Bluetech Award

5th Bluetech Technology Manual

January 2020

Bluetech Clean Air Alliance

Bluetech Clean Air Alliance

Bluetech Clean Air Alliance (BCAA) is a non-profit professional organization focusing on the development of clean air technologies and industries in China and the world through technology transfer, technology assessment and demos, investment service, IP protection, and policy research. BCAA is evolved from the Clean Air Alliance of China, an integrated platform launched in 2013 by 10 leading Chinese research institutions to tackle China's severe air pollution problem. Over seven years' operation, the Alliance has conducted and participated in various clean air research projects, carried out pilot projects in 12 provinces and cities in China, published 50 policy and market research reports, assessed over 300 advanced clean air technologies from 20 countries, established collaborations with partners across 20 countries, and carried out a series of activities and pilot work in the field of green technology intellectual property awareness raising and high-value patent cultivation.

Contents

Bluetech Award Introduction

The Bluetech Award is launched in 2015 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 Bluetech Clean Air Alliance (BCAA) and its partners to expand their ability to create a blue sky for everyone.

Bluetech Award

- 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

Launch → Application → Assessment → Ceremony → Match Making

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 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 of 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 achieve 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.: Many provinces and cities including Shanxi and Inner Mongolia are gradually enhancing delicacy management in improving the environment and air quality while abating the pollution caused by coal use. In 2017, Shanxi issued the action plan for air pollution prevention and treatment for the province. The plan proposes actions that allow to meet comprehensive governance requirements for VOCs in key sectors while continuing to strictly control the coal pollution. The VOCs alternation and pollution treatment technologies gathered by Bluetech platform are capable to assist Shanxi in the treatment of VOCs. Futhermore, the plan also requires strengthening coping with heavy pollution regulations and improving the capacity of provincial and municipal air quality monitoring, early warning systems and response teams, all these requirements increase the need to investon technology for monitoring air quality and pollution sources. The monitoring technology provided by the Bluetech platform is able to help Shanxi to enhance the monitoring of air quality and at the same time to improve its management capacity.

Global Award

Three Bluetech Award assessed nearly 300 technologies. Those applicants came from 20 countries including China, USA, France, Germany, United Kingdom, Japan, New Zealand, Australia, Malaysia, Switzerland, Denmark, Holland, Sweden, Isrel, Italy, India, Finland, Poland, Norway and Canada.

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

◎ China Association of Environmental Protection Industry – Committee of Vehicle Emission Control

◎ China Association of Environmental Protection Industry – Committee of VOCs Pollution Control

◎ Chinese Society of Environmental Sciences – Professional Committee for Pollution Prevention and Control of Volatile Organic Compounds

◎ Xiamen Environment Protection Vehicle Emission Control Technology Center

◎ The Chemical Industry and Engineering Society of China- Water Borne Coatings Committee

◎ China Electric Vehicle Charging Technology and Industry Alliance

◎ China Highway And Transportation Society

◎ 3iPET International Platform for Environmental Technology

◎ TEDA Low-carbon Economic Promotion Center

◎ China Machinery & Environmental Industry Development Center

◎ ESCO Committee of China Energy Conservation Association

◎ IE Expo

◎ Japan International Cooperation Agency

◎ Japan External Trade Organization

◎ IVL Swedish Environmental Research Institute Beijing Representative Office

◎ Air & Waste Management Association (US)

◎ US-China Clean Tech Center

◎ UK Trade & Investment

◎ Clean Air Alliance UK

◎ VERT Association (Swiss)

◎ Swiss clean technology association

◎ World Future Council (Germany)

◎ France Chamber of Commerce and Industry

◎ Clean Cluster Denmark

◎ China Culture Desk (Austria)

◎ Italian Chamber of Commerce

◎ International Laboratory for Air Quality and Health (Australia)

◎ Commonwealth Scientific and Industrial Research Organization (Australia)

◎ New Zealand Trade & Enterprise

◎ International Council for Local Environmental Initiatives (Korea)

◎ China-Britain Business Council

◎ US-China Energy Cooperation Program

◎ Water Borne Platform

◎ National Big Data Alliance of New Energy Vehicle

◎ World Bank

◎ Cteam

◎ Zhongguancun International Environment Protection Industry Promotion Center

◎ Centre of Excellence for Research on Clean Air

◎ Sino Italian Cooperation Program for Environmental Protection

◎ Iranian Embassy

◎ Swisscleantech

◎ Japan Science and Technology Agency

◎ Los Angeles Cleantech Incubator

◎ Energy Foundation China

◎ China Council for Industrial Environmental Protection (CIEP)

◎ Canada-China Business Association

◎ European Union Chamber of Commerce in China

◎ China Association of Private Equity

◎ Beijing Global Village Environmental Education Center

◎ State of Green(Denmark)

◎ China-Britain Business Council

◎ Sino-Sweden innovation& Entrepreneurship center

◎ International Fund for China's Environment

◎ Chambre de Commerce et d'Industrie Française en Chine

◎ Plug and Play

◎ Young Green Tech. Entrepreneurs Forum

◎ Bay Area Council

◎ Prospect Silicon Valley

◎ World Alliance for Efficient Solutions

◎ Aquilaris

◎ danish embassy

◎ Smogathon

◎ Council of Industry and Technology Alliances in Z-park

◎ Beijing Institute of Collaborative Innovation

◎ US-China Energy Cooperation Program

◎ China Association of Environmental Protection Industry – Committee of Vehicle Emission Control

◎ Green Finance Committee of China Society for Finance and Banking

◎ bio.china-nengyuan.com

◎ China Energy Net

◎ IE Expo

◎ Swiss Chinese Chamber of Commerce

◎ International Fund for China's Environment

◎ Chambre de Commerce et d'Industrie Française en Chine

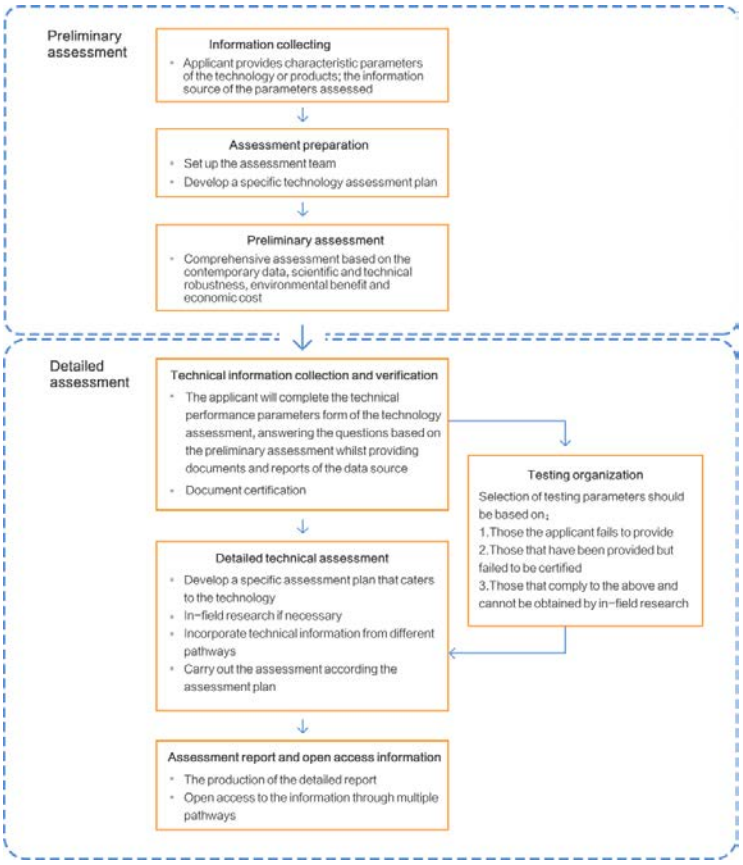
◎ Korea Association of Energy, Climate Change and Environment

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 BenefitBluetech Clean Air Technology Assessment: Economic Cost*



Bluetech Acceleration

In order to encourage the development of award-winning technologies and other outstanding green innovations, BCAA and its partners jointly established the "Bluetech Acceleration Platform". By setting up technology demonstration projects, providing intellectual property strategy training, carrying out high-value patent cultivation pilot projects, and organizing publicity and resource connection, the Platform opens up an "accelerated channel" for the application and promotion of related technologies in China and the world.

Technology Demonstration Projects

Among the demonstration projects, BCAA will cooperate with local departments such as Development and Reform Department and Environmental Protection Department, to support technology enterprises to obtain demonstration and pilot opportunities for practical application in China according to the needs of the implementation of relevant environmental policies. Technology enterprises also have the opportunity to apply the Bluetech technology assessment method to carry out the systematic third-party assessment on the technical performance, environmental benefits, and economic costs related to the technology in the demonstration application process. The evaluated demonstration projects can also be included in the Bluetech online demonstration platform for display.

IP Strategy Training

Conducting awareness training programs on intellectual property (especially patents and commercial secrets) for technology companies, research institutes, investment funds, incubation platforms, and industry alliances focusing on clean technology can not only improve their deep understanding of the intellectual property system, increasing the emphasis on patent quality, and discover how to use the rules of the patent system to carry out the effective business competition. But also can enhance their cognition of relevant parties to the intellectual property management system, guide the enterprises to establish an effective intellectual property management system according to their development stage and technical characteristics, so as to systematically manage the risks related to intellectual property and promote the generation and maintenance of rights.

High-value patent Cultivation Pilot

BCAA will select leading technology enterprises in the clean technology field to carry out pilot projects and organize a professional intellectual property service team to cooperate with

them. According to the development stage, competition status, and industry characteristics of the enterprise, BCAA will closely combine the mining and layout of patents, the business strategy and research and development of the enterprise and carry out targeted patent layout to help enterprises cultivate high-value patents and patent portfolios (including international patents).

Project and Resource Matchmaking

- ◎ Investment matchmaking: combining with the development stage of the enterprise, BCAA will help the technology enterprises to dock with the corresponding capital resources.
- ◎ Industry seminar: according to the specific needs of the air quality improvement work of the country and provinces/cities, representatives of relevant departments, experts, industry organizations, and technology enterprises will be invited to hold industry seminars on relevant topics.
- ◎ Local demand matchmaking: BCAA will organize technical enterprises to communicate with environmental protection departments and demand-side enterprises according to the demands of provincial and municipal environmental protection management.
- ◎ Investor salon: combining with the characteristics of technology, enterprises, and industries BCAA will assist enterprises to connect with capital resources and achieve rapid development.

Pilot Demonstration

The Bluetech award technologies have the opportunity to be demonstrated at the annual Bluetech conference, which is attended by 300 to 400 people each year. In past conferences, participants include attendees from national and local environmental protection departments, technology companies, experts and industry organizations, investors, and media. The technical representatives can communicate directly with the domestic and foreign authoritative experts, and obtain the propaganda support from the domestic and foreign media, thereby expanding the popularity and influence of the technology on a global scale.

Dissemination

- ◎ We-media platform: The award winners 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 seminars refer 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 Cleanair 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 be able to take part in the Bluetech media seminars, and also could be demonstrated during the seminars.

◎ Bluetech's Remark: Bluetech's Remark is a promotion brand introduced by BCAA, which is through interviews in the field of clean air, and by partnering with the media, providing excellent technologies with the opportunity of perform a systematic promotion.

◎ Promotion through cooperative media: Bluetech has established an 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, allowing the award winning technologies to be promoted across the globe under the support of our partners. Futhermore, 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.

5th 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.

5th Bluetech Winner Introduction

The 5th Bluetech Award officially began in April 2019, and completed technology gathering in September. 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 5 technologies win Bluetech Award and 2 techonology in Bluetech Future Stars Award, which are high-quality, innovative technologies to tackle China's air pollution!

Disclaimer

The Bluetech Clean Air Alliance (BCAA) undertook the mandate to organize the Bluetech Award Clean Air Technology Schemes and entrust Innovation Center for Clean-air Solutions (ICCS) as a technical support entity to carry out relevant technical assessment work. BCAA 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 Particiapting Technologies, include but not limited to inventors, applicant, technical parameters, legal status, etc.

BCAA will organize experts in related fields to make objective assessment on the evaluation technology based on the relevant information provided by the participating entities.

BCAA 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. BCAA does not take responsibilities for any un-authorized use of relevant technology information in any form of distribution in the internet. BCAA reserves the right of final interpretation to the above statement.

Bluetech Winners

In the 2019 Bluetech clean air technology campaign, 5 technologies win the Bluetech Award. The winners cover diesel engine pollution control category, coal combustion emission control & clean energy substitutes (non-power sector) category, indoor air pollution control category and 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	
Disel Exhaust Cool Particulate Regeneration (CPR)	Global Clean Diesel
Coal combustion emission control & clean energy substitutes (non-power sector)	
Ultra Low Emission Filtration and Dust Collection Technology	Donaldson (China)Trading Co., Ltd
Technology of Selective Circulation of Sintered Flue Gas for Energy Saving and Emission Reduction	Beijing KBSC Environmental Engineering Co.,Ltd
Indoor air pollution control	
Permanent Attachment Technique for Nano-sized photocatalysis Material	Liontrunk (Beijing) Technology Company Limited
Advanced pollution source and air quality monitoring	
Wide Temperature Nanometer-scaled Ultrafine Particle Dilution Generation and Number Concentration Measurement Systems	Beihang University

Disel Exhaust Cool Particulate Regeneration (CPR)

Category:

Diesel engine emission reduction technologies & clean energy substitutes

Applicant:

Global Clean Diesel

Country:

United States of America

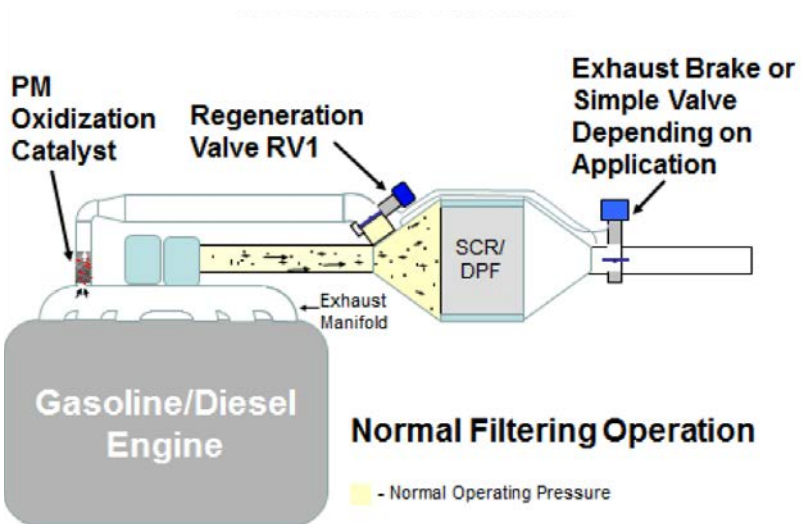
Technology Overview:

◎ Disel Exhaust Cool Particulate Regeneration (CPR) is a low-cost, post-processing technology that can meet the particulate matter emission requirements of the Euro VI emission standards.

◎ The technology is mainly composed of two groups of mechanical valves, filter materials and regenerative particulate matter collection tanks.

◎ This technology is a exhaust filteriation system with a highly efficient non-thermal regeneration process. The technology can be used on diesel engines and gasoline engines

◎ The technology uses a DPF to filter the particulate matter in the exhaust gas, and regenerates the DPF through a series of valve combinations and engine exhaust pressure pulse back flushing, eliminating the high-temperature regeneration process.



Operation Cycle

◎ The technology can be applied to fuels with high sulfur content and biodiesel.

Environmental performance:

◎ The exhaust filtered by CPR can meet Euro VI emission standards

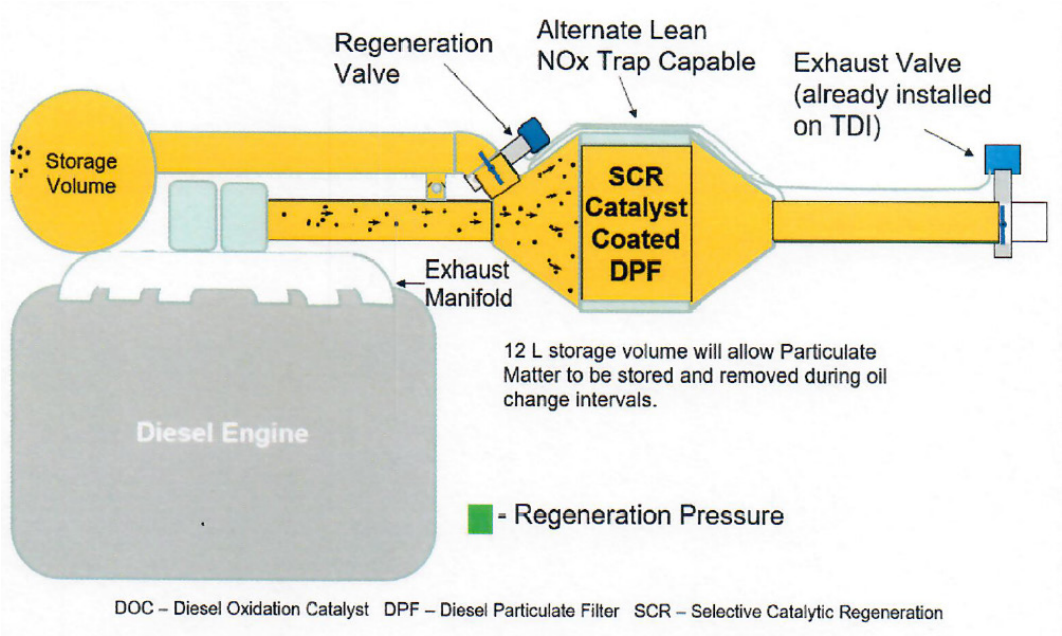
Financial Features:

◎ The cost after mass production is lower than the cost of existing particulate traps.

◎ No thermal regeneration process, saving fuel costs.

Implementation Status:

◎ Prototypes have been tested in the United States.



Regeneration Cycle

Ultra Low Emission Filtration and Dust Collection Technology

Category:

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

Applicant

Donaldson (China) Trading Co., Ltd.

Country:

United States of America

Technology Overview:

◎ Donaldson ultra-low emission dust removal product technology mainly uses the surface filtration method of nano-fiber filter material, using an ultra-thin fiber layer to adhere to the filter material, allowing almost all the particles can be concentrated on the surface of the filter material, thereby reducing penetrates particles in the bottom layer to improve the filtration effect.

◎ Compared with the deep filtration method of the ordinary filter bag, the resistance of the deep filtration in the surface filtration method increases obviously. The surface filtration method makes it difficult for the dust to adhere to the surface of the filter bag, so the resistance is stable, and the filtration efficiency is also stable.

◎ Based on the application of nanometer filtration technology, the dust particles quickly accumulate on the filter surface to form a thin layer of breathable dust cake, which can prevent the dust from permeating and solve the problem that the filter material is susceptible to be blocked. At the same time, the dust cake can be effectively removed in the blowback cleaning.

◎ Donaldson has a cartridge filter with surface filtration technology. Its working process is that after the dusty gas enters the dirty air chamber of the dust collector from the top of the dust collector, due to the sudden expansion of the airflow section and the pre-separation effect of venturi, some large particles in the airflow descend to the dust hopper under the action of gravity and inertia force. After the dust particles with small particle size enter the dirty air chamber, the dust is deposited on the material surface of the filter cylinder through the combined effects of screening/interception/inertia impact/Brownian motion, and the purified gas enters the clean air chamber and is discharged from the exhaust port by the fan.

Environmental performance:

◎ Meet ultra-clean emission requirements (< 5mg/m^3).

◎ Compared with similar filter equipment, the ash removal effect is better.

◎ The operating energy consumption of the dust remover could be reduce

Economic performance:

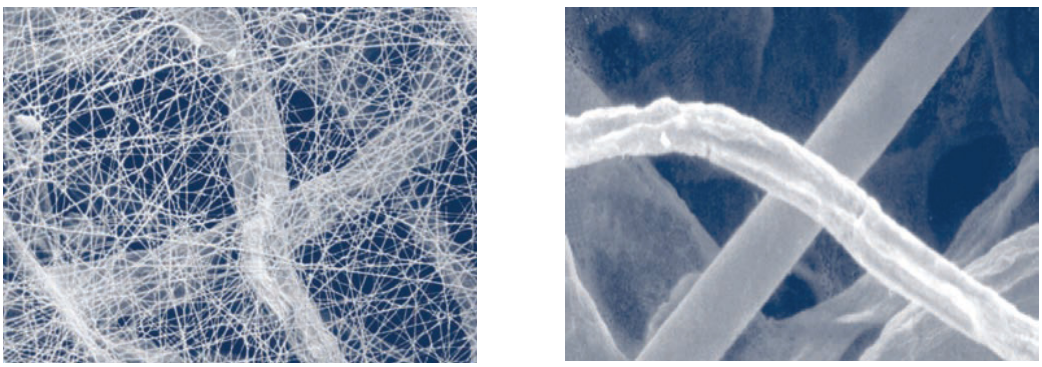
◎ The total cost of ownership (TCO) of Donaldson pleated cartridge system is lower than that of competing equipment.

◎ Under the same operating conditions, Donaldson's filter could be used in a smaller model than the ordinary filter cartridge dust remover, saving up to 40% of the filter cartridge number.

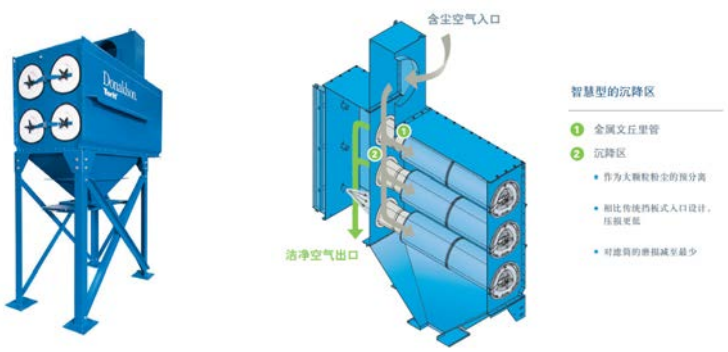
◎ Installation and replacement is more convenient, could shorten the shutdown transformation time, save the user shutdown cost.

Implementation Status:

◎ The technology has applications in metal grinding, plasma cutting, material processing, medicine manufacturing, thermal spraying, welding, metal manufacturing and processing, glass industry, food processing, and other industries.



Comparasion of nano surface filtration fiber (left) and regular filtration fiber (right)



Ultra Low Emission Filtration System

Technology of Selective Circulation of Sintered Flue Gas for Energy Saving and Emission Reduction

Category:

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

Applicant

Beijing KBSC Environmental Engineering Co.,Ltd.

Country:

China

Technology Overview:

◎ Selective circulation of sintered flue gas for energy saving and emission reduction technology is a technology applied to the flue gas treatment of the sintering process in the steel industry. Its principle is based on the differences in the flue gas emission characteristics (temperature, oxygen content, flue gas volume, pollutant concentration, etc.) of the sintering bellows, and on the premise of not affecting the quality of sintering ore, the flue gas cycle of specific bellows section is selected to return to the surface of sintering pallet, and it is ignited and sintered with hot air, thereby reducing emissions and improving energy efficiency.

◎ Circulating flue gas process: It is led by the sintering machine air box, passes through the dust removal system, circulating main exhaust fan, and flue gas mixer, passes the sealing cover, and then the flue gas is introduced into the sintering material layer and participates in the sintering process again.

◎ The circulating flue gas and sintering material layer undergo a series of complicated heat and mass transfer and chemical reaction processes, including the high-temperature circulating flue gas and sintering material layer heat exchange, the secondary combustion heat release of CO, the high-temperature decomposition of dioxin, and NO_X catalytic reduction, while reducing the total amount of pollutant emissions, the sensible heat of the flue gas is supplied to the sintering mixture for hot air sintering, which can reduce the sintering solid fuel consumption, improve the quality of the surface sintering ore, increase the temperature and uniformity of the sintering ore layer and the physical and chemical indicators of crushing strength, achieve energy-saving, emission reduction, and multi-functional coupling.

◎ Selective circulation of sintered flue gas for energy saving and emission reduction technology has formed a sintering flue gas selective circulation purification and waste heat utilization technology process package and complete sets of equipment, which can provide a systematic solution for the green upgrading of the steel sintering process, with the coupling effect of energy conservation, emission reduction, and production increase.

◎ The project is expected to save 16,300 tons of solid fuel and increase the output of sintering ore by 86,500 tons per year, with an annual economic benefit of about 30 million yuan. At the same time, it can reduce the CO emission by 12,300 tons, improve the ambient air quality index, and show the co-exist significant economic, environmental and social benefits.

Environmental performance:

◎ Through hot air sintering, the waste heat utilization effect of the flue gas circulation process is enhanced, and the solid fuel consumption of sintered ore is reduced.

◎ Through the flue gas circulation process, the total amount of exhaust gas can be reduced, the total emissions of CO, dioxin, and NO_X can be reduced, and the circulating flue gas extraction air box and gas distribution location can be optimized. The circulation system is also used to regulate the atmosphere of the sintering bed, reduce the generation of CO, promote the re-burning of CO, and further realize the source reduction and process emission reduction of CO.

Economic performance:

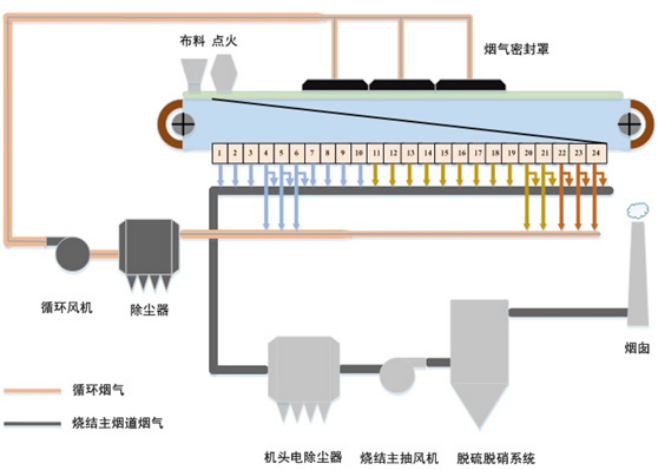
◎ Improve the quality and output of finished ore without reforming sintering machine;

◎ Reduce the operation cost of pollutant control facilities such as dust removal and desulfurization that have been put into operation;

◎ Reduce the investment and operation cost of pollutant control facilities of the new sintering machine.

Implementation Status:

◎ Hegang Handan iron and steel group co., LTD., applied the 2#360m2 sintering machine in Handan Hanbao ironmaking plant.



Process Diagram

Demo Project Picture

Permanent attachment technique for Nano-sized photocatalysis material

Category:

Indoor air pollution control

Applicant

Liontrunk (Beijing) Technology Company Limited

Country:

China

Technology Overview:

◎ The Nano-sized photocatalysis material is able to generate active groups which can form chemical bonds with functional groups on the substrate surface through chemical reactions in room temperature, so that the photocatalytic materials can be firmly attached to the substrate surface, and the enduring and effective performance of photocatalytic materials can be realized in a real sense.

◎ Dispersion stability of the product: the dispersion stability of the product is mainly solved by the preparation of nano TiO_2 pre-hydrolyzed products and the synthesis process of the microwave-assisted hydrothermal method. Through the preparation of nano-TiO_2 pre-hydrolysate, controlled hydrolysis of titanium alkoxide can be achieved, and the water solubility of nano-TiO_2 particles is increased, effectively preventing the agglomeration of nano-particles. Microwave-assisted hydrothermal synthesis is conducive to the formation of fine crystal nuclei, which in turn generates small, uniform and stable nano-sized TiO_2 particles, which effectively prevent the deposition of nano-particles.

◎ The visible-light photocatalytic performance of the product: In the process of microwave-assisted hydrothermal synthesis of nano-TiO_2 photocatalytic materials, modifiers are added in stages according to a particular ratio to control the reaction temperature and pH value. The modified nano-TiO_2 photocatalytic materials can be obtained after 24h of reaction. Through co-doping modification, its forbidden bandwidth was reduced from 3.2eV to 2.11eV, and the response wavelength of nano-TiO_2 was also extended from the ultraviolet region to the visible light band, which improved the photocatalytic efficiency of the material in an indoor environment.

◎ The long-term adhesion performance of the product is mainly solved through the synthesis of organic modified nano-SiO_2 and product formulation design. After construction, nano-SiO_2 particles and nano-TiO_2 particles will form a layer of organic-inorganic composite hybrid coating on the surface of the substrate. A robust chemical bond will be formed between the nanoparticles, and between the nanoparticles and the substrate. It dramatically improves the wear resistance and service lifespan of the composite coating.

◎ Utilizing the unique properties of Saifu Shield series products, we have carried out applied

research and development in several aspects, such as indoor air treatment services and air purification sprays. Furthermore, we formulated the Saifu Shield series of nano-TiO_2 photocatalytic material enterprise standards and air treatment service enterprise standards, finally, mass-produced spray products.

Environmental performance:

◎ It can effectively remove formaldehyde, benzene, ammonia, nitrogen oxides and other toxic and harmful VOCs pollutants in the air under the action of photocatalysis, and has the function of disinfection and sterilization.

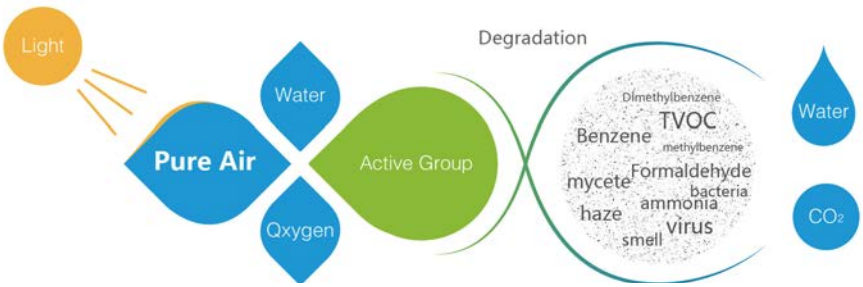
Financial Features:

◎ This technology improves the adhesion time of nanometer titanium dioxide material on the substrate surface and prolongs the service lifespan of the product.

Implementation Status:

◎ Wanda Hotel Indoor Air Treatment Project
◎ Qingdao Wanda Grand Theater Project
◎ Wanda Vista Qingdao Oriental Movie Metropolis
◎ Wanda Realm Hotel Qingdao Movie Metropolis
◎ Qingdao Wanda Yacht Club
◎ Qingdao Wanda VIP Hotel

Product Sample



Photolysis Diagram

Wide Temperature Nanometer-scaled Ultrafine Particle Dilution Generation and Number Concentration Measurement Systems

Category:

Advanced pollution source and air quality monitoring

Applicant

Beihang University

Country:

China

Technology Overview:

◎ The technology is a particle detection system that can be used under high temperature conditions, and can test the sample temperature degree with a temperature limit of 300℃. It can also be combined with the wide temperature dilution system to ensure that VOC and water vapor do not condense, effectively avoid the system error caused by cooling, and improve the test accuracy. The system can meet the new detection standard of particle number and concentration added in the latest National VI Vehicle Detection Regulations in China, and can also be used for online monitoring of the atmospheric environment, dust-free laboratory, dust-free workshop, indoor purification system, and other normal temperature environments.

◎ The coagulation and nucleation technology of nano-scale fine particles in a wide temperature range is the key technology. Based on this, the applicant established a measuring method for the latent heat of evaporation of non-ideal solution based on Hess law and enthalpy of mixing theory, and also proposed a phase change heat and mass transfer prediction method to suit non-ideal solution. Then, by using the influence of quantitative characterization of component activity coefficients on gas-liquid two-phase flow to precisely control the dynamic process of surface infiltration growth of nano-particles. In addition, a numerical model of gas-liquid-solid phase transition heat and mass transfer in microporous channels was established to guide the invention of heterogeneous nucleation and surface infiltration growth methods of nanometer fine particulate in a wide temperature range (-10-300℃).

◎ This technology applies the dilution method of fine particles in a wide temperature range based on the automatic control of the self-adjusting parameter PID. It combines with the random variation rule of thermal deposition of nanometer particles with particle size and dilution temperature proposed the nonlinear response numerical model of loss efficiency and dilution conditions of nanometer fine particles with different modes. Besides, the team also developed a wide-temperature (-10-300 ℃) ejector low-flow diluter and a high-precision venturi flowmeter. It finally integrated a multi-stage self-

adaptive fine particulate dilution acquisition system. In this way, dynamic adjustment and precise control of the dilution process of different gas samples and tested environment could be realized through real-time monitoring of sample temperature and particle concentration. The dilution ratio can continuously and precisely adjustable between 1:1:255:1, and the dilution temperature is consistently and precisely adjustable between -10-300℃ .

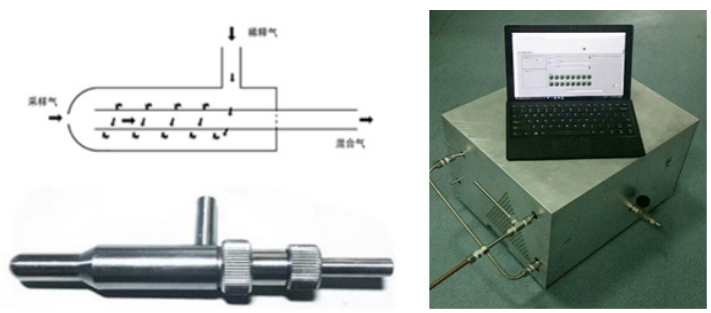
◎ This technology utilizes a wide-temperature micron particle detection method, and the gas-heat-light-electric multiphysics coupling design concept develops a microcantilever mass-sensitive microparticle sensor based on the piezoelectric effect. This allows the micron-sized fine particles after condensation to grow up to laterally impact the surface of the piezoelectric material of the micro-cantilever beam and counts by detecting the electrical signal generated by the impact. Thus, a micron particle counter suitable for a wide temperature (-10-300℃) range is realized.

Financial Features:

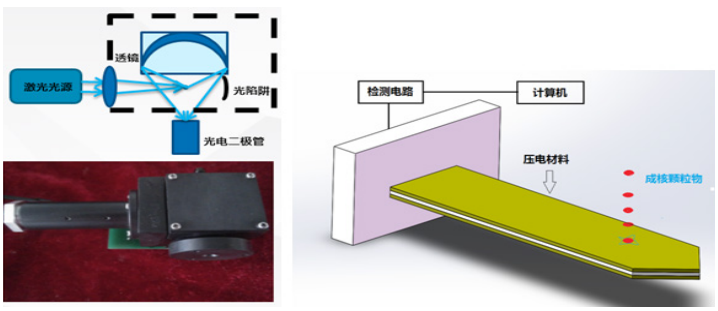
◎ In the case of better performance than imported instruments of the same type, the price is 30% -50% of the cost of similar imported testing instruments.

Implementation Status:

◎ The technology has been applied in China Institute of Atomic Energy, Dongfeng Motor Corporation, automotive department of Tsinghua university, college of the environment of Peking University, Tsinghua university Suzhou automotive research institute, Suzhou Suxin company, Ningbo Yinzhou DLT Technology Co., Ltd. and other companies.



Diluter Diagram



Particle Counter

Bluetech Future Star

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
User Side Voltage Quality Optimization Technology Based on Regulations of Electromagnetic Balance	Anhui Gemini Electrical Technology Co., Ltd.
Nano Photocatalyst Air Purification and Self-Cleaning Technology	Dalian Thinpair Technology Co., Ltd.

User side Voltage Quality Optimization Technology Based on Regulations of Electromagnetic Balance

Applicant

Anhui Gemini Electrical Technology Co., Ltd.

Country:

China

Technology Overview:

◎ This technology optimizes the quality of user-side power consumption by sampling the electrical parameters of the user-side electrical equipment, calculating and comparing the parameters, and voltage parameters are rectified and adjusted by the use auto-coupling excitation voltage regulation technology to correct and adjust the voltage parameters, to optimize the power quality on the user-side, and finally achieve the effect of improving the power quality and saving power on the user side.

◎ The electromagnetic power quality optimization device is connected in series between the power source and the electric equipment. The Data Collection Module (DCM) in the device samples the output voltage parameters of the equipment, and the sampled data enters the Center Processor Model (CPM). Then, according to the Center Processor Model (CPM), the optimization program of the power supply, load, and load-rate conditions such as the supply voltage, motor operating current, and system power factor is calculated to obtain the optimal operating point of the motor in this state. The results obtained by Central Computing Module (CPM) will be used to adjust the power supply parameters of the equipment through Non-Turbulence Change Module (NTCM), so that the working state of the motor is close to the optimal working point, improving the working efficiency of the motor and reducing the energy consumption of the motor.

◎ The technology has high reliability, effectively solves the voltage deviation, fluctuation, and three-phase imbalance, has the noticeable power-saving effect, does not

generate harmonics, does no harm to the power grid and equipment, has the function of cleaning the power grid, has fast response speed, and has very low self-loss. , Especially suitable for workplaces with harsh environments.

◎ The special structure of the electromagnetic conversion host makes the electromagnetic conversion efficiency increase, and its self-loss is very low (no-load loss ≤ 0.1%).

◎ The optimal working point tracking technology is mainly to track and adjust the optimal working state of the equipment according to the output of the load and the impedance characteristics of the load itself and the power supply. Adjust the power supply of the device to make the device appear in the state of highest energy efficiency conversion and lowest self-loss during work. This is mainly realized by sampling and calculating the power supply and output.

Environmental performance:

◎ The technhology can improve power-saving efficiency, save much electricity, and reduce coal use and CO_2 emissions.

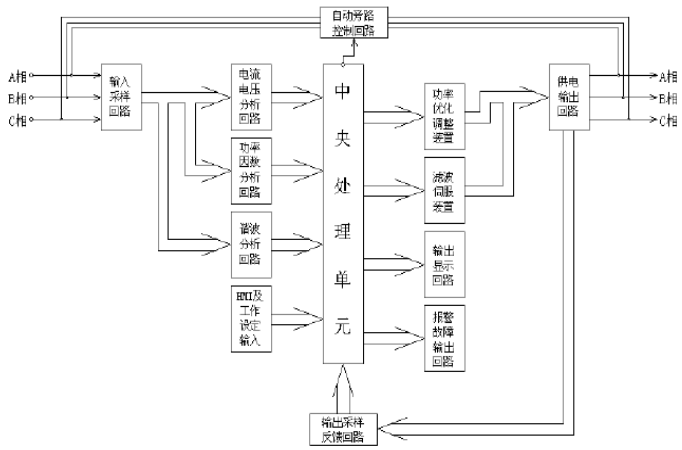
Financial Features:

◎ One investment can benefit 15 years.

Implementation Status:

◎ The power distribution system of the library of Anhui Medical University has been reformed to save electricity, with an electricity-saving efficiency of about 15%, an annual saving of 196,500 kWh, an annual saving of 24.15 tons of standard coal, and an annual reduction of CO_2 of 88.56 tons.

◎ The technology was applied in the energy-saving demonstration project of the Tongling Human Resources Center Training Building. The power saving efficiency was about 12%, the annual power consumption was 29,000 kWh, the annual standard coal savings was 3.56 tons, and the annual CO_2 reduction was 13.07 tons.



Control Circuit Diagram

Internal Structure

Nano Photocatalyst Air Purification and Self-cleaning Technology

Applicant

Dalian Thinpair Technology Co., Ltd.

Country:

China

Technology Overview:

◎ Photocatalyst air disinfection, purification, and self-cleaning technology is a kind of polymer nano-photocatalyst material that is excited by the ultraviolet light source and has the powerful oxidizing ability, which can quickly and completely decompose the pollutants in the air. This series of products use nano photocatalytic materials, to purify pollutants in the air. Photocatalytic reactions are required to illuminate volatile organic compounds such as formaldehyde and benzene in the air, bacterial viruses, and have high-efficiency purification and self-cleaning effects. These include the following self-developed materials: polyethylene glycol (PEG) as a structure-directing agent, a new idea for the preparation of TiO_2 mesoporous thin-film photocatalysts, and the TiO_2 thin film photocatalyst with pore diameter of 10nm, crystal phase structure of anatase and high-temperature stability was obtained, and the degradation activity of formaldehyde in gas phase can be increased by 6 times, and that of rhodamine B solution can be increased by 22 times.

◎ Nano-structure photocatalyst materials, combined with a variety of photocatalytic activity of $Ba_5Ta_4O_{15}$, Bi_2WO_6 and other visible photophotocatalysts with single molecular layer nanosheet structure, significantly improve the efficiency of photocatalysis. Characteristics of photocatalyst materials: (1) gas resistance: about 3 Pa, (2) considerable strength: robust processability, size can be adjusted at will, easy molding, high flexibility; (3) mesoporous film: 3nm, 80 and 100 mesh, strong stability, airstream resistance, water resistance; (4) high activity: the purification rate is better than 60%; (5) high adhesion rate: the adhesion rate is more than 99%.

Environmental performance:

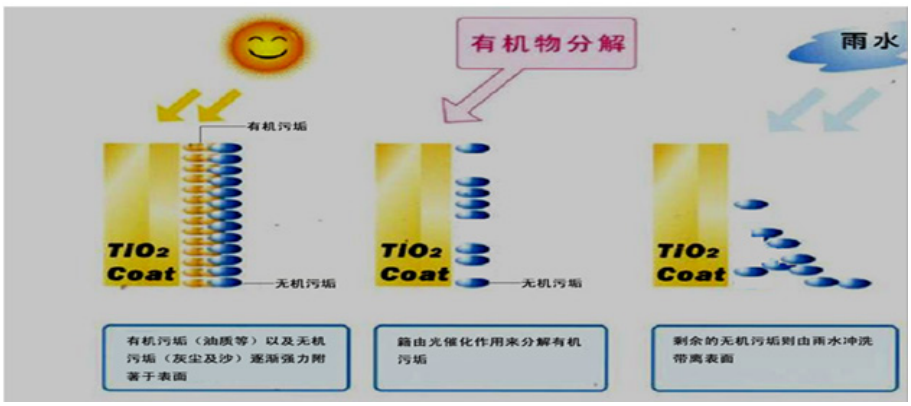
◎ The catalyst material is applied to air purification equipment. The actual removal efficiency of formaldehyde is about 80%, the actual removal efficiency of benzenes is about 70%, and the decomposition rate of bacteria is more than 99.99%. Cost varies from different project.

Financial Features:

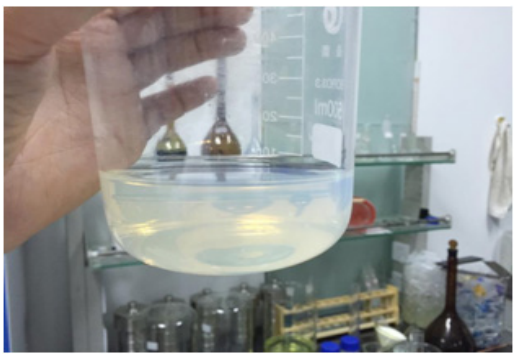
◎ The photocatalyst coating on the surface will produce a photocatalytic protective film, which has the air purification function under the sunlight. Every 200 square meters of photocatalytic building outer wall is equivalent to the air purification capacity of 14 poplar trees. The photocatalyst material has been tested in the laboratory for 50 years.

Implementation Status:

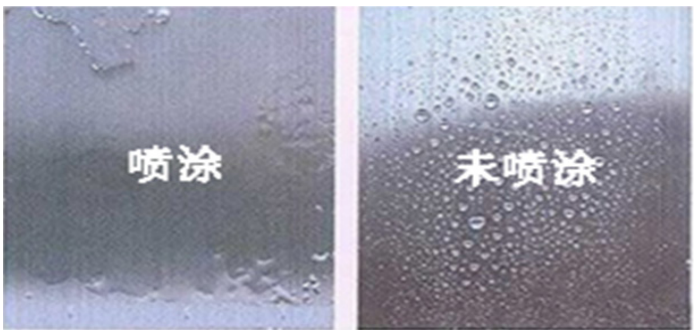
- ◎ Peking Union Medical College Hospital
- ◎ Liaoning Provincial People's Hospital
- ◎ Dalian Henglong Shopping Center
- ◎ Beijing Eighth Middle School
- ◎ Dalian University Affiliated Xinhua Hospital
- ◎ Dalian Public Security Bureau.



Photocatalysis and self-cleaninig Diagram



Photocatalytic liquid



Self-cleaning comparision

Previous Winners

1st Bluetech Award 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 Purfication Technology	
Mayair Electric-Pocket Technology	Mayair Technology (China) Co., Ltd.
EKEAIRTM MKJ-4000 Air Purfication Disinfector	Jiaxing Sanyin Environmental Purfication Technology Co., Ltd.

2nd Bluetech Award 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	Intermet Techonology Chengdu Co., LTD.
Escaping Current Particle Measurement	Pegasor Oy

3rd Bluetech Award Winners

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.
Bluetech Future Star	
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.

4rd Bluetech Award Winners

Technology/Product	Applicant
Advanced pollution source and air quality monitoring	
$PM_{2.5}$ Sensor Grids for Urban Air Quality Monitoring	Beijing Municipal Environmental Monitoring Center
TT24-7xr	Markes International
Simple VOC Detection Technology using Interference Enhanced Reflection (IER) Method: Handy VOC Sensor	O.S.P Inc.(Japan)
Onboard Air Quality Monitoring System	Nova Fitness Co.Ltd.
High Spatio-Temporal Resolution of Mobile Real-Time VOCs Monitoring System	Guangzhou Hexin Instrument Co.,Ltd.
VOCs substitution and pollution prevention	
XPO® Ultra Low NO_X Gas Burner	Honeywell
Large-scale Dairy Farm Sewage Classification and Treatment Technology	Huameng Kechuang
Bluetech Future Unicorn	
Electric Airplane	Ampaire Inc.
Bluetech Future Star	
Bi-Modal Real-Time Air Quality Solution	Clarity Movement Co.& Ramboll Group A/S
Modular Unit of Indoor Air Purification (MUIAP)	Air Liquide Group
Waterless Printing Technology to Enable Elimination of VOCs	Toray International (China) Co., Ltd.
Supercritical Carbon Dioxide Coating Apparatus	Kami Electronic Industry Co., Ltd.& Nagase Co., Ltd.
Cogeneration of Power and Heat	SunOyster Systems GmbH
Wearable Air Purifier	ATMOBLUE

Accelerate Green Industries Restore Blue Skies

Promote Tech Innovation Shape a Cleaner Future

BCAA
中关村创蓝清洁空气产业联盟
BLUETECH CLEAN AIR ALLIANCE

中关村创蓝清洁空气产业联盟

BLUETECH CLEAN AIR ALLIANCE

010-59693575

北京市朝阳区广渠路21号金海商富中心A座1403

bluetech@iccs.org.cn