



Small Pacific islands and low-lying countries like Bangladesh will be among the first affected by rising global temperatures.

How important is technology in metropolitan solutions?

G. Van Begin: Technology is absolutely essential. But I get the impression that cities don't want to hear companies talk about their technical solutions anymore. Problems are no longer singular. They're multifaceted. The mayor of Dar-es-Salaam, for instance, was reelected on his record of building infrastructure such as hospitals and roads. But the population there may have tripled during the time he was in office. So even with new roads, the city is still just as congested. It is my aim to see companies anticipate these trends and offer not just technology but solutions, and even capacity-building. In the end, cities are demanding industry best practices.

Creativity is surely a big part of it.

G. Van Begin: Definitely. For mobility, one good idea I've seen is to use cable cars as mass transit for informal settlements. In Bogotá, Colombia, for instance, people live in the hills, and these people need to get to the city. In Copenhagen, one out of two commuters cycles to work. Since the cycling paths are congested, Copenhagen is trying to get employers to allow people to work at different times and to provide showers at work. To build a cycling path is not

the creative part anymore. The innovation is in taking it one step further, as Copenhagen did, and working with employers to change behavior. I've also seen great ideas in urban agriculture that cut down on food transportation, such as seafood farming in large vertical basins in a building.

What keeps you up at night, Mr. Van Begin?

G. Van Begin: When I look at the map, I see that some cities just won't exist anymore as the global temperature rises, glaciers melt, and sea levels rise. Some cities will sink underwater. This requires a whole new way of thinking and planning. Imagine that we had to relocate Bonn to another place. How do you plan and execute that?

Which areas will be affected first?

G. Van Begin: The small islands of this world and low-lying countries like Bangladesh. First comes flooding, then problems with drinking water. And on it goes. There's also the problem of the build-up and release of methane gas from thawing permafrost in the Arctic. That is very dangerous; if the methane is released, it will be as if we had done nothing at all about global warming. Cities are trying to get a head start, particularly by creating a green

infrastructure. Some cities will need more trees to provide shade when temperatures rise. This is a much better alternative to air-conditioning. Others will need to deal with flooding, perhaps by building water squares, which are plazas that can be used for collecting heavy runoff.

These are situations no one wants to face.

G. Van Begin: That's right, but those scenarios are not science fiction. There's no time to waste. In developing countries and emerging economies, it's incredible to see how fast cities grow. Today, some 3.5 billion people live in urban areas. That's half of the world population. They'll be having children, so another 3.5 billion people will join our cities in the next 40 years. And they'll live longer. That means we have 40 years to provide the same amount of water, energy, electricity, houses, jobs, infrastructure, etc. over again, in addition to what we already have today, for these 3.5 billion new people. We have 40 years to do what took us almost 4,000 years to achieve. ■

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About ICLEI

- Founded in 1990 at summit of 200 local governments from 43 countries
- World's leading network of over 1,000 cities and towns committed to building a sustainable future
- Helps to make cities sustainable, low-carbon, resilient, and livable
- Focus on the green economy and smart infrastructure
- Next World Congress in Seoul from 8 to 12 April 2015 for mayors, local governments, NGOs, and others

Hard Hats

Siemens at Work

Cities are permanently under construction. Siemens is involved in a broad range of projects worldwide. The following pages illustrate the technological and geographical scope of the Siemens portfolio, which is as diverse as the cities it serves.



Illustration: Kelli Anderson

Financing for European Locomotive Leasing

Facts: 8-year €140.5 million asset-based Senior Term Loan Financing | Up to 50 Vectron locomotives | Max. output rating 6,400 kWh | Top speed 200 km/h

European Locomotive Leasing (ELL) is a provider of full-service locomotive leasing solutions to freight and passenger operators throughout continental Europe. With rail traffic liberalization across the continent and the growing prominence of private rail operators more likely to favor leasing over owning locomotives, the locomotive leasing sector benefits from highly attractive market dynamics. The business outlook is set on expansion – which is why ELL signed a framework agreement for up to 50 Vectron locomotives from Siemens, with financing secured in-ter alia by Siemens Financial Services (SFS) via Siemens Bank (SBA). Christoph Katzensteiner, founder and CEO of ELL, says: “The versatile Vectron locomotives are particularly well suited to the European market and are proving to be very popular with our lessees. In particular, we are pleased about their built-in

European Train Control System (ETCS), which allows seamless domestic and cross-border traffic.” Several consignments of Vectron locomotives have already been ordered, and the first locomotives went operational for ELL customers in July 2014. Additional locomotives will be delivered until 2016, allowing ELL to satisfy the demand from its expanding customer base. The order is for AC locomotives and for multisystem locomotives. The AC units are intended for border-crossing traffic in Austria, Germany, and Hungary. In addition, the multisystem units can be deployed in border-crossing traffic in Poland, the Czech Republic, and the Slovak Republic. Locomotive leasing is a capital-intensive business. ELL – at that point still in a dynamic start-up phase – envisaged an extremely short time frame to close the deal, especially for any loan provider to make itself

comfortable with the underlying asset values and challenges of the entire business model. This is where Siemens’ in-house financial expertise came into play. The substantial order was made possible through an eight-year asset-based Senior Term Loan Financing over €140.5 million set up by SBA – and based on dedicated SFS expertise of managing and evaluating rolling stock assets. The loan is mutually provided by SBA and DVB Bank SE. But there is additional substantial backing to set ELL on the right track: The equity sponsor is global investment firm Kohlberg Kravis Roberts, which provides resources from its established infrastructure funds together with ELL management to finance all up-front and start-up costs, as well as an agreed percentage of all equipment costs including spare parts and initial funding of reserve accounts.



“The versatile Vectron locomotives are particularly well suited to the European market and are proving to be very popular with our lessees.”

Christoph Katzensteiner, CEO, European Locomotive Leasing



ELL's new border-crossing state-of-the-art Vectron locomotives.

Illustration: Siemens AG



By using onshore power rather than the ships' diesel engines, port cities can massively reduce emissions.

Cleaner Port Call at Hamburg Cruise Terminal

Facts: Order volume of approx. €8.5 million | SIHARBOR power supply with 12-MVA capacity | Suitable for 50- and 60-Hz frequencies and all voltage levels

One of the main causes of local air pollution in ports are the exhaust emissions of the diesel engines that moored ships use to generate electricity. Over a period of about eight hours, a berthed cruise ship (12 megavolt-amperes) generates as much NO_x emission as 10,000 cars (i.e., 1.2 tonnes) and as much particulate matter as 6,000 cars (i.e., 30 kilograms) would in approximately the same period. No wonder that reducing emissions is a strong concern in port cities around the world. For more than ten years now, the European Commission has recommended, through regulations, incentives, and access facilitation, that port authorities provide ways for ships to use onshore power sources during lay days in port – and thus avoid diesel engines polluting the harbors and the surrounding areas. Hamburg has now taken the appropriate measures to cut down on emissions from cruise ships: The Hamburg Port Authority has commissioned Siemens as a general contractor to build a turnkey onshore power supply at the Hamburg Altona cruise terminal. The system will supply electricity to cruise ships of all common sizes and electrical system designs, allowing them to turn off their own diesel generators during their lay days. Not only does this result in cleaner air, it also reduces noise and vibrations in the port area. Upon commissioning in spring of 2015, it will become the first European onshore power supply system of this type. It has a capacity of 12 megavolt-amperes and works with a patented mobile robot arm designed specifically for the tidal range. The heart of the system is a frequency converter with control software that adjusts the frequency of the local distribution grid to the ship's electrical system. The scope of supply for Siemens also includes the medium- and low-voltage switchgear, the transformers, the fire safety system, and the terminal building's air-conditioning and ventilation system.

Photos: Siemens AG

Iconic New Public Transportation for San Francisco

Facts: Order volume US\$648 million | 175 light rail cars | Option for 85 additional cars | Currently 700,000 passengers on weekdays

San Francisco's public transit is one of its prime tourist attractions. The famed cable cars and historic streetcars rattling down the steep streets are a must for every visitor to the Bay Area. Light rail trains and electric as well as hybrid buses complement the city's comprehensive transportation network, operated by the San Francisco Municipal Railway (Muni), making it one of the most environmentally friendly cities in the USA. Now, San Francisco is gearing up for a comprehensive modernization of its urban transport fleet and plans to provide energy-saving, modern light rail trains to transport the city's more than 700,000 daily weekday passengers. San Francisco's Municipal Transportation Agency (SFMTA) has awarded Siemens a contract to deliver an initial consignment of 175 light rail cars for its Muni transit system at a

value of US\$648 million. With an option for an additional 85 cars, this is one of the biggest orders for light rail cars ever placed in the USA. Siemens will deliver a newly developed light rail car based on its Model S200. The car is especially energy-efficient thanks to a lightweight drive system that recovers braking energy and an LED lighting system that uses up to 40 percent less electricity than standard neon lighting. The trains will be built at the Siemens plant in Sacramento, California, and the first cars will be delivered at the end of 2016. “This order marks a milestone for Siemens in the history of our US business. With our rail vehicles made in the USA, we're already the leading provider and have delivered more than 1,300 streetcars and light rail cars in 17 cities across North America to date,” says Jochen Eickholt, CEO of Siemens Mobility.



Three of the designs proposed by Siemens – one of which will be chosen by the SFMTA following public input.

World-Leading Fire Safety for Kuwait's New Landmark

Thousands of people visit the Al Hamra Business Tower each day. Kuwait's tallest building comprises office space, a luxury shopping center, and a theater; the sky lounge on the top floors offers stunning views of the Arabian Gulf. While its height makes the multipurpose building attractive to visitors, it also poses a challenge for fire protection: Each environment – from restaurant kitchens to offices to server rooms – needs a dedicated solution. Siemens installed the advanced fire protection and emergency system FireFinder XLSV, incorporating the latest voice evacuation technology for intelligible, undistorted voice messages to guide people calmly out of the building in case of an emergency.

11-floor car park

5-floor retail mall with **23,000 m²** of retail space

414 meters high

98,000 m² of commercial space on 62 office floors

Photo: SOM

Upgrade for Latin America's Oldest Subway System

Facts: Order volume of €32.9 million | 340,000 passengers/day on Line C | Trainguard MT train control system

Mass public transport has a long tradition in Buenos Aires. The metro system – known as “subte,” short for Subterráneos de Buenos Aires – opened its first section on December 1, 1913, making it Latin America's oldest subway system. Today, it boasts a network of six lines with a total route length of 53 kilometers and 83 stations, providing transportation for 12.7 million residents as well as visitors in the larger metropolitan area of the Argentinian capital. Siemens has in recent years contributed solutions for new segments of the “subte” network – e.g., signaling technology, power supply systems, and communication-based train control technology (CBTC) for the new Line H in 2007 and 2012 – and has now won a contract to upgrade Line C, which originally dates from 1934. Running 4.3 kilometers from Retiro to Constitución, Line C connects the north and the south of the city, and carries up to 340,000 passengers every day. As this is one of Buenos Aires' busiest lines, the upgrade will take place without interruption of normal service. Commissioning is planned for the end of 2016. In order to optimize punctuality and headway and improve safety, Siemens will install its Trainguard MT train control system on Line C. Based on the line data, the automated system calculates exactly how and where a train has to accelerate and brake to arrive punctually at the next station. Automatic train monitoring will be handled by the Controlguide Vicos operations control system, while radio

transmission will make use of the Siemens Airlink solution. Sicas electronic interlockings are being installed for safe setting of the train routes. The signaling technology will be directed and monitored via the operations control center in Constitución, the southern terminus station of Line C.



The six lines of Buenos Aires' “subte” run for 53 kilometers with 83 stations.

Siestorage Safeguards Steel Mill Operation

Facts: Power rating 2.8 MVA | Capacity 720 kWh

Eisenhüttenstadt is a special German town. Built in the 1950s in East Germany as a planned city for the workers of the ironworks industry close to the Polish border, its name actually translates as “Ironworks City.” Accordingly, the town's largest employer still is the steel mill. ArcelorMittal Eisenhüttenstadt GmbH (AMEH) operates the largest integrated steel and rolling mill in eastern Germany at this location, with a closed metallurgical cycle comprising ironworks, a converter steel mill, a hot rolling mill, and a cold rolling mill, as well as various galvanizing and finishing plants. Vulkan Energiewirtschaft Oderbrücke GmbH (VEO) is responsible for the operation and maintenance of all electrical networks in the industrial area of Eisenhüttenstadt. In order to

keep the critical production processes at the AMEH steel mill running in the event of a blackout at the local 110-kilovolt distribution grid, and thus prevent follow-up damage – which could potentially cost millions – VEO has a backup plan in place: an island network that involves the Siemens battery storage system Siestorage. Based on lithium-ion batteries, the main function of the Siestorage energy storage system consists of being able to start a gas turbine through a starting motor at any time from the de-energized state and without feeding in power from the public grid. The blast furnace gas-fired power plant will then supply the steel mill with electricity and heat.

Photo: GUY Christian/hemis.fr/iaif



The EcoTram in passenger service.

Vienna's EcoTram Research Completed

Facts: 5 years project duration | Test tram in regular service: 10 months | 4,200 kWh energy saved

In 2009, Viennese tram operator Wiener Linien started a research project – together with its partners Rail Tec Arsenal, SCHIG mbh, Siemens, Technical University Vienna, and Vossloh Kiepe, and supported by the Austrian Research Foundation's Climate and Energy Fund – to find out how smart technology could reduce energy consumption for heating, cooling, and air-conditioning in its tramways. The first phase of this project involved collecting data from one of the conventional Siemens ultralow floor (ULF) trams, which have been in service for Wiener Linien since 1998, in a climatic wind tunnel as well as in regular line service. Subsequently, a custom-made ULF test tram – the EcoTram – was fitted with a wide range of energy-saving features such as a cooling and heating system with predictive control, CO₂ sensors tracking how many passengers are on board to ensure an optimal supply of fresh air, a multistage cooling system, and special sunlight-inhibiting window foils. The heating, ventilation, and air-conditioning system (HVAC) with a heat pump makes use of the ambient temperature for energy-efficient heating and cooling – the first time this technology has been installed in a tram.

After further testing in the climatic wind tunnel, the EcoTram was deployed in passenger service on Line 62, which connects the world-famous Opera with Lainz, in the west of Vienna. Günter Steinbauer, General Manager of Wiener Linien, is enthusiastic about the successful completion of the research project: “In the past five years, we’ve been able to gain valuable insights into the energy-saving potential of trams, and also to test new technologies in regular line service.”

The result: During the ten-month test period, the EcoTram saved more than 13 percent – up to 4,200 kilowatt-hours of energy – on heating, ventilation, and air-conditioning, compared to the data initially collected from the conventional tram. This roughly equals the energy consumed annually by an average household in Austria. In the future, Wiener Linien is looking to capitalize on the scientifically proven energy-saving potential.

Automation for Iron Ore Transshipment Rail Station

Facts: MK2 interlocking | Rail 9000 operations control system | ACM 200 axle counting systems

Narvik on the north coast of Norway lies 220 kilometers north of the Arctic Circle. One of the most northerly towns in the world, its mean annual temperature is 3.8 degrees. However, due to the North Atlantic Current, an extension of the Gulf Stream, its port remains ice-free all year round, and the surrounding mountains protect it from the icy coastal winds. It is a key harbor facility for the transportation of iron ore from the Swedish town of Kiruna, only 180 kilometers away.

In Kiruna, Swedish mining company Luossavaara-Kiirunavaara Aktiebolag (LKAB) operates the world's largest iron ore mine. The Kiruna line has been operating since 1903, initially with steam locomotives, later changing to electric locomotives. Nowadays, each freight train consists of 68 wagons, each wagon hauling 100 tonnes of ore.

LKAB contracted Siemens to equip the transshipment railroad station in Narvik with state-of-the-art signaling and instrumentation and control technology. The automation of shunting processes and the optimization of loading and unloading processes at Narvik station constitute an important milestone in LKAB's modernization road map to expand annual production to 35 million tonnes of ore. Siemens is supplying the MK2 interlocking, the Rail 9000 operations control system, type ACM 200 axle counting systems, a container for the indoor systems, a diesel emergency power unit, shunting signals, and derailers. Due to the arctic weather in the region, installation of the equipment will take place in 2015 as soon as outside conditions permit – in the short summer period when temperatures might rise to daytime average temperatures of 18 degrees.



Automated shunting and loading helps LKAB raise its annual iron ore production.

Photo: Siemens AG



The eMeter EnergyIP MDMS allows utility JEA to gain maximum benefit from its two-way meters.

Smart Savings for Community-Owned Utility

Facts: 65,000 two-way meters (and counting) | eMeter EnergyIP MDMS

JEA is a community-owned, nonprofit utility based in Jacksonville, Florida, serving an estimated 427,000 electric, 313,000 water, and 240,000 sewer customers. In 2009, the utility was awarded a US\$13 million Smart Grid Investment Grant by the US Department of Energy – with the utility contributing matching funds – to invest in advanced metering infrastructure. Now equipped with two-way meters, JEA was able to avoid monthly meter reads in the field, resulting in immediate expenditure savings. Extracting further value from the installed infrastructure, however, depended on the right meter data management system (MDMS) to support the desired functionalities. Brian Novak, JEA Program Manager for Advanced Metering Systems, says it was a matter of “getting value out of the [installed] system or just getting one meter read a month and not realizing the benefits of this incredibly large investment.”

JEA selected Siemens' eMeter EnergyIP platform as its MDMS because it is technology-agnostic, with flexible architecture to address both electric and water resources. Its standard adapters interface seamlessly with various data collection systems, transforming the data into a common format. Hence, EnergyIP now serves as the focal point for all of JEA's systems. The EnergyIP MDMS has enabled the utility to remotely connect or disconnect customers at any time, improve the timeliness and reliability of electricity usage data for customers, decrease time spent assessing loads on the system, better identify assets that may need replacement, and better understand where and when new infrastructure assets need to be built. The remote connect-disconnect functionality alone has allowed JEA to avoid 130,000 truck rolls, which resulted in US\$1.6 million in savings in the last year and a half. For Brian Novak, this is just the start. “We’ve only tapped into a small portion of what we’re capable of,” Novak says. “We’re going to take all these systems to the next level.”

Illustrations: Kelli Anderson

“We’re going to take all these systems to the next level.”

Brian Novak
JEA Program Manager for Advanced Metering Systems

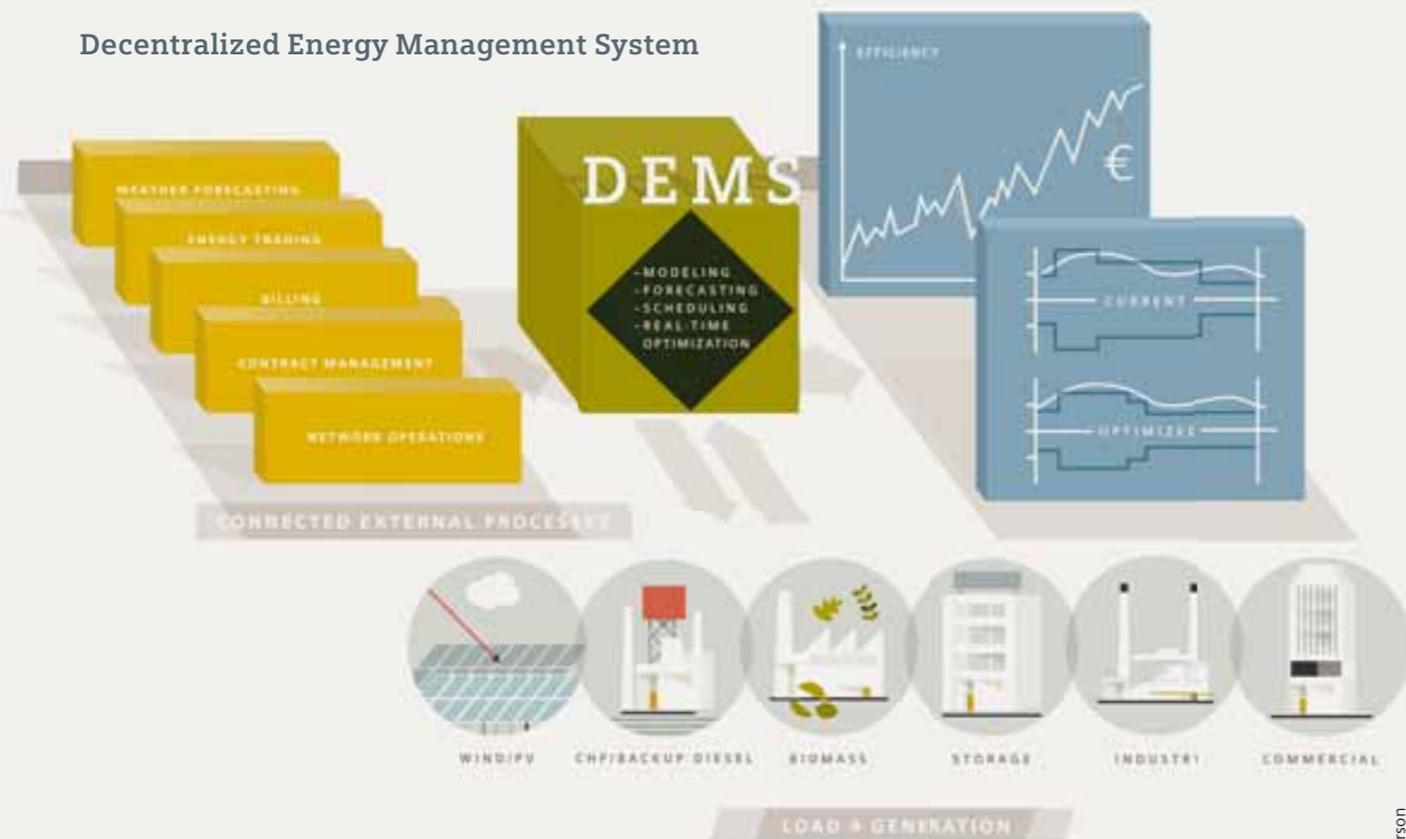
Virtual Power Plant Boosts Utilities' Business

Facts: Cloud-based IT solution based on DEMS energy management system

Siemens is supplying North Rhine-Westphalia-based energy services provider Mark-E with a hosted, cloud-based IT solution for a virtual power plant. The infrastructure is delivered and operated by Omnetric GmbH, a joint venture of Siemens and Accenture. The solution is based on Siemens' proven energy management system DEMS, which includes communications interfaces for the distributed energy resources, supply forecasts, and aggregation mechanisms. Virtual power plants play an important role in

Germany's sustainable energy supply, which increasingly relies on decentralized generation. But distributed energy resources can only participate in energy and balancing power markets if they are grouped together. The cloud-based solution enables smaller utilities to operate their own virtual power plants – and thus reach the critical size to participate in the energy market – with only a minimal investment by using Siemens technology and collaborating with Mark-E as their market partner.

Decentralized Energy Management System



With the cloud-based DEMS system, smaller power plants can be combined into a single virtual entity, achieving the "critical mass" required to take part in the energy market.

Illustration: Kelli Anderson



The new building in Kowloon Bay not only has zero net energy consumption, but actually feeds green energy into the grid.

Hong Kong's Zero-Carbon Construction

Facts: 1,800 hardware points | 3,200 software points | 2,800 sensor points | 160 kWp photovoltaic system

Like so many visionary innovations, this one originated in a radical question: Is it possible to build a house that generates more renewable energy on-site than it consumes – even taking into account the energy needed to produce its construction materials, the energy used during construction, and the energy its eventual demolition will consume? In Hong Kong, one of the most densely populated cities of the world, where high air pollution seems to be the price to pay for energy-guzzling buildings, the Construction Industry Council provided a very palpable answer to this question: the Zero-Carbon Building (ZCB), which opened at the end of June 2012 in Kowloon Bay. In the traditional definition, a zero-carbon building is a building with zero net energy consumption or zero net carbon emissions on an annual basis. The Hong Kong ZCB, fitted with Siemens technology, has since raised public awareness of sustainable living and boosted interest in reducing greenhouse gas emissions in the construction industry. It houses exhibition and training areas, office and living space, and a multipurpose hall. Siemens provided reliable technical solutions for all areas – controlled by a smart building management system. A smart indoor and outdoor lighting system with light and motion detectors controls lighting automatically based on occupancy, individual needs, and the natural lighting level.

Photo: Balfour Beatty

The building also incorporates a Sinteso fire alarm system. Generating renewable energy on-site with photovoltaic panels and a trigeneration system that uses biofuel made of used cooking oil, the Hong Kong ZCB not only has zero carbon emissions on a net annual basis. Going beyond the basic understanding of a zero-carbon building, the ZCB even exports surplus energy to offset carbon emissions accrued during the construction process.

Saving Energy at University of Hong Kong Buildings

The University of Hong Kong opted for an Energy Performance Contract with Siemens to install several improvement measures at its Chow Yei Ching and Tsui Tsin Tong buildings. Measures implemented to guarantee energy savings included chiller plant and lighting retrofits at both buildings, as well as additional features including an upgrade of the building management system at the Chow Yei Ching building. The energy improvement retrofit will be financed by the guaranteed operational cost savings; the contract will run for eight years until 2021.