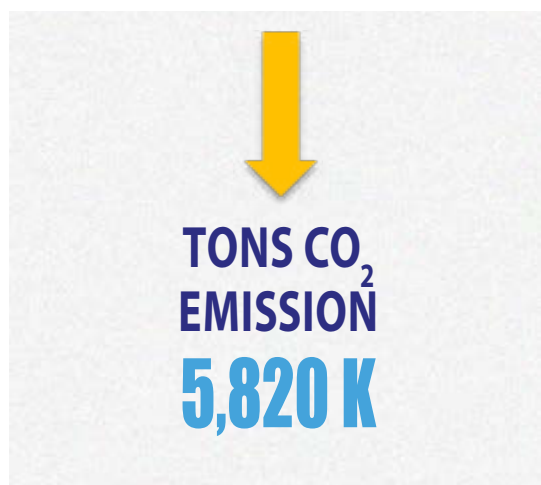


ANNEX 12 - PRC: Catalyzing Climate Finance (Shandong)

Shandong Green Development Fund Project Concept Notes

June 2018



TRANSFORMATIVE ENERGY MANAGEMENT FOR ZERO ENERGY – ZERO WASTE AT EXPRESSWAY SERVICE CENTERS IN SHANDONG PROVINCE

*Themes: Circular Economy, Coal Substitution,
Energy Efficiency*

Background: Expressway service areas typically consume large amounts of energy. The service areas generate wastewater, kitchen waste, solid waste, and greenhouse gases (GHG) emissions. The potential for renewable energy including wind, solar and bioenergy as well as recycling resources is untapped. Along with the energy and resource savings is the high opportunity to educate people as well as change behavior of vendors.

Rationale: At 35 twin expressway service areas in Shandong, the Project replaces 14 million kWh of grid-supplied power annually. The project promotes low-carbon circular development by introducing renewable energy, improved energy efficiency and the promotion of electric vehicles (EV) charging to reduce GHG emission and contribute to Shandong Low Carbon Development Action Plan (2017 -2020).

Scope: 35 pairs (70) of Shandong expressway service facilities are upgraded under the Project with new primary renewable energy sources from solar and wind with 1,000 and 100 kW respectively per twin service area. Biomass from waste produces additional energy and fertilizer. 172 EV charging bays are provided and energy-saving tower mounted lighting system erected and powered by solar panels. A Smart Energy Service Area Management System is used to control the enhanced energy distribution system with smart micro-grid. Circular design building principles are applied to design truck stop accommodation and restaurants maximizing energy saving. Rainwater storage and swales are constructed to attenuate flooding and reuse for watering and site washing. Multiple sponge systems are proposed for the parking areas.

Difference: Shandong Green Development Fund (SGDF) works with the project sponsor and the service station vendors to green their supply chain, thus influencing their structures, energy use, recycling and resource re-use. SGDF works with interested vendors on employing new, energy saving technologies in their day-to-day operations. SGDF also works with the sponsor and interested vendors to provide educational information and signage to explain and educate patrons on energy efficiency.



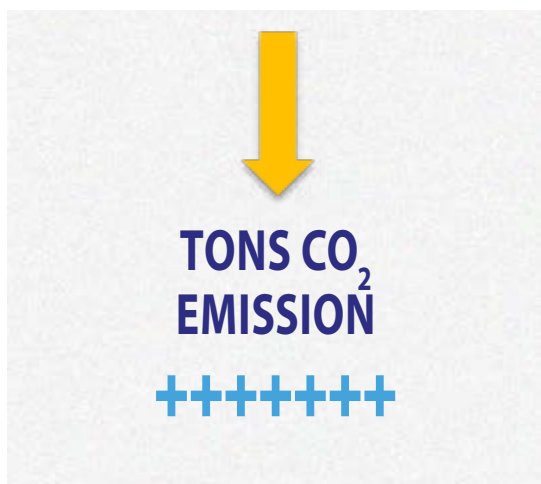
Project Sponsor: The Shandong High Speed Service Area Management Company (The Company) is the Project Sponsor. It was established in 2015 in Jinan under the Shandong High Speed Group. The Company operates service areas in Shandong, Henan, Sichuan, Yunnan and other provinces.

Cost: The total investment required is estimated at CNY1.19 billion (\$185 million) and under consideration for funding by SGDF.

Benefits: Use of renewable energy for power generation and EV charging bays reduces CO₂ emission by about 5.82 million tons over the Project's lifetime. A regenerative circular economy approach is applied to management, re-use and treatment of rainfall runoff, digestion of wastes, waste recycling and climate resilient design of accommodation and shopping areas.

Green Climate Fund Investment Criteria:

Transformational. The upgrade of 35 twin service areas in Shandong applies a combination of technologies and processes for a transformational circular design with an extensive use of different renewable energy sources from solar, wind and biomass cogeneration to reduce GHG emissions. The Company intends to expand its expressway service areas to other provinces based on its Shandong experience.



DISRUPTIVE “HYDROGEN VALLEY” LEADS THE CHARGE FOR URBAN MOBILITY

*Theme: Industrial
Transformation, Energy Storage, Coal
Substitution*

Background: Jinan Municipal Government (JMG) applies Shandong Provincial Government Policies of Low Carbon Development Action Plan (2017 – 2020) to develop a transformative business zone “Hydrogen Valley” covering the hydrogen energy value chain. Hydrogen Valley focuses on hydrogen development and production for a range of disruptive applications from fuel cells in bus transportation to industrial power and power storage.

Rationale: “Hydrogen Valley” is located in Jinan in the Energy Conservation Pilot Area in Jinan, as the catalysis for companies beyond research and development to develop an industrial supply chain based on hydrogen as a clean energy source for coal substitution.

Scope: Shandong Saikesaisi Hydrogen Energy Company Ltd (Saikesaisi) is a leading company for hydrogen development. Saikesaisi currently manufactures for export 6-12 m³/hour hydrogen generators and hydrogen power generation plant coolant. Saikesaisi is now constructing a 53 hectares manufacturing center in “Hydrogen Valley” with the support of the municipal and the provincial governments. With a first target to produce a 200 m³/hour hydrogen generator, Saikesaisi and JMG are developing a partnership with Jinan Public Bus Company to construct and operate 10 hydrogen charging stations with hydrogen fuel cells powered bus service. Saikesaisi requires funding to expand both its hydrogen generator production and hydrogen charging station construction.

Difference: While the current manufacturing method of hydrogen by pyrolysis requires substantial electric power (1,000 kWh to produce 200 m³ hydrogen), the introduction of hydrogen fuel cells for powering buses and trucks results in a major reduction in GHG emissions. Hydrogen fuel cells are also a potential solution for stranded solar and wind renewable energy production and energy storage.



Hydrogen production by pyrolysis, 1m³ of hydrogen from 1m³ of water , just add 5 kWh of electricity

Project Sponsor: Saikesaisi is affiliated to the Shandong Saikesaisi Group. Beginning in 1992 as a medical manufacturer, in 2008, Saikesaisi expanded to manufacturing hydrogen generators based on a patented PEM/SPE pyrolysis process.

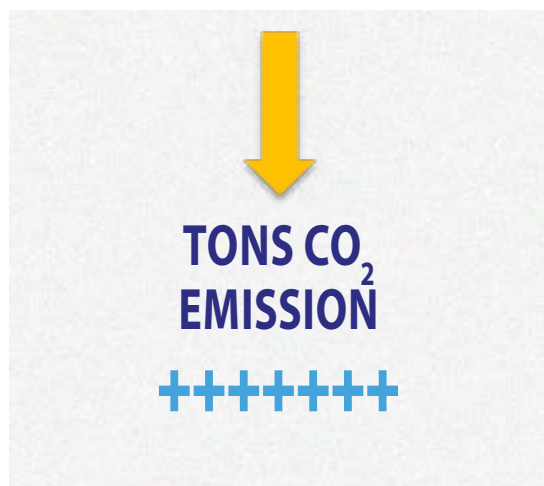
Cost: Confidential: Business plan under discussion.

Benefits: With increased production and availability of hydrogen in a safe and cost-effective manner, hydrogen for standby power and fuel cells for mobility results in coal substitution. The reduction in CO₂ emissions is being assessed and is likely highly substantial. With Jinan ranked top congested city in China, hydrogen fuel cells in use in public transport directly benefit the 7 million population in Jinan.

Green Climate Fund Investment Criteria: The increased production of hydrogen acts as a catalyst for hydrogen fuel cell development for mobility with conversion of bus fleets and trucks to zero emissions. With a short recharging time and 300-km range, the hydrogen powered buses and trucks provide an effective alternative to electric vehicles and traditional fossil-fuelled vehicles. Zero tailpipe emissions from the hydrogen buses greatly reduce GHG emissions.

TRAVEL TO THE FUTURE ON SHANDONG'S SMART SOLAR HIGHWAY

Theme: Renewable Energy, Mobility



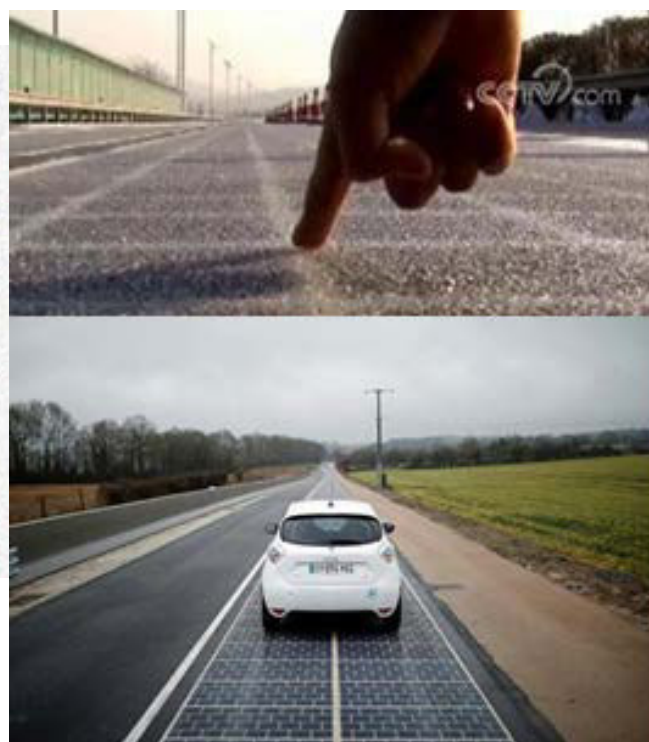
Background: Photovoltaic (PV) pavements also known as solar road is a promising technology incorporating specialized hand manufactured PV panels as surfaces on roads. The transformational technology is internationally piloted in Europe, Japan and in Shandong Province with a pilot 1 km stretch of solar road highway. Total installed capacity is 817 kW with electricity generated supplied directly to the National Grid. A second pilot solar road of 2 km is constructed in Shandong with various tests and analysis conducted before moving to industrial phase before 2020.

Rationale: This transformative and disruptive technology incorporates solar power generation with road construction to realize benefits of electricity generation and future wireless charging of electric vehicles, self-driving vehicles and a new information communication technology (ICT) smart-grid.

Scope: Funding is required to further expand, improve and reduce cost for PV pavement technology. Construction of PV pavement is currently hand made in three layers: transparent concrete on top, photovoltaic panels in the middle, and insulation at the bottom. Transformational technology for solar roads is beyond research and development and implementing trials and energy data analysis, operation and maintenance costs. The solar pavement is expensive at CNY3,000 (\$465) per m² with the key objectives to improve current construction techniques and reduce investment costs.

Difference: Shandong Green Development Fund (SGDF) works with the project sponsor to assist with the business plan and public support, green the supply chain, and expand the disruptive technology to reduce the coal reliance of the province and increase the percentage of clean primary renewable energy. SGDF also explores opportunities with the project sponsor for electric vehicle (EV) charging from solar roads to reduce grid energy at EV charging stations.

Project Sponsor: Qilu Transportation Development Group Company Limited, a provincial State-Owned Enterprise, is responsible for highway operation, maintenance and management as well as major highway construction projects on behalf of Shandong Provincial Government. The company serves as an investment and financing platform for key transportation projects in Shandong Province.

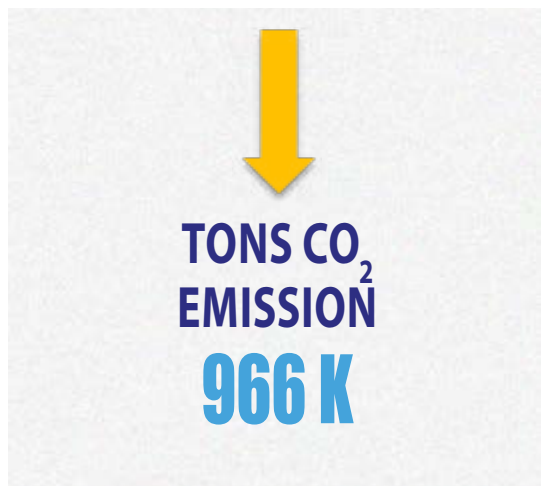


Cost: Confidential; Business Plan under preparation.

Benefits: The main obstacle to solar roads construction is the high cost. Benefits include generation of solar renewable energy, thereby reducing CO₂ emissions and coal substitution. Additional benefits include wireless charging of EV and self-driving vehicles. The quantity of CO₂ emission reduction arising from solar roads is being assessment during the ongoing trials in 2018 but likely substantial.

Green Climate Fund Investment Criteria:

Transformational. Mounting of solar panels on roads surface pavements combined with solar power generation is a transformational technology, that contributes to coal substitution and CO₂ emissions reducing, as well as revolutionizes EV charging, allows safe self-driving vehicles; provides local, off-grid power along the highway; and also provision continuous ICT access from new 5G/6G mobile telecommunication.



CLIMATE RESILIENCE TAKES OFF AT QINGDAO'S NEW INTERNATIONAL AIRPORT

Theme: Coal Substitution, Energy Efficiency

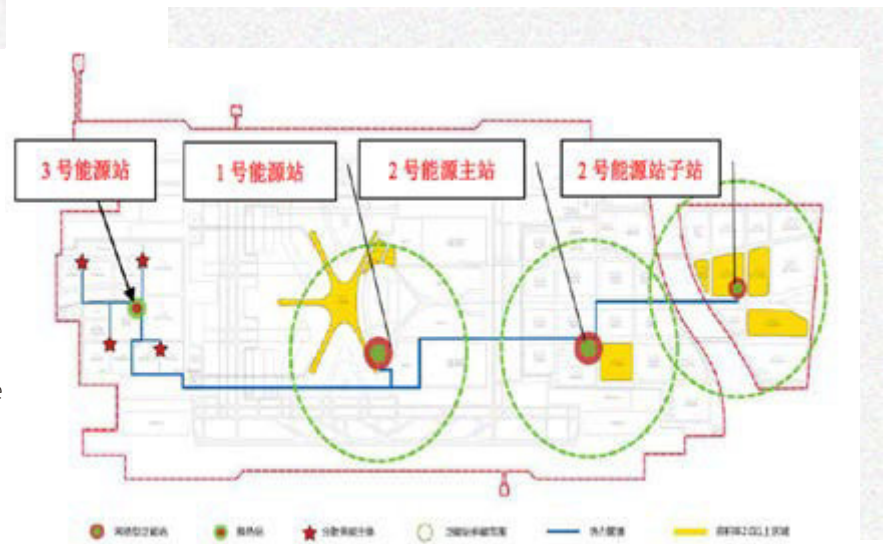
Background: Qingdao's new Jiaodong International Airport will host an estimated 35 million passengers annually by 2025. It is designed as multimodal transport hub integrating air, rail, subway, shuttle buses, and taxi etc. The Airport also desires to become more energy efficient and more climate resilient. To support the Shandong Low Carbon Development Action Plan (2017 – 2020), the Airport proposes to use two new renewable energy sources: geo-thermal and solar.

Rationale: By using renewable energy sources, the Airport contributes to doubling the percentage of new primary renewable energy sources in the Province by 2020 to 7%. With the Project, the Airport will only use power from the national grid in case of emergency electricity requirement.

Scope: The Project generates power for the Airport from interconnected power stations using geothermal and solar. The Airport and its facilities are powered, heated and cooled with an advanced, smart micro-grid managing the different energy inputs to achieve peak efficiency based on demand. Heating is increased by heat energy from the geothermal system.

Difference: Qingdao new International Airport's multiple energy sources controlled by an intelligent smart micro-grid achieves maximum efficiency for energy conversion. The inclusion of geothermal energy source for airport heating and power is a novel and disruptive way to reduce its carbon footprint while improving climate resilience.

Project Sponsor: Qingdao Internal Airport New Energy Development Co. Ltd. is the Project Sponsor. This company was established in 2016. The parent company Qingdao International Airport Group Company Ltd has interests in airport management and air-transportation in the country.



Cost: Under preparation for consideration by SGDF.

Benefits: The Project reduces CO₂ emissions by 38,642 tons annually, or 966,000 tons over the project's 25 years lifetime. Direct beneficiaries are the 35 million passengers anticipated to use the Airport by 2025.

Green Climate Fund Investment Criteria:

Transformational. The Airport intelligent energy grid coupled with electricity generated from various renewable energy sources represents a transformational project and a first for PRC. The Project supports the use of advanced technologies. The replacement of grid supplied power for the Airport's facilities and heating / cooling systems substitutes coal fueled generation and reduce GHG emissions.



**TONS CO₂
EMISSION
3,940 K**

SOLAR SMART-GRID FOR INCLUSIVE ACCESS TO INFORMATION COMMUNICATION TECHNOLOGY IN SHANDONG PROVINCE

*Theme: Coal Substitution
Inclusive*

Background: Shandong telecommunication towers, connected to the power grid, require daily electricity supply up to 150 kilowatt-hours (kWh) per tower for mobile 3G/4G. These towers are in open, sun-drenched locations and ideal for distributed solar power generation.

Rationale: By replacing 175 million kWh of grid-supplied power annually, the Project contributes to the decarbonization of Shandong and supports its Low Carbon Development Action Plan (2017-2020) to double the share of renewable energy by 2020. This Project also helps Shandong's CO₂ emission to peak around 2027, three years earlier than the national commitment under the Intended Nationally Determined Contribution (INDC).

Scope: Solar panels are installed on top of 23,148 telecommunication towers in Shandong. Each solar Smart-grid is integrated into the national power grid and supplies from 20 to 25 kWh per day to each tower, corresponding to about 15% of the total power to improve 4G expansion in the coming years. The capacity of each solar smart grid is 6.5 kilowatts (kW), comprising 18 solar panels rated 360 watts (W) each.

Difference: Shandong Green Development Fund (SGDF) works with the project sponsor to green the solar supply chain, influencing solar panels manufacturing in the People's Republic of China (PRC). The Project explores how to strengthen the towers and expand solar to tower mounted designs. The goal of 100% power supply with batteries from clean and renewable energy eliminates the costly and energy-intensive grid connection while reducing CO₂ emission in the Province.

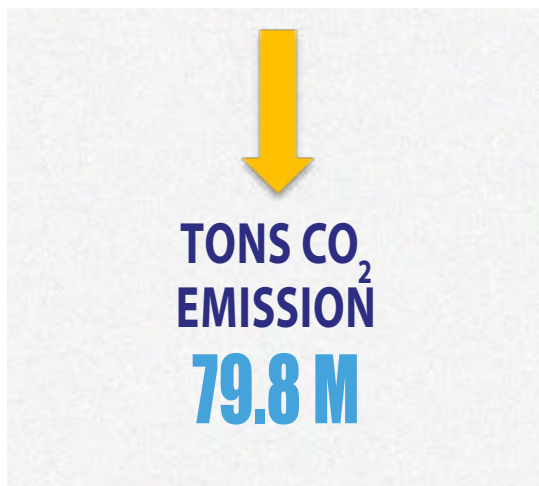
Project Sponsor: Linuo Power Group (Linuo) is a private company from Shandong, established in 1994. Solar energy represents 30% of the company's business. Linuo already signed agreements to supply solar generated power with China Tower Corporation (China Tower), which manages telecommunication towers in 70,000 towns throughout PRC.



Cost: The total investment cost for the 150 megawatts Solar Power Project is estimated to be CNY1.15 billion (\$183 million) under consideration for funding by the Shandong Green Development Fund. Under the Project, China Tower will pay Linuo CNY0.958 / kWh for 20 years, and the government solar subsidy to Linuo for the next 5 years will be CNY0.32 / kWh.

Benefits: The Project enables 52,500 tons of coal substitution annually and reduces CO₂ emissions by 3.94 million tons over the 25 years' lifetime of the Project. Direct beneficiaries are the millions of 3G/4G users in Shandong, China Tower which is trailblazing the adoption of transformational renewable energy strategies to reduce its greenhouse gases (GHG) emissions and Shandong Province, which mix of renewable energy increases to meet its targets.

Green Climate Fund Investment Criteria: Advanced. The replacement of grid-supplied power by renewable energy to power mobile 3G/4G telecommunication substitutes coal fueled generation and reduces GHG emissions. Based on the success of the pilot in Shandong, Linuo proposes to expand rooftop solar generation to Hebei and Liaoning Provinces and thus increasing the proportion of renewable energy used for telecommunication. The Project is inclusive and allows the development of mobile 3G/4G and information communication technology to locations with limited access to electricity.



LARGE SCALE BIOMASS DELIVERS DECARBONIZATION AND IMPROVES URBAN – RURAL LINKAGES IN SHANDONG PROVINCE

*Themes: Circular Economy
Coal Substitution*

Background: Shandong is China's agricultural champion: agricultural byproducts and animal production are considered waste, a potential source of soil degradation and greenhouse gases (GHG) emission.

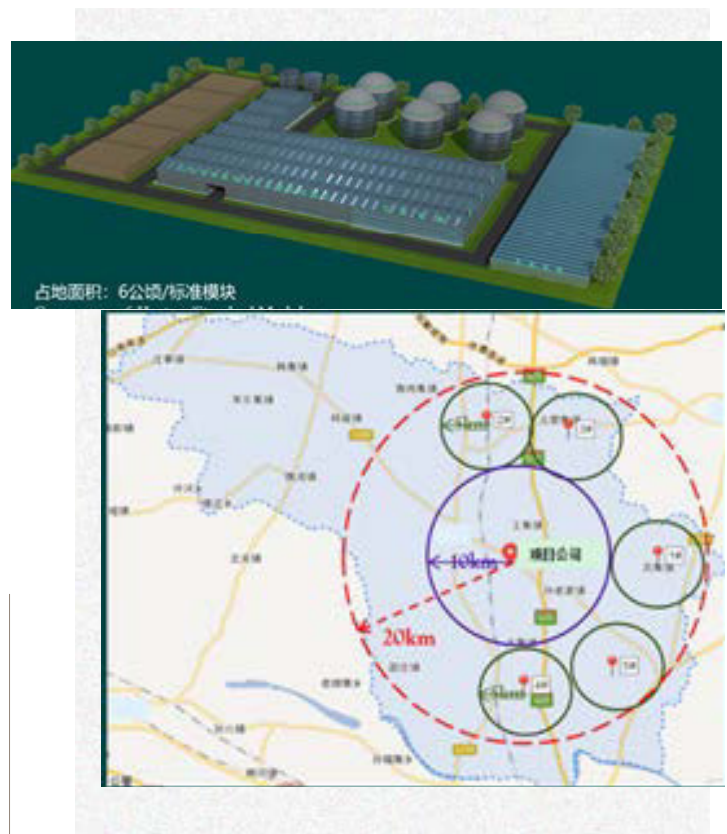
Rationale: The proposed Project constructs and operates agricultural and animal husbandry waste recycling facilities at three locations in Shandong. The Project treats agricultural waste in an environmental-friendly manner, reduce point source pollution and provide a high-value fertilizer for fruit and vegetable production while reducing GHG emission to support the Low Carbon Development Action Plan (2017 – 2020) of the Province.

Scope: The Project uses anaerobic digestion of wastes to generate electricity and produce fertilizer in Qingzhou, Gaomi and Caoxin Counties. The digesters and associated dewatering units are located within the same land parcel. Each facility comprises two modules which supports 20,000 ha of farmland and two crops of straw. Waste processing comprises digestion, biogas cogeneration, biogas conversion to fertilizer.

Difference: Shandong Green Development Fund (SGDF) works with the project sponsor to maximize the gas capture as well as the conversion to energy. At the same time, SGDF provides technical expertise to maximize the resulting organic fertilizer potential and work with the end user on proper application, no-till farming techniques and run-off prevention strategies.

Project Sponsor: Shandong Elon Energy Company Limited (Elon Energy) was incorporated in 2017. It is a subsidiary of Shandong Elon Environmental Protection Co., Ltd, a private company mainly involved in water, energy, fertilizer and agribusiness.

Cost: The total investment required for the implementation of the three proposed biomass plants is estimated to be CNY1.64 billion (\$255 million) and under consideration for SGDF funding.



Benefits: The biomass to energy generates up to 140 million kWh of electricity per year from each of the three installations, reducing reliance on coal and providing a clean product. The Project generates local employment and increases household income by more than CNY16 million annually through straw acquisition and peripheral services. Direct beneficiaries at the three locations of Qingzhou, Gaomi and Caoxin total 11,475 people temporary and long-term employed. The Project's three biomass plants saves 126,400 tons of coal annually, or 79.8 million tons of CO₂ emission over the Project's lifetime.

Green Climate Fund Investment Criteria: Advanced.

The three county level biomass facilities in Shandong applies advanced circular design principles to gain greater value from the biomass resulting from anaerobic digestion of straw and animal wastes. Biogas produced is used for power generation at a cogeneration facility and the dehydrated digestion residue is a high-value organic fertilizer. Some of the electricity generated is used to maintain the digestion process and power the plant.

↓
**TONS CO₂
EMISSION**
1.85 M

INCLUSIVE SOLAR POWER PLUS GREENHOUSE AGRICULTURE

*Theme: Coal Substitution, Inclusive,
Food Security*



Background: Whilst solar power generation becomes an increasingly attractive alternative to coal, a great deal of land is needed to scale up generation. In Shandong Province, the country's top agriculture producer, where farmland is valuable to local livelihoods, the combined uses of farming and renewable energy generation creates a win-win situation for vulnerable farmers and the environment while solar improving Food Security and reducing GHG.

Rationale: 20 counties from four poorest municipalities in Shandong—Heze, Linyi, Liaocheng and Tai'an—are identified by Shandong Provincial Government to receive poverty alleviation assistance. Various actions are taken to improve living conditions in villages including installation of photovoltaic (PV) rural power projects, PV greenhouses, and provision of PV power to schools and small industry.

Scope: To establish development projects in rural areas that have good economic and social benefits while reducing the carbon footprint and CO₂ emissions. PV greenhouses, primary processing of multi-plot fresh vegetables and fruits, edible fungi, tea and nursery stock, manufacture of sauces and customized products for export, PV village electricity supply and logistics distribution are project examples to be funded targeted at the vulnerable population. Specific examples include construction of 260 PV greenhouses and 1 MW PV solar village producing 3,300 kWh/day. Solar panels on greenhouses provide energy to the national grid, but also contribute to the growing agricultural products in a green symbiosis.

Difference: Shandong Green Development Fund (SGDF) works with the project sponsor to green enterprise supply chains, maximize enterprise use of renewable energy and explore other opportunities for CO₂ reduction on the village level, such as use of high efficiency stoves with renewable fuel. The goal for each village is to achieve 100% renewable energy, including PV, wind power and renewable resources. When combined with emergency storage capabilities, such as batteries, the villages operate independently from the national grid and do not rely on diesel generators.

Project Sponsor: Shandong Silk Road East Solar Power and Agriculture Development (Silk Road East) is joint venture between Shandong Silk Road Investment Development Co., Ltd, a subsidiary of Shandong Development Investment Holding Group, and Qingdao New Energy Solution Inc, a leading provider for integrated solar solution. Silk Road East is implementing the provincial government's policy of poverty alleviation through innovative cooperative enterprises and climate resilient interventions to improve situation of poor farmers and reduce CO₂ emissions.

Cost: Not available; feasibility study under preparation.

Benefits: The Project is expected to reduce CO₂ emissions by 1.85 million tons over 25 years. Direct beneficiaries are millions of rural poor in 20 counties in southern Shandong who will enjoy higher living standards, enhanced agricultural production from PV greenhouses, more affordable residential power, and income generation opportunities from tourism.

Green Climate Fund Investment Criteria: Advanced.

Replacement of grid supplied power by a renewable energy sources substitutes coal fueled generation and reduce GHG emissions. The project is Inclusive targeting the vulnerable and poor, allowing for both rural income generation opportunities and the expansion of renewable, affordable power supply to poor locations with limited access to electricity.

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**TONS CO₂
EMISSION**

BASE ON MARKET

ENERGY EFFICIENCY BOILS DOWN TO HEAT RURAL POOR IN SHANDONG

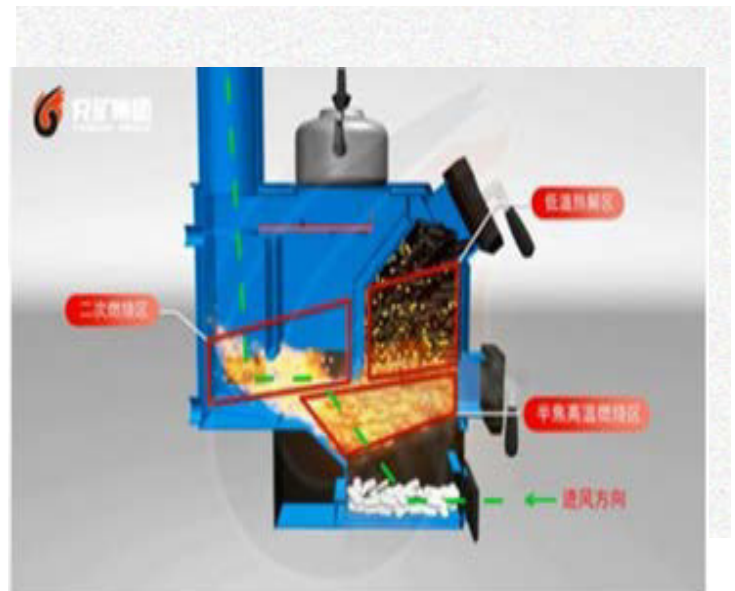
*Theme: Industrial
Transformation, Energy
Efficiency*

Background: Coal burning is the dominant force of CO₂ emission in rural areas due to low-efficiency stoves, self-made heating facilities in rural areas.

Rationale: Most rural houses in Shandong use inefficient stoves and boilers for heating and cooking. Promoting higher efficient stoves and boilers saves 2.5 million tons per year of standard coal. The market for commercial heating stoves in the PRC is about 120 million units, of which only 23% are energy-saving stoves. At the same time, more than 10 million heating stoves need replacement each year. With an average stove life of up 8 years, the Project targets 100% energy efficient stoves within 10 years in Shandong supporting the Low Carbon Development Policies of the government.

Scope: The Project supports the manufacturing of 3 types of high efficiency and cost-effective stoves based on the latest research and affordable for the rural dwellers, schools and industries. The Project uses advanced robotics in manufacturing for high and consistent quality product. The design focuses on 10 kW household stove with combustion efficiencies greater than 75% and at least 30% CO₂ emission reduction. The Project also includes the construction of a clean fuel pellet factory to support the increase in efficiency for the improved combustion chamber. The new stove costs approximately CNY1,500 (\$233), which is more than offset by the increased efficiency over the 7 to 8 years stove life. A medium size boiler rated at 350 kW specially designed for schools and farms heats a larger area of 5,000 to 10,000 m². The boiler uses a catalyst to improve combustion, achieving 85% efficiency while reducing GHG emissions. A larger boiler targets industrial user with high efficiency and CO₂ emission reduction.

Difference: Shandong Green Development Fund (SGDF) works with the project sponsor to green the stove equipment manufacture supply chain and the construction of the clean fuel pellet factory. The improved stove designs together with the clean burning fuel pellets significantly reduces GHG emissions and save fuel costs.



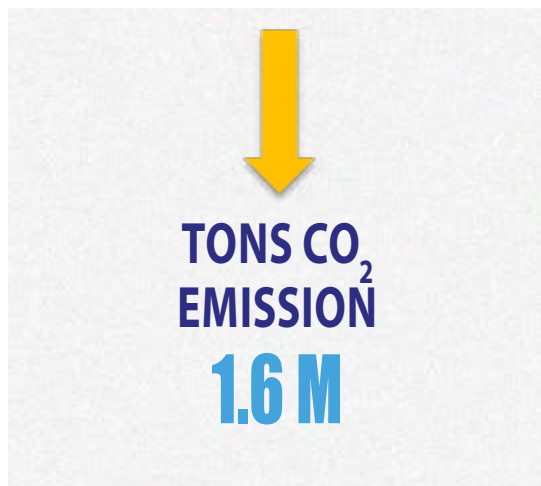
Project Sponsor: The project sponsor is Yankuang Group Company Ltd, a state-owned energy company, established in 1999. By 2017, total assets were CNY275 billion, with 94,000 registered employees. It has four domestic and overseas listed platforms.

Cost: The total project investment is CNY448 million (\$70 million), including equipment for the stove factory component of CNY137 million (\$21 million) and the clean fuel pellet factory of CNY311 million (\$49 million).

Benefits: The Project improves stove efficiency and reduces fuel costs, therefore reducing CO₂ emissions and improving air quality. Reduction of CO₂ emission is likely substantial and based on ongoing market surveys.

Green Climate Fund Investment Criteria:

Advanced. The design and manufacture of improved designs of small, medium and industrial sized boilers result in improved efficiency of combustion, improved heating and therefore reduced GHG emissions. The promotion and use of fuel pellets improves fuel quality, allowing higher combustion temperature and less emissions. Advanced automation results in industrial transformation for the manufacturing of stoves and boilers. The Project is Inclusive allowing improved heating solutions at lower cost in rural areas for the most vulnerable.



Background: Energy saving measures in construction processes are currently under exploited. There is a lack of comprehensive energy and resource saving in the entire building supply chain. Traditional concrete construction methods are highly energy intensive, requiring scaffolding and formwork; fixing steel reinforcement; manufacturing liquid concrete off site and transported over long distances with diesel trucks; pumping and mixing liquid concrete up to 10 storeys high; labor intensive wall plastering; and considerable on-site construction waste.

Rationale: Adoption of pre-fabricated and pre-cast building processes leads to substantial improvement and efficiency of resource and energy utilization, energy conservation and CO₂ emission reduction. Thin pre-cast concrete panels manufactured under factory-controlled conditions, reduce cement use, as well as limestone, coal, oil, natural gas and electricity consumption. Construction time, building erection and final corrections are fast tracked. Labor requirements and thus costs and energy are reduced driving CO₂ reduction emission and increasing climate resilience.

Scope: The Project supports additional production capacity for pre-casts solutions in Shandong, so that the provincial government can increase the ratio of pre-fabricated buildings currently at 50% (Shanghai is 100%). Pre-cast solutions are designed in a foam/concrete sandwich, safe heat-insulating outer wall panels, thin pre-stressed concrete laminated floors, stairs, balconies and air conditioning panels. The pre-fabrication process typically contributes to 80% of the total concrete use in a building with an overall energy savings rate over 65%. The pre-cast components are steam cured with strict water conservancy measures. On-site lifting uses renewable electric energy, as opposed to diesel powered for conventional construction methods. Production quantity of pre-cast components under the Project increases to 1 million m² per year

PRE-CAST SOLUTIONS BUILDING CLIMATE RESILIENCE IN SHANDONG

*Theme- Industrial
Transformation, Energy
Efficiency, Decarbonization,*

Difference: Shandong Green Development Fund (SGDF) works with the project sponsor to green the pre-fabricated supply chain and make the pre-cast products more climate resilient. The Project explores the possibilities of further reducing energy inputs during construction, such as more efficient use of energy, expanding use of renewable energy, water savings, improving employee productivity, reducing waste, and environmental degradation.

Project Sponsor: Shandong Onestar Construction Technology Company Ltd. (Oonestar) is a private company headquartered in Jinan. Onestar has 10 years of experiences in the design and development of pre-fabricated building systems and their manufacturing processes, construction technology, industrialized production and sales of various pre-fabricated components, precast construction and prefabricated building technology services with various patents.

Cost: Total investment required is CNY470 million (\$73 million).

Benefits: The Project reduces 1.66 MT CO₂eq emission over 25 years.

Green Climate Fund Investment Criteria:

Advanced. Expansion of existing prefabricated precast concrete panels in tower building construction reduces use of steel, concrete and energy which substitutes coal fuelled generation and reduces GHG emissions. Product consistency and resiliency is also increased. Company proposes to expand production beyond Qingdao to Beijing/Hebei border, Tianjin, Shanghai and Chongqing.



QINGDAO GOING E BUS BRT ALL THE WAY

*Theme: Coal Substitution, Urban
Mobility*



**TONS CO₂
EMISSION**
1,748 K

Background: With an urban population of 10 million, Qingdao is served by 6,000 diesel and gas buses operated by three public bus companies. Qingdao Municipal Government's drive to lower GHG emissions includes replacing their fleet with new electric and efficient buses.

Rationale: The Project replaces 6,000 old fossil fuel powered buses with 5,000 new electric and efficient buses. In parallel, new routes for Bus Rapid Transit (BRT) are created to improve urban mobility and promote a shift from private to public transport. The investment complies with Shandong Low Carbon Development Action Plan (2017 -2020) by saving 219,000 m³ of fossil fuel annually and contributing to Qingdao's early CO₂ peaking around 2020.

Scope: The existing bus fleet is gradually replaced with electric (E) buses over 5 years at the rate of roughly 1,000 E buses per year. The existing bus routes are optimized as E buses are introduced. Concurrent with the deployment of E buses, Qingdao introduces a BRT management system and operation and maintenance program to prolong the E buses life and reliability. These programs also decrease energy and resource use.

Difference: SGDF works with the project sponsor to install innovative E bus rapid electric charging systems that charge the E buses between stops, thus reducing bus down time and increasing efficiency. E Bus stations also are gathering places and SGDF works with Qingdao on providing parking and charging bays for e-bikes as well as exploring services that can be provided at the stations. SGDF also works with the bus companies on how to increase the amount of renewable energy they purchase. This may include renewable options purchased by the companies, offset by passenger surcharges or vendor payments on collateral real estate. Other options including actual renewable investments are being explored.



Project Sponsor: The project sponsor is under consideration for SGDF funding. Both the Qingdao Development and Reform Commission and the Qingdao Transportation Committee are developing the budget required for replacement of the existing buses.

Cost: The total investment required for the replacement of the existing bus fleet in Qingdao urban area is estimated to be CNY4 – 5 billion (\$600 - 800 million).

Benefits: The Project saves 219,000 m³ of fossil fuel consumption annually and reduces the emissions from 5,000 buses by 1.747 million tons over a 12-year period. Further reductions are possible if the mix of grid energy is influenced. Direct beneficiaries are the millions of citizens living in Qingdao urban area using public transport. The three public bus service companies are required to comply with the national and provincial renewable energy strategies to reduce GHG emissions.

Green Climate Fund Investment Criteria:

Advanced. The replacement over 12 years of 6,000 fossil fuel powered public buses by 5000 E buses in Qingdao reduces GHG emissions to become a showcase for other cities in Shandong province and in PRC to follow.