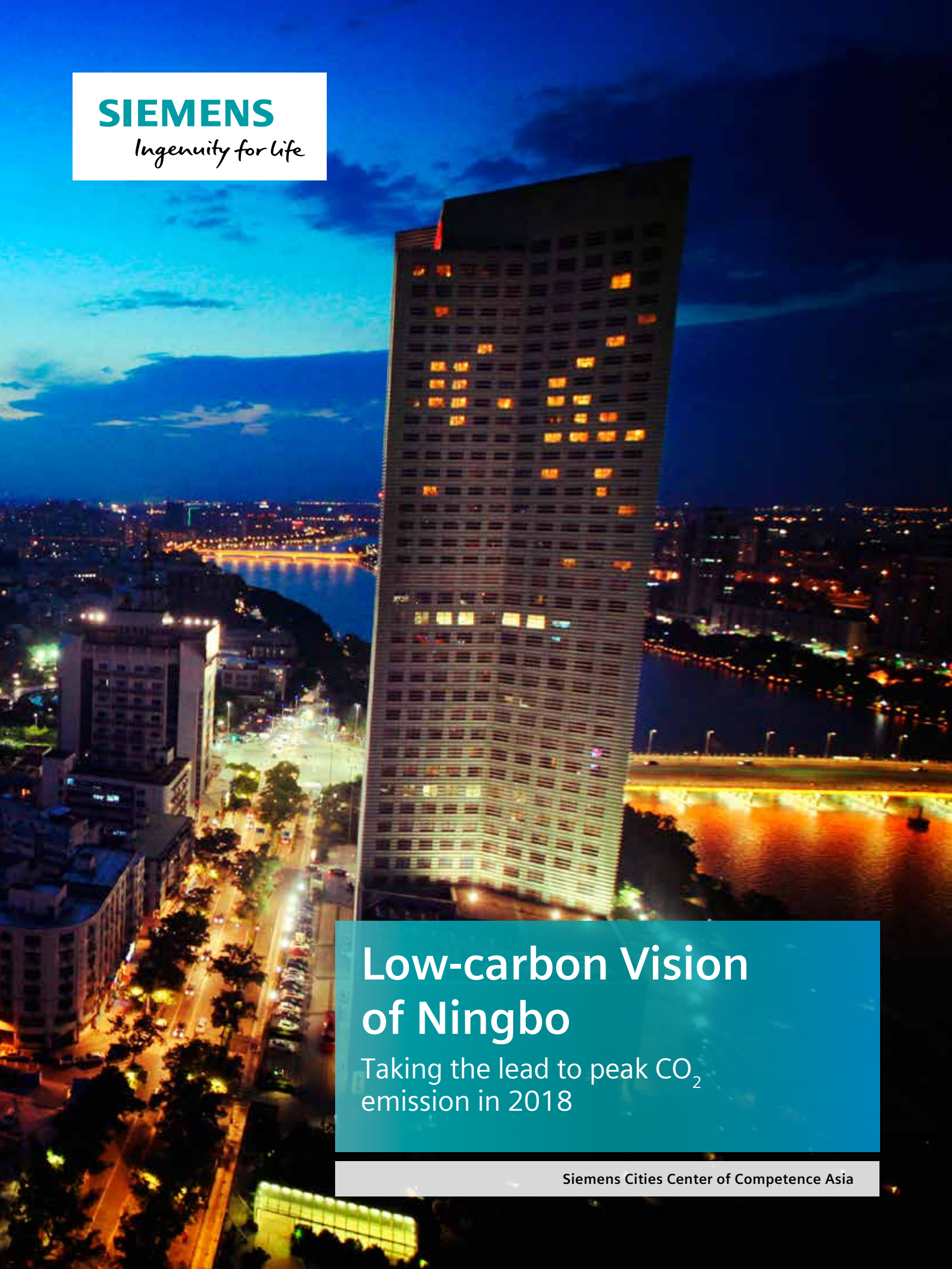
SIEMENS

Ingenuity for life



Low-carbon Vision of Ningbo

Taking the lead to peak CO_2 emission in 2018

Siemens Cities Center of Competence Asia

"Low-carbon Vision of Ningbo" – Taking the lead to peak CO_2 emission in 2018

Fully executing "Low-carbon Pilot City Implementation Plan" and enhancing the application of technology levers in green infrastructure during 13th Five Year plan, Ningbo is capable of taking the lead in peaking CO_2 emission in 2018 and reserves adequate space for industrial and economic development.

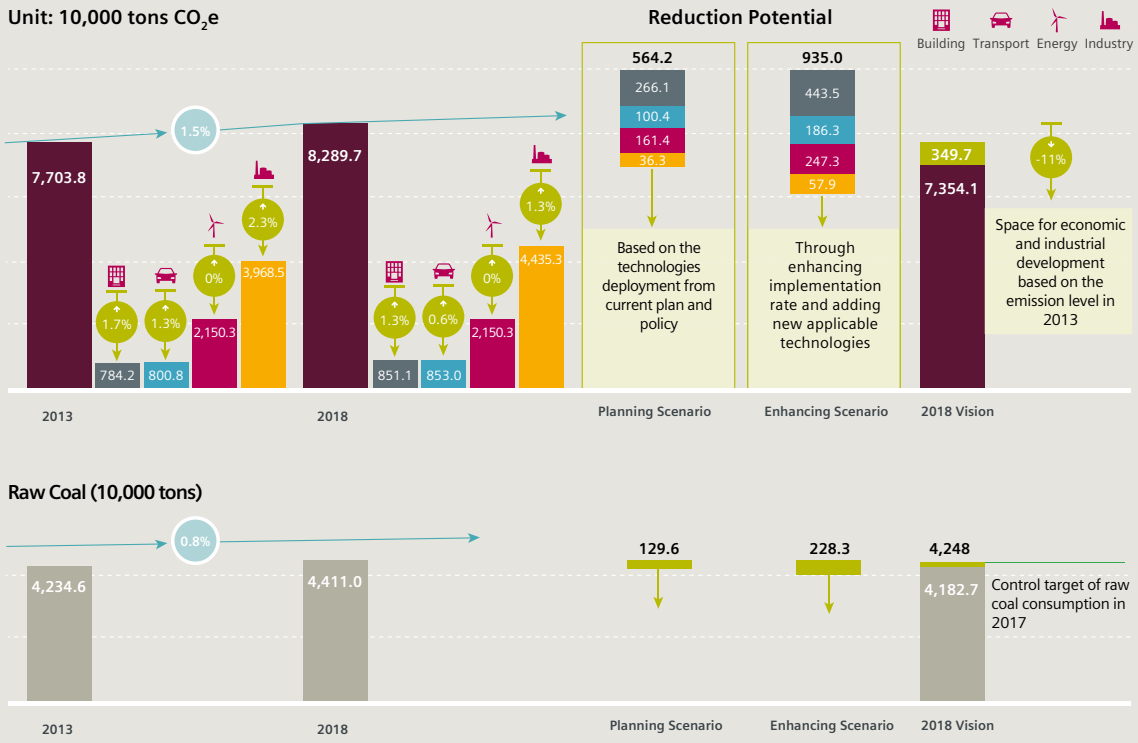


Figure 1: Low-carbon Vision of Ningbo

Action Plan

- **Industry:** Without compromising economic development and employment, increase energy efficiency for key industrial players. By incorporating the concept of"Industry 4.0", promote industry transformation and upgrading.
- **Energy:** Further encourage the use of clean and distributed energy, such as Combined Cycle Gas Turbine and CCHP. Enhance energy retrofitting for coal-fired power plants and promote smart grid application in district level.
- **Building:** Fully implementing both passive building and intelligent building automation technologies, strictly control the energy consumption quota of large-scale public and commercial buildings. Promote performance optimization for existing buildings.
- **Transport:** Continue to execute the Rail Transit plan of Ningbo (Line 3, 4 and Yinzhou Tramline etc.). Encourage the application of E-vehicles, such as E-bus, E-taxi and E-car sharing. Promote Intermodal Traffic Management and ITMS.

Background

Considering future economic development and transformation, population growth, progress in technology deployment and changes in consuming-style, it is predicted that the GHG emission in Ningbo will keep increasing but the growth rate will be slow down. Even though, 82.9 million tons GHG emission will be emitted from the city in 2018, which is about 10% higher than its emission level in 2013 and brought tough challenges to the city in meeting its target of peaking GHG emission by 2018.

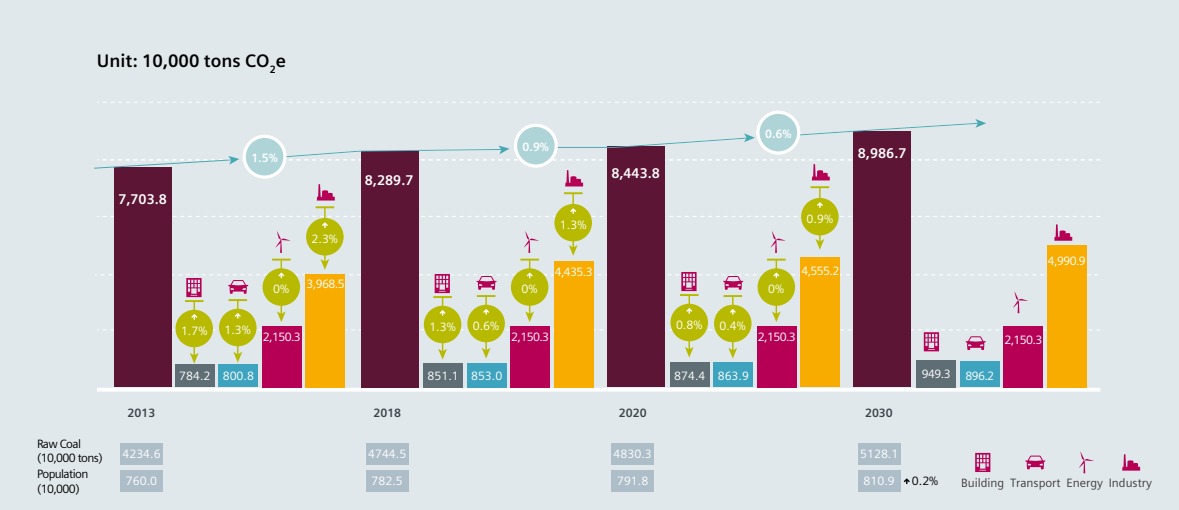
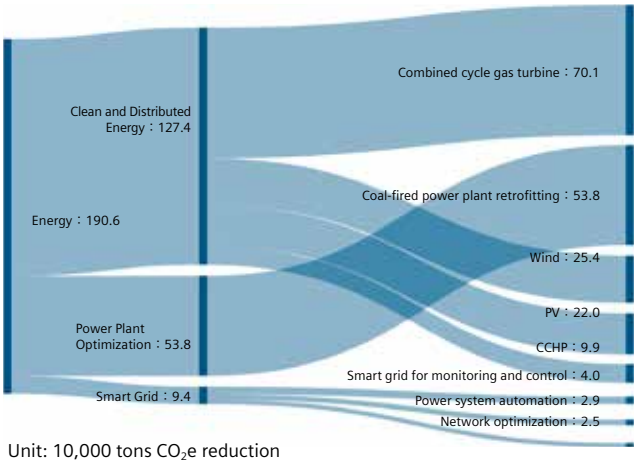


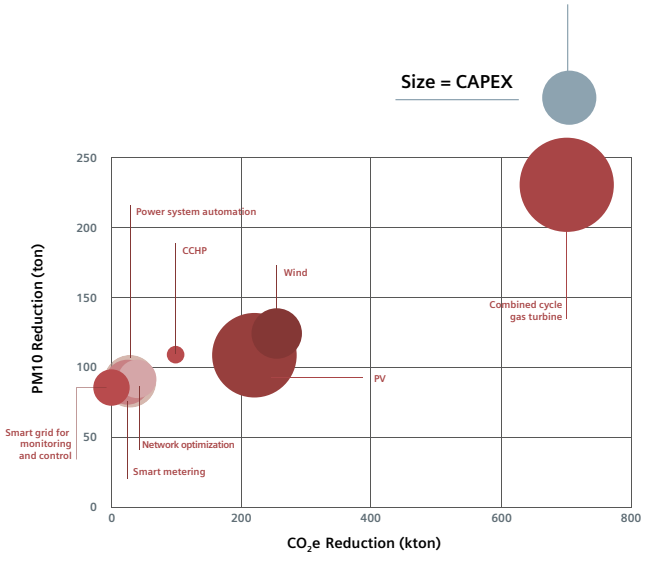
Figure 2: Forecast of GHG emission in BaU scenario

Key Findings

Energy

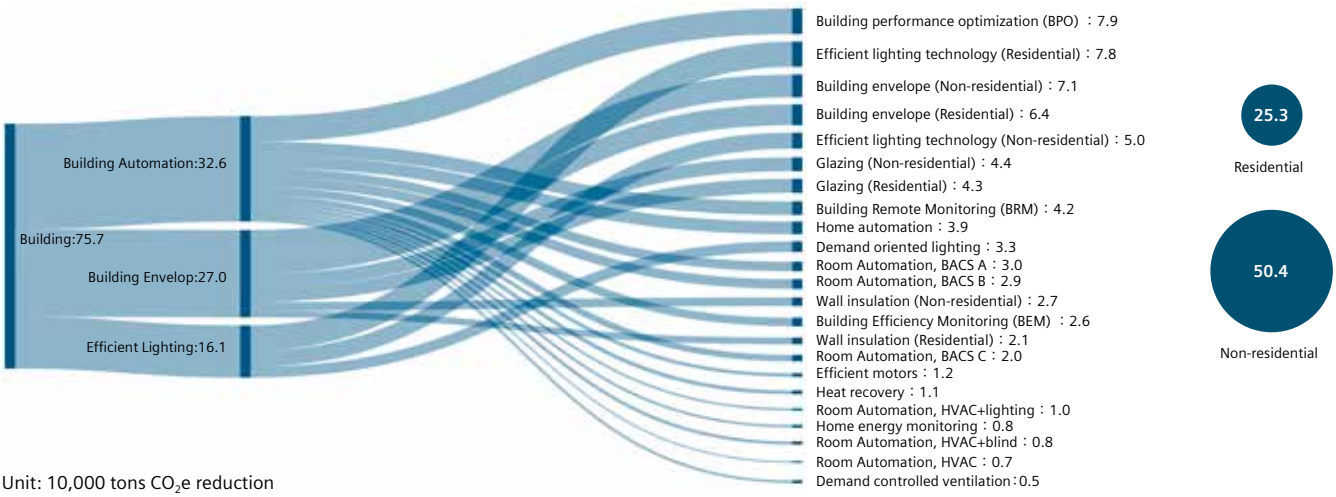


Unit: 10,000 tons CO_2e reduction

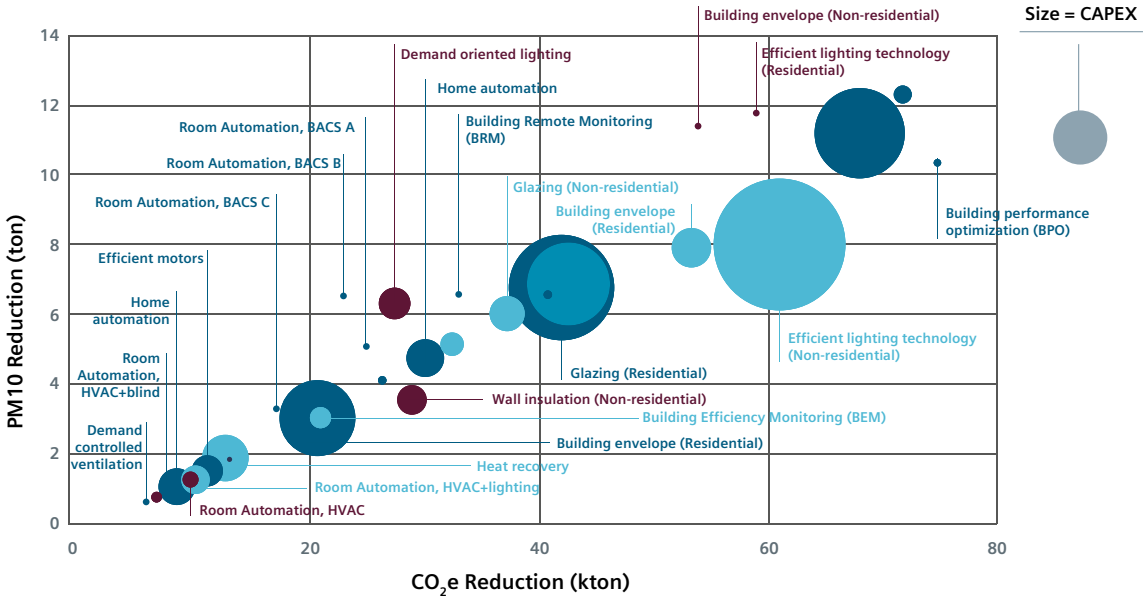


Clean and distributed energy has the most significant impact in GHG emission reduction, such as **Combined Cycle Gas Turbine, PV, Wind** and **CCHP**. Considering the cost and saving potential, CCHP will be the most effective technical lever. Due to the current large setup of coal-fired power plant, it will also be important to increase the efficiency and reduce the consumption of raw coal through **coal-fired power plant retrofitting**.

Building

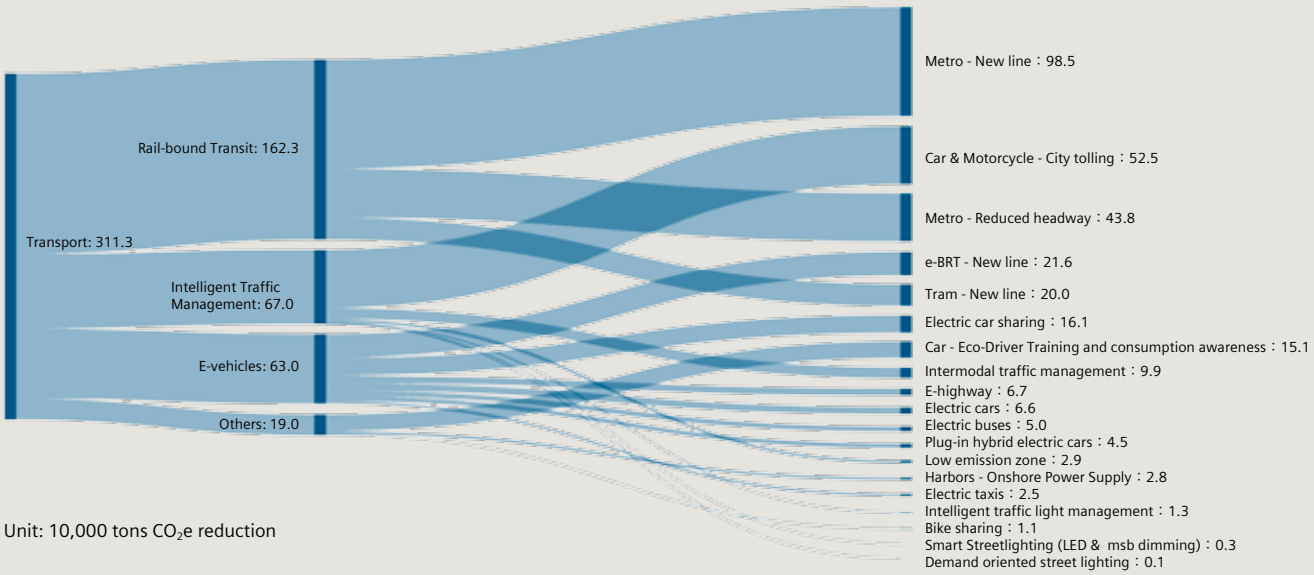


Unit: 10,000 tons CO_2e reduction

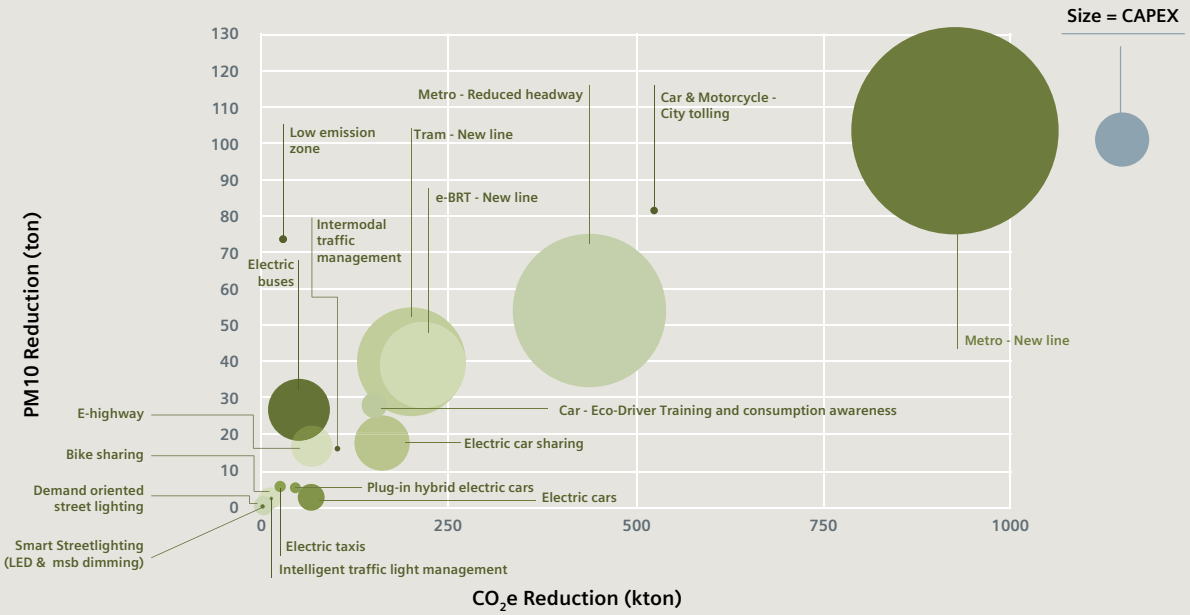


Public and commercial building provides almost twice the contribution in GHG emission reduction than residential building. **Building performance optimization, efficient lighting** and **building envelop** are the top performers in building sector. Looking at the overall performance, technologies from intelligent building automation will bring more CO2 saving potential with limited investment, such as building performance monitoring, BACS etc.

Transport

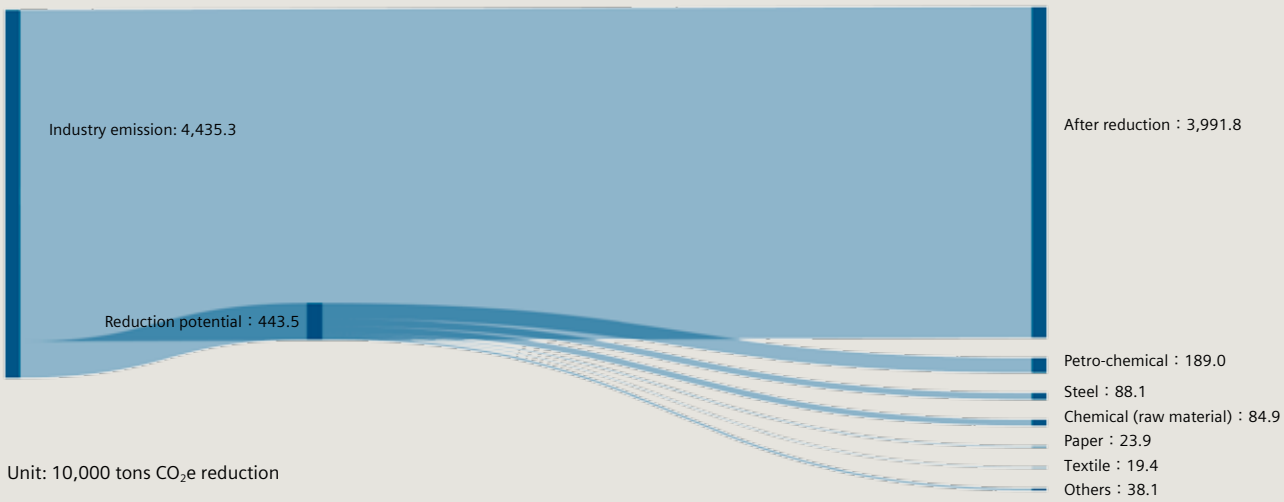


Unit: 10,000 tons CO_2e reduction



The most significant impact in GHG emission reduction comes from rail-bound transit, such as **new metro lines, reduced headway** and **new tram lines**. City tolling, E-BRT and E-car sharing also provides considerable savings in GHG emission. Considering the cost, technologies from intelligent traffic management are more effective, such as **intermodal traffic management, intelligent traffic light control, city tolling** etc.

Industry



Focusing on the key industry categories (top 5) in Ningbo, such as petro-chemical, steel, chemical (raw materials), paper and textile, it will be possible to achieve 10% energy saving by applying the following technical levers:

- Optimization of local heating and power supply
- Energy recovery
- Process automation and optimization
- Enhance production integration

Economics

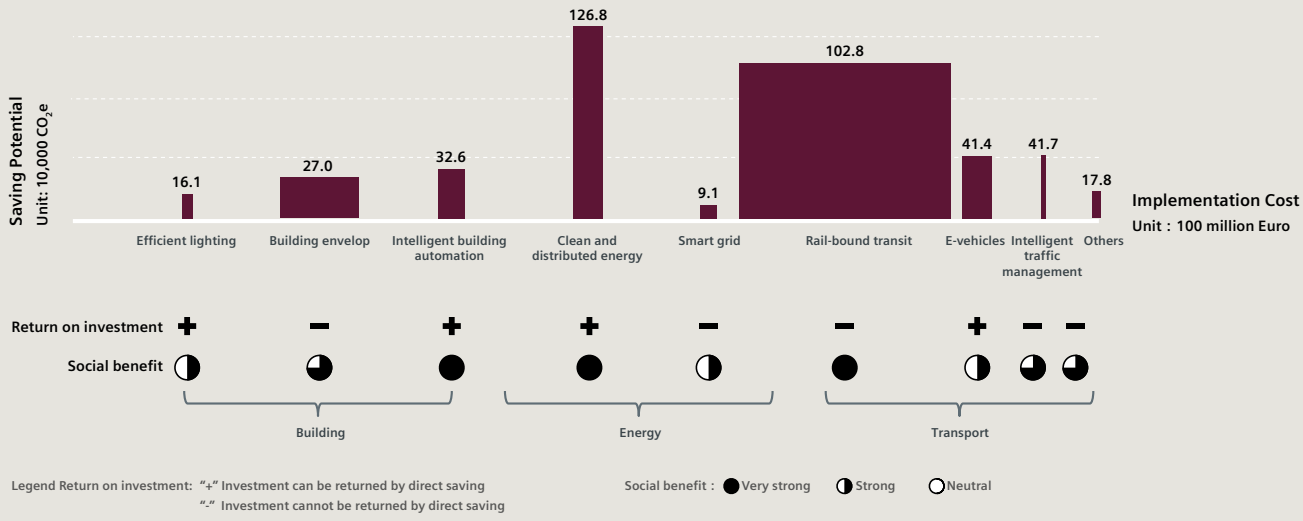


Figure 3: Economic analysis of technical levers

Implementation Rate

Technical levers	Implementation rate 2018	
Combined cycle gas turbine	20%	20 % of electricity will be generated from Combined Cycle gas Turbine Capacity of CHP, Wind and PV will be 200MW, 700MW and 550MW.
CHP	3%	
Wind	3%	
PV	2%	
Network optimization	70% of grid	
Smart Grid for monitoring and control	70% of grid	
Power System Automation	70% of user	
Residential - Wall insulation	2% stock/year	All new residential building (7,000,000 m^2 per year) will meet the basic green building requirements of building envelop and efficient lighting. All new public and commercial building (4,000,000 m^2 per year) will meet the basic green building standard (1 star), of which 30% will achieve at least 2 star local green building standard. 800,000 m^2 public and commercial building will be upgraded and retrofitted every year, to achieve higher level of energy efficiency.
Residential - Glazing	2% stock/year	
Residential - Efficient lighting	2% stock/year	
Non-Residential - Wall insulation	2% stock/year	
Non-Residential - Glazing	2% stock/year	
Non-Residential - Efficient lighting	2% stock/year	
Non-Residential - Demand oriented lighting	2% stock/year	
Non-Residential - Building Efficiency Monitoring (BEM)	2% stock/year	
Non-Residential - Building Performance Optimization (BPO)	2% stock/year	
Non-Residential - Demand controlled ventilation	2% stock/year	
Non-Residential - Heat recovery	2% stock/year	
Residential - Home Energy Monitoring	1% stock/year	
Residential - Home Automation	1% stock/year	
Residential - Building Envelope	2% stock/year	
Non-Residential - Building Envelope	2% stock/year	
Non-Residential - Room Automation, BACS C	1% stock/year	
Non-Residential - Room Automation, BACS B	0.6% stock/year	
Non-Residential - Room Automation, BACS A	0.4% stock/year	
Non-Residential - Efficient Motors	2% stock/year	

Technical levers	Implementation rate 2018	
Non-Residential - Room Automation, HVAC	1% stock/year	
Non-Residential - Room Automation, HVAC+lighting	0.6% stock/year	
Non-Residential - Room Automation, HVAC+lighting+blind	0.4% stock/year	
Non-Residential - Building Remote Monitoring (BRM)	2% stock/year	
Metro - new line	3 lines	3 new metro lines will be implemented by 2018. Headway during peak time will be further reduced to 180s. 1,000 new E-buses and 1,000 E-taxies will be applied. 5,000 E-cars will be applied for city wide E-car sharing program. Promote ITMS and intermodal traffic management.
Hybrid electric buses	15% replacement	
Electric taxis	15% replacement	
Bike sharing	5 / 1000	
Tram - New line	1 lines	
Automated train operation (ATO) Metro	100%	
Intelligent traffic light management	80%	
Intermodal traffic management	40% of user	
LED Street lighting	40% replacement	
E-highway	15% of highway	
Demand oriented street lighting	30%	
Electric car sharing	1.5 / 1000	
Electric cars	5%	
Plug-in hybrid electric cars	5%	
e-BRT (Bus Rapid Transit) - New line	2 lines	
Car - Eco-Driver Training and consumption awareness	40%	
Metro - Reduced headway	180 seconds	
Car & Motorcycle - City tolling	20% reduction of traffic	
Lorries/Trucks - Low emission zone	Euro 4	
Smart Streetlighting (LED & msb dimming)	30%	
Harbors - Onshore Power Supply	30%	

Introducing CyPT

The City Performance Tool is a dynamic simulation tool which studies a series of more than 70 technologies from Building, Transport and Energy Technologies – at different time periods and implementation rates. It is designed to reduce the environmental impact of everyday activities in your city. It covers GHG emission from buildings and transport, as well as air pollutants such as particulate matter (PM) and nitrogen oxides (NOx). The model is based on life cycle assessment methodology and builds upon Siemens' technology expertise and global databases of deep vertical process knowledge, calculates the environmental and economic impacts of individual technologies at different implementation levels.

Ningbo

Geographical Area

9816 km²

Population

7.8 million

Energy (% of Electricity Mix)

Hardcoal	**72.6%**
Hydro	**22.2%**
Nuclear	**3.7%**
Wind	**1.5%**

Buildings (Area Per Capita)

32.9
(m²/person)
Residential

8
(m²/person)
Non-residential

Passenger Kilometer

20.1
(KM/person/day)

Xu Li

Business Developer, Cities Center of Competence Asia

Tel: +86 (0) 21 38892046

Email: xu_li@siemens.com

www.siemens.com