean Air Alliance of China)

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Bluetech Award



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