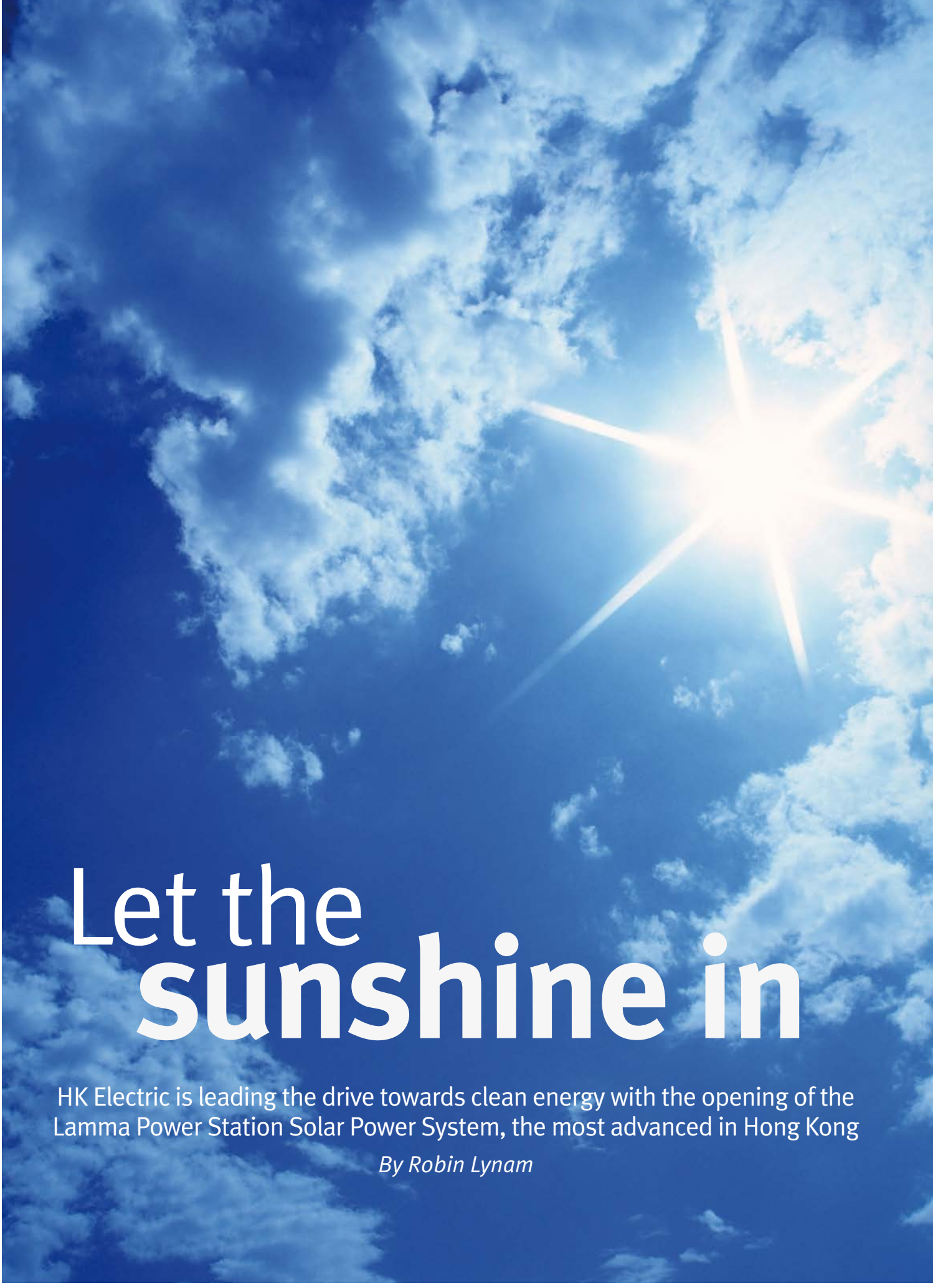


Let the sunshine in

HK Electric is leading the drive towards clean energy with the opening of the Lamma Power Station Solar Power System, the most advanced in Hong Kong

By Robin Lynam

"MIGHTY OAKS FROM LITTLE ACORNS GROW," goes an old saying, and a particularly apt one for the formal opening by HK Electric, a subsidiary of Power Assets Holdings Limited on 29 July last year of one of the biggest renewable energy projects yet attempted in the city.

HKD23 million (USD2.9 million) might seem a lot to pay for an acorn, but the effect of putting the Lamma Power Station Solar Power System into commission is estimated to be equivalent to planting 22,000 trees.

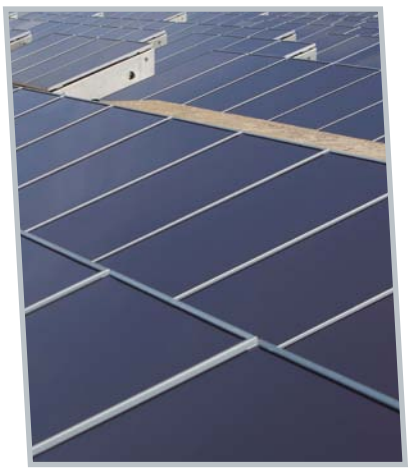
The power it generates – while producing no emissions whatsoever – will allow the station to supply electricity to 150 family homes and reduce carbon dioxide output by 520 tons per annum.

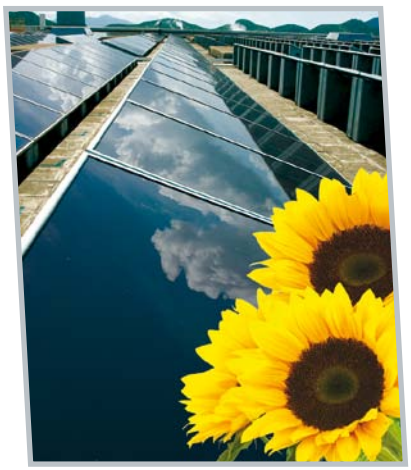
The Solar Power System in its present form is capable of generating a total of 550 kilowatts, but plans are already being formulated to almost double capacity to one megawatt by 2012.

That doesn't mean that solar power, or any other kind of renewable energy source, is going to replace coal as the main fuel of the Lamma Power Station anytime soon, though.

The station's capacity is 3,735 megawatts, and wind and solar power technology are still far from a point at which they could conceivably generate that much electricity.

Nevertheless HK Electric has achieved sufficiently promising results from its wind turbine and Solar Power System pilot projects to justify the further development of green energy, and it is clear that environmentally friendly sources will play a growing role in generating electricity for the company's customers in the future.





Blue skies ahead: The new Solar Power System at Lamma Power Station reduces carbon dioxide output by 520 tons per year.

New wind installation planned

The Hong Kong government has set a target of having two per cent of the city's energy produced from renewable carbon neutral sources by 2012, and in support of that objective HK Electric is also planning a wind farm off the coast of Lamma Island which is expected to be capable of producing as many as 100 megawatts of clean electricity.

"We believe that solar power and wind power are the most promising renewable sources for the Hong Kong environment," said Frank Lau Fuk-hoi, HK Electric's General Manager, Projects. "We are at the pilot project stage. We need to gain experience in order to embark on further renewable energy projects in the future."

Results so far are encouraging. The success of commissioning Hong Kong's first wind turbine – also situated on Lamma Island – as a source of green electricity has provided a spur to the second larger wind based installation.

Better than expected efficiency on the part of the Solar Power System justifies the plan to almost double its capacity.

According to Mr Lau one reason for the better than expected results from the solar panels installation was the decision to use more advanced Amorphous Silicon Thin Film Photovoltaic (TFPV) technology.

"Our supplier, DuPont Apollo Ltd, has a joint-venture manufacturing operation in Shenzhen, a research centre in the Science Park in Hong Kong, and a marketing office in Hong Kong. This is called the 'Innovation Circle', joining hands with the Shenzhen manufacturing base so we can have a win-win situation for the two cities. We are the first customer to use this TFPV technology, and they are doing a lot of research work to improve the efficiency of their products," he explained.

Progress in the field is accelerating. Just months after the installation of the first panels on the roofs of the Lamma power station buildings, newer models offering a higher conversion efficiency have already been developed that will probably be used in the next phase of the system's development.

According to Mr Lau, there were a number of technical reasons for choosing TFPV panels rather than the more common modules which use thicker layers of crystalline silicon. These are the types of panel used for the 350 kilowatt installation at the Electrical and Mechanical Services Department in Kowloon Bay, and the 198 kilowatt system at the Hong Kong Science Park, both of which were completed in 2005.

"We have been studying these TFPV panels compared with the conventional crystalline silicon panels," said Mr Lau. "One reason we chose the thin film ones is that in producing those panels much less silicon is required. On the other hand, it takes a large amount of silicon to produce conventional panels, which means you expend a lot of energy on producing the panels and then you wait for several years before the solar energy can pay back the energy used in making the panels. Conventional panels have a payback period of about three or four years, as opposed to one and a half years for PV panels. The panels have a design life of 20 years.

"The second reason is that conversion efficiency of conventional panels drops quickly under high temperatures, while that of amorphous thin film panels does not. Amorphous thin film panels maintain roughly the same conversion efficiency, so they are more suitable for a tropical or sub-tropical environment.

"Finally, thin film panels maintain a good percentage of conversion efficiency under weak sunlight conditions. The conventional ones do not. That means thin film panels can harness more energy over a year."

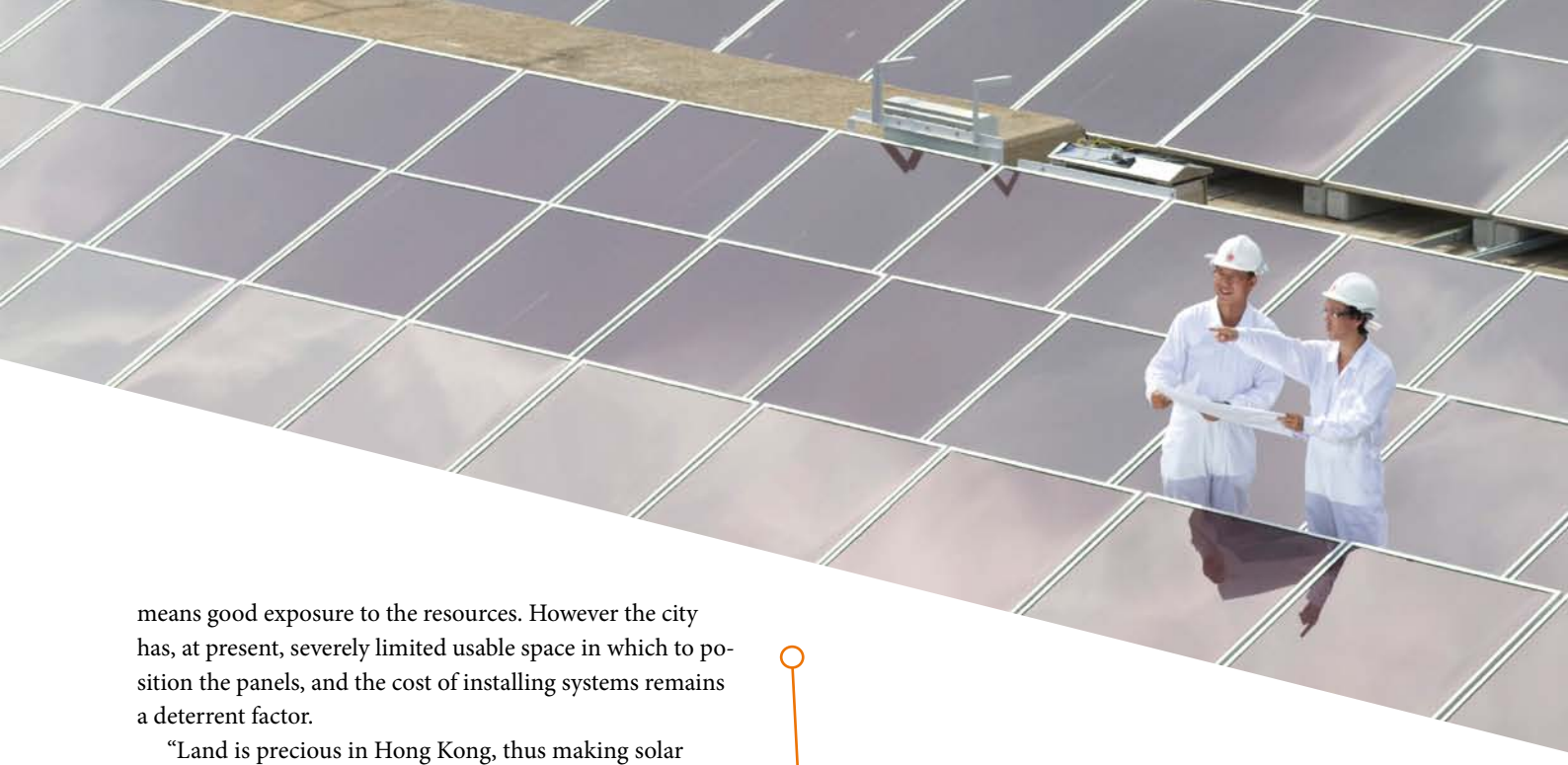
HK Electric's findings so far are that better than expected power output can be achieved in conditions of low irradiance.

The adoption of solar energy is now a well established international trend, notwithstanding the still relatively high costs involved. The panels are generally perceived as being environmentally superior to most alternative energy sources, because they emit no gaseous or liquid pollutants and do not produce noise.

"Solar and wind power generation are growing fast," stated Mr Lau. "In 2010 installation of solar photovoltaic systems crossed the threshold of 10 gigawatts globally in a single year – setting a new record and once inconceivable number. Expectations for next year are close to 20 gigawatts. The global market has been growing at a phenomenal rate – an average of 47 per cent per annum over the past five years."

In some respects Hong Kong is well positioned to harness solar energy. A generally sunny climate

The System's solar panels use advanced Amorphous Silicon Thin Film Photovoltaic technology, so they harness more energy than other panels, are more environmentally friendly to produce and are better suited to a sub-tropical climate.



means good exposure to the resources. However the city has, at present, severely limited usable space in which to position the panels, and the cost of installing systems remains a deterrent factor.

"Land is precious in Hong Kong, thus making solar power system installation very difficult," observed Mr Lau. "The cost for the implementation of solar energy is also higher than that of conventional thermal power plant."

That does not mean, however, that adoption of solar power systems in the city will not be more widespread in the future, particularly as costs come down. It is possible that systems could be developed to suit Hong Kong's unique conditions.

Although the roofs of most tall buildings in the city are used as a platform for air-conditioning plant and other building services equipment, it is possible in the future that the sides of new developments could be covered with TFPV modules.

Solar panels for skyscrapers

"These panels can be installed to act as a curtain wall. Light can penetrate through them, but the cost of the panels is still relatively high, and building developers may not find the idea attractive yet. However the market trend is that the cost of PV panels is coming down very quickly. Within the next three years the cost will come down to a point at which building developers and power utility companies may become interested in revisiting this concept," Mr Lau reflected.

In the long term, solar power has too many advantages to be ignored as an electricity source, and will become progressively more attractive as technology costs come down.

"It's clean energy. There is no doubt about that. There are no emissions and very little maintenance is required. Once the solar panels are connected to the power grid they are producing electricity every second, and very little attention has to be paid to them. However due to solar energy's intermittent nature, the growth of its adoption worldwide will be constrained until reliable and low-cost technology for storing solar energy becomes available," Mr Lau concluded.

Thinking Thin

Solar panels – also called photovoltaic panels or modules – convert solar radiation into electricity using silicon as a semiconductor. Solar energy absorbed by the modules drives electron flow to produce electricity.

Because solar energy can be generated in any location with suitable light conditions, and because the technology produces no emissions in operation, systems of solar panels have emerged among the front-runners of renewable energy sources.

Considerable progress has accordingly been made in panel design and construction, and units capable of achieving significantly higher levels of efficiency are more readily available.

The amorphous silicon thin film photovoltaic modules made by DuPont Apollo use a semiconducting layer of silicon only micrometers thick deposited on a glass panel, and require less energy to manufacture than crystalline silicon units.

HK Electric's Frank Lau says that increased demand for the panels is exerting gradual downward pressure on their cost, and this should lead to even more widespread adoption of the technology.

"R&D has continuously made improvements in existing technologies and developing new technologies achieving significant cost reductions and efficiency improvements. Concurrently the use of energy and materials in the manufacturing process will become significantly more efficient, leading to considerably shortened PV system energy payback times and lengthened operational lifetime," stated Mr Lau.