

MYANMAR TIMES  
HEARTBEAT OF THE NATION

A special report | August 2013

# ENERGY

The struggle for power



Mining the benefits  
of transparency

Who's who in offshore efforts

How dangerous is life on an oil tanker?





# Mining the benefits of transparency

*The government's decision to adhere to the global Extractive Industries Transparency Initiative (EITI) standard for extractive industries will help ensure revenue from natural resources benefits the country as a whole and contributes to the broader reform process, writes EITI head Jonas Moberg*

Shwe gas pipeline in Rakhine State. Photo: Ko Taik

JONAS MOBERG

**L**AST year, President Thein Sein announced that transparency in the extractive sector is necessary to ensure that all citizens benefit from the country's resources, not just a small group. Since then, the government of Myanmar has committed itself to tackling the opacity that has long characterised Myanmar's oil, gas and mineral sectors.

Part of this reform involves implementing the Extractive Industries Transparency Initiative (EITI), a global standard that ensures openness about revenues from oil, gas and mining. Thirty-nine countries currently subscribe to EITI standards, while a number of others are in the preparatory stages, including France, the United Kingdom, the United States – and now Myanmar.

Under the guidance of the EITI Leading Authority, chaired by Union Minister U Soe Thane, the government aims to submit a candidature application to the international EITI Board by the end of 2013. Each country implementing the EITI Standard must follow a common set of regulations while also adapting the process to address the particular challenges of their own extractive sectors. For some, transparency is a way of minimising the risks of corruption; for others, it helps build trust and attract responsible investment.

Myanmar's extractive industries have their own mix of

challenges, all of which the EITI is well-suited to address. But it will be crucial to include the relevant actors and institutions in the design process in order to derive the proper benefits.

For instance, estimates vary about oil, gas and mining production and revenue. While citizens deserve to know what the government is getting when the nation's finite natural resources are sold off, accurate and timely information is currently unavailable. As demonstrated by the continuous protests around the Letpadaung copper mine, this can cause considerable public discontent: Despite government and corporate claims that the mine is profitable for Myanmar, people continue to be unhappy because they don't yet see the benefits for themselves.

Under EITI standards, however, Myanmar will publish annual reports prepared by an independent third party. Stakeholders will have access to reliable information about how much extractive companies pay the government for the right to extract resources. This information will inform the ongoing debates about whether or not the country is receiving a fair share, and will be useful in cases like Letpadaung and others recently in the news.

In July, gas started to flow through the 793-kilometre (493-mile) pipeline from the Shwe gas field on Myanmar's west coast to Kunming in China. With a parallel oil pipeline expected to begin operations next year, and the existing pipelines to Thailand,

transit revenues are becoming an increasingly important source of income for Myanmar. Through the EITI, citizens will know exactly how much the government receives from these transits. This reporting could even be expanded to include verification that oil and gas earmarked for domestic use reaches its proper destinations.

EITI Reports often help to detect weaknesses or inefficiencies in how revenues from oil, gas and mining are collected and managed. Having accurate numbers can improve tax collection systems, allow regulatory oversight of the sector and even lead to the recovery of missing revenue. It can also help stimulate broader sector

*Citizens deserve to know what the government is getting when the nation's finite natural resources are sold off.*

reform, including revisions of relevant legislation, enforcement and monitoring of standards and regulations, and more efficient sharing of sector revenues for the benefit of the people. With the EITI bringing multi-stakeholder groups of government, companies and civil society representatives together to oversee implementation, reports can inform public debate about how the extractive sector is being governed.

Another benefit of EITI implementation is that transparency and good governance attract foreign investment. With companies

now bidding for large onshore and offshore fields, and debate swirling over the ongoing licensing rounds, it's important for bidding companies to know the procedures by which companies are to be awarded licences. Potential investors want to know the investment environment is transparent, which is why many large international companies, including Chevron and Total, strongly support the institution of EITI standards. It's also important for citizens to know that licences are being awarded to those with the necessary technical and financial skills to develop the country's natural resources in a responsible and efficient manner.

With much of Myanmar's natural resources located in areas where ethnic conflict is ongoing, the EITI also helps provide a platform for dialogue through its multi-stakeholder group, contributing to improved relationships and building trust between all parties.

This is not to say all these changes will be easy. EITI's success in Myanmar will require continuous political leadership, a commitment to reform and the courage to engage industry and civil society in debates about how the sector is managed. All companies extracting oil, gas and minerals must agree to disclose information about their payments, whether private, state-owned or other quasi-state actors. Civil society organisations, academia, parliamentarians and others, in particular by those living in resource-rich regions,

will also need to be involved in reform. Lastly, the international community must be ready to provide a helping hand where necessary.

President Thein Sein's commitment to EITI implementation signals, however, that the government is ready to step up to these challenges. The progress achieved so far indicates that the process is moving in the right direction. The next step is to accelerate the consultations within and between each stakeholder group to form a multi-stakeholder group, which will take on the crucial task of designing an EITI process and work plan that's right for the country.

"EITI implementation alone cannot resolve all the issues in the natural resources sector in Myanmar," U Win Shein, Minister of Finance and Revenue (as it was formerly known), said at the EITI Global Conference in Sydney in May, "but it can make some important contributions." He's right on both points. The EITI cannot solve all the challenges involved in managing Myanmar's natural resources. But an ambitious and inclusive EITI process – one well connected to broader reforms – is undoubtedly a good place to start.

*Jonas Moberg is head of the Extractive Industries Transparency Initiative (EITI) International Secretariat and is based in the United States. Email: [secretariat@eiti.org](mailto:secretariat@eiti.org)*





# Lighting up the night, one customer at a time

Thanks to affordable and reliable solar technology, it's getting easier to keep the lights on, even in some of the remotest corners of Myanmar

JEREMY MULLINS

jeremymullins7@gmail.com



**E**IGHTY-FOUR percent of rural households are still off the grid in this country, according to the World Economic Forum's "New Energy Architecture: Myanmar" report. While rural dwellers have traditionally used candles and kerosene lamps fuelled with diesel in their homes after dark, economic development over the past few years has put a light at the end of the tunnel for some rural households struggling with the costs of non-renewable energy. With new technology finding its way to some of the furthest reaches of the country, the results are as different as, well, night and day.

One company, Proximity Designs, has found an especially effective solution for those living without electricity: solar power. Based in Yangon, the company describes itself as a "social enterprise", employing hundreds of people across the country and selling products and services specifically aimed at improving the lives of its customers. While many companies might make similar claims, Proximity Designs isn't shilling luxury goods: It figures out what poor people, particularly in rural areas, need, then sets out to import – or, if they can't find anything adequate, design and build themselves – high-quality products at prices customers can afford. With a wide range of products and services, Proximity offers anything from technology to advice to low-interest loans.

One of its most successful units, which has become profitable on its own terms, is lighting. According to Chris Page, a business analyst for Proximity, the company has sold 22,000 solar-powered lights in rural Myanmar since it began offering them in March 2012.

Proximity's lights are made by d.light, a US-based company specialising in solar solutions in the developing world. The US-designed, China-manufactured solar lights sell for between US\$9.50 and \$33, depending on the model. That's a higher cost than some of the other, cheaper brands currently on the market, but Mr Page said d.light's products come with a difference.

"These lights are quite durable," he said. "We have these three tests: We can step on them, run them over with a motorbike, dump them in water – they're water resistant. We can drop them out of a coconut tree. Quality is a huge thing here."

The value of such a reliable product light is obvious to rural dwellers, as it often helps with their work. For instance, rubber tappers in Mon State prefer to work at around 2am, while many rice threshers like to work in the middle of the night, he said.

While solar-powered lighting



Source: Global Energy Network Institute

seems a novel solution to Myanmar's energy problem, its success means Proximity is not the only game in town. Over the past two years a number of primarily Chinese competitors have entered the business, often offering solar-powered lights at a discounted price. As a result, Mr Page said, Proximity helps customers look at better lighting as an investment in a brighter future.

According to the company's research, rural households spend an average of \$4 to \$6 a month paying for fuel for lamps or candles or other options such as flashlight batteries or diesel for generators. While d.lights may have a higher cost up-front, they pay off over the long term. And to alleviate the challenges of cobbling together the lump sum required for the lights, Proximity offers a credit program, allowing households to pay by installments. This is a major selling feature, according to Mr Page, as its rivals do not offer such plans.

"People are so starved for cash they don't want to spend more money than they have to on a product," Mr Page said. "We have to make a case that it's going to provide an economic benefit to them rather [than saying] this is really a quality light with a cool design or something."

Another factor differentiating a d.light from a competitor's model is that d.lights rarely require servicing, while Chinese-made knock-offs often fall apart in a couple of months.

One competitor recently copied a d.light model directly and sold the resulting product in Myanmar. Proximity sold the original at

K29,000, while the counterfeit equivalent could be bought for K18,000. After two months of use, however, the counterfeit light generally broke down.

"We had to register our copyright here," Mr Page said. "In China,

d.light took action against this [counterfeit] manufacturer."

Proximity expects its success with d.light's products to draw further competition. Mr Page pointed to international firms such as Unilever and DKSH as



A resident in Hmawbi Township in Yangon Region examines an S250 model of d.light solar light, which charges cell phones

Photo: Chris Page at Proximity Designs

enterprises with well-performing nationwide distribution systems, and said it was companies such as these that would capitalise on Myanmar opening up. But he also said Proximity's hard-won reputation and extensive distribution network are key advantages.

For instance, Proximity's partners in border areas enable it to widen its distribution network beyond where it would be viable on its own. It has sold over 1000 lights in Chin State, and pursued a successful partnership with a Karen faith-based organisation.

"Having the intimate knowledge of rural areas really gives us an edge over [competing] companies," he said. "Right now in the solar light world, technology's going to get more and more similar, and so it's going to be about who can get into communities the best."

One of the next steps for Proximity is to offer solar panels capable of powering an EVD (enhanced versatile disc) player, which Mr Page said are in large demand in rural areas. Such solar panels are likely a year away from introduction to Myanmar, he said, but the plan is in keeping with the firm's goal of providing in-demand products to people who otherwise have limited options.

"In the 1990s, rural people, even if they needed to buy stuff, just couldn't get access to good stuff," he added. "That's what Proximity really wants to do – provide distribution channels so people in rural markets can get really good products."

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# CNG cost hike worries taxi drivers

MYA KAY KHINE

mya.simplyfly@gmail.com



ON August 1, the Ministry of Energy posted a notice on its website confirming that they are discussing an increase in the price of compressed natural gas (CNG), which is used by many taxis, buses and vehicles in Myanmar.

The announcement came as no surprise to taxi drivers in Yangon, who have been hearing rumours about the reported change for months. But it has set off a debate as to whether or not Myanmar, which has always had its own abundant supply of natural gas, should be raising the price of CNG fuel.

Sustainability issues are one reason why the government is considering

raising the price, said U Ko Lay, general manager of the CNG department of the Myanmar Oil and Gas Enterprise under the Ministry of Energy. He said eight years ago, the Aphyauk gas field in Yangon produced 100 million cubic feet per day. Now, the amount of natural gas produced has significantly decreased, he said.

"Gas and fuel are natural resources that have been given by nature. So one day they will be gone. Gas is not a renewable energy so we should use it economically," U Ko Lay said.

Another possible reason for the increase, U Ko Lay said, is that the government has plans to divert some of the supply for other uses: For example, the gas may be used for fuel in gas turbines for electricity, in chemical fertilizer plants for the agriculture sector or in cement plants for the purpose of building more

roads and bridges.

Regardless of how the government plans to use CNG, taxi drivers say they are already struggling to make ends meet and have come to rely on the CNG-converted cars as Yangon's roads have become more crowded and they are forced to spend more time in traffic jams and therefore more money on fuel.

"Is CNG not produced in our country?" said Min Min Oo, a 45-year old taxi driver who has been driving for 20 years. "Other countries can increase the CNG price because they import CNG from foreign sources. But we shouldn't have to. Our country has so many gas and oil fields. CNG is a commodity which

brings in foreign income, so we should be able to use it freely without charges."

The CNG price is currently K273 a kilogram, which is significantly less than the price of petrol. Although drivers of CNG-fueled taxis pay less for fuel per day than petrol drivers, they pay more to owners to rent their cars - K15,000 daily compared to K10,000 for a petrol car.

In 2005, the Myanmar government passed a law forcing passenger buses and cabs to change to CNG. However, four years ago the government changed its mind and banned CNG conversion on new cars. Some taxi drivers are hoping that the ban will be lifted and they might again

have the option to convert their petrol vehicles to CNG.

"[Even] if the price of CNG rises, it is better than if they don't allow [conversion to CNG]," said taxi driver U Hla Kyaw, who now drives a CNG taxi. "Now, all taxi drivers are affected by traffic jams. If drivers stop downtown, they are stuck downtown. And also, drivers who go to the suburbs don't come downtown."

Drivers say they prefer CNG taxis for long trips and for when they are stuck in traffic jams, as the fuel is less expensive.

"I have driven CNG taxis before," said cab driver Ko Thet Lwin. "I started with a

petrol taxi this month. The CNG taxi is reasonable for us because we lose more money on petrol when we have to drive and this affects income. The income is different between CNG and petrol taxis."

According to statistics from the Ministry of Energy, there were more CNG vehicles than petrol-fueled vehicles in 2013. Official statistics for 2004-2013 show there were 16,460 petrol vehicles converted to CNG nationwide (excluding unregistered vehicles), and 9122 diesel vehicles converted. Vehicles manufactured to run on CNG number 27,623.



The government's symbol for compressed natural gas. Photo: Aung Htay Hlaing

# Iraq pushes for investment as India seeks more oil

PENELOPE MACRAE

IRAQ'S prime minister on Friday pitched for investment from India to rebuild his war-shattered nation, which is a critical energy supplier to New Delhi.

Iraq's Prime Minister Nuri Al-Maliki said there were "great opportunities" for Indian firms to rebuild the nation's infrastructure - constructing ports, highways, housing, railways, schools,

hospitals and investing in oil production facilities.

"There is so much potential," said Maliki, who is on a three-day trip to New Delhi and Mumbai.

Iraq is still struggling to rebuild its broken infrastructure since a 2003 US-led invasion ousted president Saddam Hussein and led to massive sectarian violence.

This is the first head of government-level visit between

the two countries since 1975, when then-prime minister Indira Gandhi visited Iraq.

During the visit, the two sides were expected to sign an agreement that would increase Iraqi sales of crude oil to fuel-import-reliant India.

Iraq has eclipsed sanctions-hit Iran as India's second-biggest crude oil supplier after Saudi Arabia.

India reduced its dependence on Iranian oil in the wake of US

and European sanctions on the import of oil from the Islamic Republic.

India and Iraq have historically enjoyed friendly ties.

But while China has been energetically seeking infrastructure contracts in Iraq, and has invested substantially in Iraqi oil production, Iraq officials say India has been noticeably absent.

Iraq has said it may need up to US\$1 trillion over the next decade to rebuild its crumbling infrastructure.

"We are rebuilding our country," said Maliki, whose visit followed a trip to Baghdad by Indian foreign minister Salman Khurshid in June.

Luring foreign investment to Iraq has been complicated anew by the worst violence in the country since 2008.

"We have some security breaches here and there," conceded the chairman of Iraq's National Investment Commission, Sami Raouf Taqi al-Araji.

But he said the country had special forces protecting foreign workers.

"We're committed to protecting foreign workers, they are away from their homes,

they are in our care," Araji told reporters.

Despite tensions, Iraq's economy has been growing, fuelled by oil exports.

Indian exports to Iraq totalled around \$1.3 billion in 2012, up from \$740 million in 2011, according to an Indian government official.

Baghdad's exports to India - the vast majority of which were oil - totalled more than \$20 billion last year, up from \$9 billion a year earlier in 2011.

India has said it is keen to "reverse the traffic" by investing in Iraqi infrastructure and moving to a more broad-based relationship.

The country, struggling to stabilise its ailing currency, is also pushing Iraq to accept payment for its oil exports in rupees, Indian trade minister Anand Sharma said Friday.

Araji said Iraq would have to consider the request.

Iran, which has long battled neighbouring Iraq for global oil market share, agreed to take payments for the oil it sells to India in rupees after Western sanctions over its disputed nuclear program blocked other payment methods.

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# The rise, fall and rebirth of biofuels in Myanmar

Following the epic failure of a jatropha roll-out five years ago, is it a case of once-bitten, twice-shy for biofuels?

BILL O'TOOLE

botoole12@gmail.com



AS Myanmar grapples with the question of how to update its severely outdated energy sector, many local companies are joining forces with outside companies to explore the intriguing but largely unproven world of biofuels. It's an industry still licking its wounds after a previous large-scale failure – but those involved say that this time things will be different.

In April of this year, the Asian wing of Nation First Economic Development signed an MoU with local firm Hisham Koh & Associates to develop algae farms both upcountry and around Yangon.

“While algae is an exciting profitable source of biofuel or commercial animal feeds for aquaculture and agriculture, it can also be a sustainable source for a broad range of high dollar value products,” a press release said. “From food to chemicals as well as cosmetics and pharmaceuticals, multiple products from the same algal biomass are possible.”

In addition, California-based green energy firm Viaspace signed an agreement in October 2012 to bring their signature product, King Grass, to Myanmar. Speaking at the signing ceremony, Viaspace engineers said their specific focus would be on using King Grass to generate electricity.

“We hope to work with our partners to create a viable and vibrant renewable biomass/bio-energy business model to serve the national interests and growth in Myanmar,” company chairman Kevin Schewe said.

Both algae and King Grass need several months to grow to a point at which they can sustain biofuels, so the relative success of these projects will not be known until at least the end of this year.

As previously reported by *The Myanmar Times*, however, these new initiatives are not the first time biofuel has been introduced in Myanmar. For many, memories of jatropha – the seeds of which were once said to be able to solve all the country's energy needs – still linger painfully in the mind.

“In 2006, the chief research officer at state-run Myanmar Oil and Gas Enterprise said Burma hoped to completely replace the country's oil imports of 40,000 barrels a day with home-brewed, jatropha-derived biofuel,” according to a report by the Ethnic Development Forum.

Under the government's plan, 8 million acres of jatropha plants – an area roughly the size of Belgium – were to be planted by 2009. Myanmar wasn't the only country seduced by jatropha's

charms: At one point there were somewhere around 250 jatropha projects worldwide, mainly in Asia, Africa and South America but also, yes, in Belgium itself. “Jatropha was mistakenly

of Viaspace.

Myanmar's all-in investment led to non-farmers being pressed into service, forced to plant jatropha on every inch of available land and even in some areas

it was: The jatropha experiment was a grand failure, folding after one dismal year.

Mr Kukkonen, who spent several decades working at NASA, said that he remains optimistic about the fu-

“Jatropha was mistakenly promoted as an almost magic crop that ordinary farmers could grow and squeeze the oil out of to power their engines.”

– Carl Kukkonen, CEO and co-founder of Viaspace

promoted as an almost magic crop that ordinary farmers could grow and squeeze the oil out of to power their engines,” said Carl Kukkonen, CEO and co-founder

which weren't available, such as fields being used to grow rice paddy.

The plan seemed to good to be true, however, and in the end

ture of biofuels in Myanmar, despite the jatropha debacle. Whether other biofuel groups – and the government itself – have learned from the past remains to be seen.



The male jatropha flower.  
Photo: Wikicommons



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# Who's who in offshore efforts

## PETRONAS



### Petronas / Yetagun

The Yetagun natural gas field has changed hands more than once since the first appraisal well was installed in 1992. Currently owned by Malaysian state energy firm Petronas, the project was initiated by Texaco Co of the United States. Development started in 1996, but the following year Texaco sold its entire stake to the United Kingdom's Premier, which in turn sold its share of the project to Petronas in 2002.

A subsidiary of the Malaysian firm is the current operator of the Yetagun natural gas field, operating in a partnership with PTTEP, Nippon Oil Exploration, and Myanma Oil and Gas Enterprise, according to PTTEP's website. Production began at the site in 2000, and the addition of four new wells in 2004 was thought to double Yetagun's capacity. The site produced an average of 376 million cubic feet per day during the second quarter of 2013, PTTEP has reported.

Located in the Gulf of Martaban, the concessions comprise blocks M12, M13, and M14 and cover 24,130 square kilometres.



Photo: MT Archives

a trip to Europe last year, in which she highlighted the need for "democracy-friendly investment" by companies such as Total. The firm began commercial production of the offshore Yadana Gas Field in 2000 following an investment outlay of about US\$1 billion. With Total serving as operator in a consortium including Chevron, PTT Exploration and Production of Thailand, and Myanma Oil and Gas Enterprise, the field has averaged 18.54 million cubic metres (654.7 million cubic feet) per day from 2001 to 2010, according to its website. With some 30 years of estimated reserves, gas from Yadana fuels Thai power plants as well as the domestic market.

Company officials have also mulled further activities in the country, and Total is one of the 61 firms currently shortlisted for Myanmar's 2013 offshore oil and gas tender.



## CNPC

### Pipeline firms

The pipeline project involves two separate pipelines, the Southeast Asia Crude Oil Pipeline (SEAOP) and the Southeast Asia Gas Pipeline (SEAGP), crossing Myanmar from Rakhine state to China and delivering overseas crude and offshore gas to the country's northern neighbour. The organisation behind the twin pipelines is understood to be a conglomerate majority owned by China National Petroleum Corporation. Other partners include two South Korean firms (Daewoo and Korean Gas Corporation), two Indian firms (Gas Authority of India Limited and Oil and Natural Gas Corporation), and state-run Myanma Oil and Gas Enterprise. While the project pumped its first gas in late July, the enterprise has drawn protests over environmental

and safety concerns. Protesters also said the contract, which was signed under the military regime, should be revisited and that Myanmar should not export gas when three-quarters of the population lack electricity.

The gas pipeline is designed to transmit up to 12 billion cubic feet of natural gas a year, though it will initially transmit only 5.2 billion in the first phase, according to SEAGP.



**DAEWOO INTERNATIONAL**  
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### Daewoo/Shwe

South Korea's Daewoo International started production at the Shwe natural gas field on June 22 of this year, with a pilot operation of its onshore pipeline and sales to Chinese and Myanmar buyers beginning in July. The firm estimates there are 4.5 trillion cubic feet of gas available for exploitation from Shwe, Shwe Phyu and Mya in the A-1 and A-3 blocks, and called it "the largest oil and gas field in scale

discovered by a Korean company abroad in the past 30 years" in a statement announcing the start of commercial production.

Currently producing some 100 million cubic feet of gas daily, Daewoo says it aims to produce 500 million cubic feet daily by late 2014. The gas is to be sold largely to the Chinese National Petroleum Corporation for the coming 25 to 30 years – equivalent to the daily power usage of 670,000 homes.

Daewoo announced the discovery of Shwe in 2004, and the then-military government awarded purchasing rights to China in July 2008. With a controlling interest of Daewoo held by large Korean steelmaker Posco, the firm is also jointly exploring the AD-7 block adjacent to the Shwe field in the Rakhine basin with Woodside Petroleum Ltd of Australia, and has conducted onshore exploration activities as well.



### MOGE

Myanma Oil and Gas Enterprise (MOGE) is the 100 percent state-owned upstream producer. The firm in its present form dates to 1989, though it is the successor to the nationalisation of the Burmah Oil Company's Myanmar assets in 1963. MOGE participates in most domestic projects as a joint venture partner, and is regarded as a major source of Myanmar's state revenue.

Meanwhile, the Ministry of Energy is currently conducting a tender for 19 deep water and 11 shallow water blocks. Sixty-one companies are currently reviewing data, including industry heavyweights such as Total and Chevron, with the results of the tender expected to come later in 2013. Ministry officials told *The Myanmar Times* earlier this month that previous tenders had not drawn this level of international participation due to the sanctions.



### Total / Yadana

Although international oil and gas firms have drawn criticism regarding industry practices, French firm Total's activities in Myanmar have been singled out as worth emulating. Called "a responsible investor" by Daw Aung San Suu Kyi during



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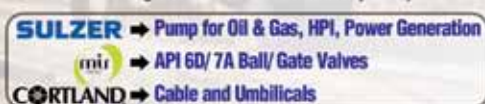
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## ENERGY

A Myanmar Times Special Report

### Editors:

Myo Lwin, Jessica Mudditt

### Photographers:

Kaung Htet, Aung Htay Laing, Ko Taik, Boothee, Fiona MacGregor, Chris Page,

### Writers:

Jonas Moberg, Mya Kay Khine, Jeremy Mullins, Fiona MacGregor, Ei Ei Thu, Jessica Mudditt, Bill O'Toole, Khin Su Wai

### Cover & Layout Design:

Tin Zaw Htway, Ko Pyo, Khin Zaw

### For enquiries and feedback:

myolwin@myanmartimes.com.mm  
jess.mudditt@gmail.com





# Global energy news update

## Japan's Abe to visit Middle East in nuclear push

THE prime minister of energy-poor Japan heads to the oil-rich Middle East this weekend in his latest push to promote nuclear technology exports, a spokesman said Friday, despite growing problems at the crippled Fukushima plant.

Shinzo Abe was due to leave Tokyo on Saturday for a six-day trip that will take in Bahrain, Kuwait, Djibouti and Qatar, with discussion of Japan's nuclear know-how expected to be on the agenda.

"Qatar and Kuwait have shown interest in Japan's nuclear safety technology," said an official at the foreign ministry.

"They don't necessarily plan to build a nuclear plant themselves, but their neighbouring countries do," the official said.

"Qatar and Kuwait are therefore concerned about a possible accident and any environmental impact that might be inflicted."

Japan has continued to push its atomic expertise as an important export, despite the 2011 catastrophe at the tsunami-hit Fukushima Daiichi nuclear power plant, where multiple meltdowns cast a pall of radiation over a swathe of the country's northeast.

An already-lengthy list of problems in the clean-up got longer this week when around 300 tonnes of highly radioactive water was found to have seeped from one of the 1000-odd storage tanks on the site.

Workers looking for other leaks on Thursday identified two more radiation hotspots near the containers, although plant operator Tokyo Electric Power (TEPCO) says they were dry and it cannot yet explain where they came from.

While the atomic catastrophe has put a crimp on Japan's own nuclear power generation, with all but two of the country's 50 reactors shut down, the government has been keen to push exports of its technology as part of efforts to boost infrastructure exports to 35 trillion yen (US\$350 billion) a year by 2020.

Abe, a supporter of nuclear power, visited Turkey in May as part of a wider Middle Eastern tour, signing a long-awaited deal to build a sprawling nuclear power plant on Turkey's Black Sea coast, in a milestone for the Japanese nuclear industry.

The agreement came a day after Japan signed a nuclear cooperation deal with the United Arab Emirates.

The foreign ministry official brushed aside suggestions that the latest setback at Fukushima might put a dampener on talks during the upcoming trip, saying the government does not expect them to have "any impact".

The nuclear shutdown in Japan has also increased the country's reliance on imported fossil fuels, of which the Middle East is an important source.

- AFP



Japanese Prime Minister Shinzo Abe. Photo: AFP

## Technip to lay world's deepest gas pipeline in Gulf of Mexico

FRENCH firm Technip will lay the world's deepest gas pipeline for energy giant Shell in the US Gulf of Mexico, the oil services company said in a statement on Friday.

This was the second big announcement by Technip in 10 days concerning deep-sea pipelaying.

In the latest statement, the company said it was awarded "an important engineering, procurement and installation contract for the development of subsea infrastructure for the Stones field," at a depth of approximately 2900 metres (9500 feet).

The project will be the deepest floating, production, storage and offloading (FPSO) unit in the world and Shell's first in the Gulf of Mexico, Technip said, without specifying how

much the contract was worth.

"With the award of this high-profile project, Technip confirms its subsea leadership and keeps differentiating itself through innovation to remain at the forefront of frontier projects," Technip's Senior Vice President for North America Savid Dickson said.

On August 12, Technip said that with Norwegian shipping group DOF it had won contracts worth 1.35 billion euros (US\$1.8 billion) involving the construction of the biggest pipelaying ships of their type for Brazil.

Technip said that they had won eight contracts from Brazilian oil group Petrobras to lay flexible pipelines at great depth.

- AFP

## Iran's envoy to UN nuclear watchdog quits

IRAN'S representative to the UN's International Atomic Energy Agency (IAEA), Ali Asghar Soltanieh, announced his resignation on Thursday without giving any reason, the Fars news agency reported.

"My mission is finished ... and I return to Iran with satisfaction," said Soltanieh, who has held the post since 2005.

On August 15, new President Hassan Rowhani named Ali Akbar Salehi to head Iran's Atomic Energy Organisation as part of his team.

Salehi, who holds a doctorate in nuclear science from the Massachusetts Institute of Technology, already headed the organisation between 2009 and 2010 before taking up the post of foreign minister under former president Mahmoud Ahmadinejad.

Meanwhile, foreign ministry spokesman Abbas Araghchi was quoted by the press Thursday as saying "a new ambassador (to the IAEA) has been chosen and will be announced soon."

Western countries and

Israel suspect Iran's nuclear program is cover for a drive for a weapons capability, an ambition Tehran strongly denies.

The IAEA has been probing the program for the past decade, and a number of international sanctions have

been slapped on Tehran for its refusal to stop enriching uranium. That process can lead to producing the fissile core of an atomic weapon.

Talks between Tehran and major world powers have so far failed to yield an agreement.

- AFP



Iran's envoy to the International Atomic Energy Agency (IAEA) Ali Asghar Soltanieh. Photo: AFP

## US scientists claim world's most accurate clock

US scientists said last week that they have built the world's most precise clock, whose ticking rate varies less than two parts in 1 quintillion, or 10 times better than any other.

The clock, made from the element ytterbium, could be used for technological advancements beyond timekeeping, such as navigation systems, magnetic fields and temperature.

"The stability of the ytterbium lattice clocks opens the door to a number of exciting practical applications of high-performance timekeeping," National Institute of Standards and Technology physicist, and co-author of the study revealing the clock, Andrew Ludlow said in a statement.

While mechanical clocks use the movement of a pendulum to keep time, atomic clocks use an electromagnetic signal of light emitted at an exact frequency to move electrons in cesium atoms.

The physicists built their ytterbium clocks

using about 10,000 rare-earth atoms cooled to 10 microkelvin (10 millionths of a degree above absolute zero) and trapped in an optical lattice made of laser light.

Another laser that "ticks" 518 trillion times per second triggers a transition between two energy levels in the atoms. The clock's high stability is owed to the large number of atoms.

The new clocks can achieve precise results very quickly.

Technicians must average the current US civilian time standard, the NIST-F1 cesium fountain clock, for about 400,000 seconds (about five days) to obtain its best performance.

But the new ytterbium clocks can achieve that same result in about one second of averaging time.

The study was published in the journal *Science*.

- AFP

## South Africa aims to start shale gas exploration by April

SOUTH Africa may start exploration for shale gas before elections in April next year, the trade minister said last week.

"We need to advance the work on taking a decision on shale gas exploration," said trade and industry minister Rob Davies almost a year after lifting a freeze. "We want to move before the end of this administration."

The current government's term ends next April.

Africa's largest economy, heavily reliant on coal, is mulling nuclear power and shale gas as new energy sources.

The country's semi-desert Karoo region potentially has one of the world's largest

untapped shale fields.

The reserves are perhaps even larger than those of its neighbour Mozambique, Davies added, after massive discoveries there in the last three years.

"The gas fields of Mozambique which have just opened have about 100 trillion cubic metres of gas, and the shale gas deposit - some of the estimates would suggest that it is multiples of the Mozambican," he said in a news conference.

"If this was the case, this could be a very, very significant game changer in terms of the energy situation in South Africa."

If the estimates are accurate South Africa could have gas equal to 400 years of

crude oil imports at the current rate, according to a study released last year and commissioned by Anglo-Dutch energy giant Shell.

Authorities last September lifted a freeze on shale gas exploration in the Karoo, sparking a national debate and concerns among environmental activists about the effect on water quality in the arid region.

But Davies was reassuring: "of course we are not going to do this in any kind of irresponsible way."

Its exploitation could create up to 700,000 jobs in a nation where more than one in four are unemployed.

- AFP





A woman in a creek near Myitsone dam. Photo: Boothee

## Greenpeace ship defies Russia by entering Arctic route

GREENPEACE said on Saturday it had defied the Russian authorities by sending its icebreaker through an Arctic shipping route to protest against oil drilling in the fragile ecosystem.

Earlier this week the global environmental group said Russia had refused its ship permission to enter the Northern Sea Route on several occasions citing concerns about the icebreaker's ability to withstand thick ice.

Greenpeace has called the move "a thinly veiled attempt to stifle peaceful protest".

In defiance of the Russian authorities, the Greenpeace ship Arctic Sunrise entered the Northern Sea Route early Saturday morning to protest plans by the country's top oil firm Rosneft and its US partner ExxonMobil to drill near the Russian Arctic National Park, the group said.

"We refuse to let illegal attempts by the Russian government to stop us from exposing dangerous oil drilling in the Arctic.

"The Russian Arctic National Park is a special place full of rare and threatened Arctic wildlife, and faces an infinitely greater threat from reckless oil companies than a fully equipped Greenpeace icebreaker," Christy Ferguson, Greenpeace Arctic Campaigner aboard the Arctic Sunrise, was quoted as saying.

"If Rosneft and ExxonMobil bring in offshore drilling platforms they will risk catastrophic blowouts and spills that could devastate the region," said Ferguson, adding the two oil majors "rely on secrecy and evasion."

Greenpeace said the plans to drill in the protected ecosystem were in contravention of Russia's own environmental laws.

Rosneft, headed by one of Putin's closest confidants, Igor Sechin, did not immediately react.

Both Russia and the United States hope that the global warming gradually melting the Arctic sea ice will help them tap the vast oil and natural gas resources believed to be buried in the region.

Putin has pledged to turn the Northern Sea Route into a key shipping artery, part of the Kremlin's bid to mark out its stake over the energy-rich Arctic. - AFP

# Ongoing hydroelectric projects unleash flood of criticism

BILL O'TOOLE



botoole12@gmail.com

**A**S controversial dam projects continue to pop up along Myanmar's riverways, activist groups warn that, rather than developing the nation, these projects are actually contributing to instability, environmental damage and ethnic conflict in many rural areas.

The most well-known project is the Myitsone dam in Kachin State. President U Thein Sein halted construction on the dam in 2011, citing environmental concerns. While members of the Chinese government have recently expressed their doubts about whether or not the project will be restarted, villagers in the

surrounding area report that the construction equipment and building materials from the site have yet to be removed.

Despite concerns and setbacks, the Union Government appears as committed as ever to hydropower. In February the Ministry of Electric Power reported to parliament that six new dam projects had been approved along the Salween River in Shan and Kayan states.

Activists of all stripes, however, have decried the new developments.

U Maung Maung, of the Mandalay-based environmental group Green Activities, has often spoken out about the need for international best practices and environmental assessments on such sites, calling for greater transparency in the decision-making and building process. Speaking to *The Myanmar Times*, he said

that even when environmental impact assessments are carried out, the results are all too often kept confidential and out of the people's hands.

In addition, the environmental advocacy group Salween Watch, in their 2013 update on dam construction in Shan State, documented several communities in which projects have brought massive deforestation and damage to the local ecology.

The group's report also said that dam construction is actively contributing to the armed conflict that has come to define so many rural areas.

In a recent press release, Salween Watch warned that the recent build-up of Tatmadaw troops along the northern stretch of the river is directly related to dam projects.

"It is feared that the Burmese Army will use force to seize the SSA-N territories ... The seizure

of the Kokang area has enabled Chinese dam-builders to proceed with the giant Kunlong dam on the Salween, where construction of access roads to the site by Asia World Company is almost completed."

Sai Khur Hseng, a spokesperson for Burma Rivers Watch, agreed. "These are the costs of dam-building in Burma's war zones," he said.

Naw Phyo Phyo, a spokesperson for the Karen Women's Organization, said earlier this year that the government and foreign investors should halt all hydropower projects until "genuine peace" comes to the country's conflict areas.

Karen activist Pati Saw Ko concurred.

"We all want development, but development must not bring suffering and difficulty for local communities."

## Argentine dam deal awarded to Chinese, domestic firms

THE construction of two hydroelectric dams in Argentina's Patagonia region has been awarded to a consortium of domestic and Chinese companies, President Cristina Kirchner announced Wednesday.

Local Electroingenieria e Hidrocuyo and China-based Gezhouba Group Company Limited secured the deal, Kirchner said.

Those losing out include Alstom (France), Odebrecht (Brazil), Isolux (Spain), Sinohydro (China) and Hyundai (South Korea).

The dams, to be built on the Santa Cruz river, will have a production capacity of 1.740 megawatts, or 4.7 percent of national electric production.

Kirchner said the new construction would mean that the Santa Cruz river would have the second largest dam after Yacyreta, a dam located on the Parana river and jointly administered by Argentina and Paraguay.

Argentina relies heavily on the Yacyreta dam, which covers 22 percent of the country's electricity needs.

The Santa Cruz river, which extends some 385 kilometres (240 miles), originates in the Andes and flows into the Atlantic Ocean.

Argentine officials say construction, which will begin in December, will take five years and create 5000 jobs.

The two new dams will be named after former governors of Santa Cruz state - Jorge Cepernic and Nestor Kirchner, who was president from 2003 and 2007. - AFP



Santa Cruz River. Photo: Wikicommons





# End looming for illegal roadside petrol sales

*The rise of legitimate filling stations, with their stable, low prices, are beginning to discourage illegal roadside sales*

EI EI THU

91.eiethu@gmail.com

**T**HE illegal roadside sale of petrol remains a lucrative business in Yangon, but profit margins are getting smaller as the number of private petrol stations increase, several petrol sellers told *The Myanmar Times*.

Roadside petrol sellers have always been a staple around Yangon, particularly so during times when the government was limiting the supply and cost of gasoline.

Up until a few years ago, however, roadside dealers caught selling petrol without a permit faced steep fines and potential punishment, and often had to bribe authorities. But at the time, business was so profitable it was worth the

risk, say sellers.

Now, they face a different kind of threat – not from the government, but from the free market system. With more petrol stations in Yangon, their business has declined.

"I have been selling petrol and diesel for a long time, about 13 years in Kamaryut," U Myint, 42, said. On average, he earns K25,000 and sells about 15 gallons of petrol and diesel a day. "We made a lot of profit before, but now the service stations are everywhere so we are down in the trade," he said.

Still, there is a market for the small roadside sellers, U Myint said. Most customers seek out the illegal traders when the electricity goes out in their shops, or when they are stuck in a traffic jam and find themselves far from a commercial station. Others, he said, prefer not to go to the petrol station during the rainy season and will

instead use a roadside seller they already know.

U Myint said he buys the petrol he sells from several sources, often from private gas stations but sometimes from other drivers, both private and government. He said profits are good enough to support his family – and much better than his previous profession in the cement and brick trade.

"Roadside petrol sales can support my family and help me save a little money," U Myint said, adding that profits depend on circumstances. "If electricity is regular, petrol stations are everywhere and sales are not good, then I will change to another job – maybe a rice station or electrical shop."

Another roadside petrol seller, U Saw Thein, 52, from Hlaing township in Yangon, has worked in the business of illegal petrol for five years. He said profits are better now under the free market because he no



Illegal petrol stations such as the one pictured are less common than they used to be. Photo: Kaung Htet

longer has to pay bribes to officials. However, he is not getting rich from his sales, he said, selling only about 10 gallons of petrol and diesel on an average day.

"It is enough to support my family," U Saw Thein said. "We live in a roadside shop and can count beads and listen to Buddhist literature with a CD player ... We will [sell petrol] as

much as we can, but this job is not making me rich – I have just enough to eat and live."

Ko Aung Khaing, 25, lives in Sanchaung and has been working as a roadside petrol seller for over seven months. He buys petrol and diesel from a private petrol company. Most of his buyers are taxi drivers and private car owners.

"I undercut the price at petrol stations by about K100 or K200, so I'm able to sell about a tank's worth a day," Ko Aung Khaing said.

He enjoys his work but admits that times are getting tough.

"Private stations are everywhere," he said, "so sales in the roadside petrol shops are lower than before. It's difficult for me."



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Tel: +951-579038, 579039, Fax: +951-665193  
Email: [mdoffice@united-engineering.net](mailto:mdoffice@united-engineering.net)

UE Office Complex

UE Building  
Corner of Wayzayantar & Yadana Rd,  
Thingangyun Township, Yangon 11071, Myanmar  
Tel: +951-573629, 572281, 560378, Fax: +951-571288  
E-mail: [uzawmin@united-engineering.net](mailto:uzawmin@united-engineering.net)



# How dangerous is life on an oil tanker?

JESSICA MUDDITT

jess.mudditt@gmail.com

**I**N a leafy area along Shwe Gon Daing Road, there's some serious training underway at MTM Ship Management's manning and training centre. There are classrooms full of young men in white shirts pouring over notebooks while their teachers animatedly issue instructions.

It goes without saying that oil and chemical tankers are big business globally – however training the industry's seaman on safety measures is a quieter, yet equally valuable understanding.

"The cargo we carry is often flammable, very highly toxic, corrosive – in short, it can be very dangerous to human health," said Captain Kyaw Min, head of MTM's fleet personnel.

It's so dangerous, in fact, that if a seaman was exposed to the carcinogenic cargo while in the tanker, there is a real risk of contracting leukemia.

"So we are doing very serious training here," he said.

Most of the 14 ships MTM owns and runs are chemical tankers carrying what is known as "liquid bulk". It also acts on behalf of owners in a management function, which includes administering crew wages (which can amount to US\$1 million a year per ship), ship maintenance, accounting for operational expenses and dry docking expenses. MTM



One of MTM's tankers. Photo supplied by MTM

charges the ships' owners – some of whom reside in Japan and the United States and include companies such as Shell – management fees, which is what makes the business a profitable one. In

total, MTM operates 28 chemical tankers, eight oil tankers and two product tankers.

MTM's tankers ply routes all across the world – from the US to South America (MTM's main route), to Japan from the major oil producing area, the Persian Gulf, as well as an Asian route that encompasses Taiwan, Indonesia and Singapore – because "they are all oil consuming countries," Captain Kyaw Min said.

Singapore cannot produce oil but it has enormous refineries, including Shell's.

Domestically, MTM has a smaller sized tanker that travels from Singapore to Myanmar, which delivers oil to Myanmar and carries diesel to Singapore.

Under British rule, Myanmar was an oil-producing country. Across the Yangon River in Thanlyin, there is a refinery that was set up by the British and which has still the "potential to be a profitable venture," said Captain Kyaw Min. It was nationalised in 1962 and has since fallen into disrepair.

"A lot of trees and vegetation has grown up around it, but the towers and tanks are still there; plus the jetty and pipelines," he said.

There has been talk that it will be upgraded with assistance from Japan – though the project will of course take years to complete.

Meanwhile, as reports emerge in the media about the exploitation of seamen and corrupt practices becoming more common, such as issuing false Department of Marine Administration certi-

icates for unqualified candidates, it is reassuring to see firsthand how stringent reputable companies are about safety.

"No deaths have occurred on my ships," said Captain Kyaw Min, who has 15 years of experience. According to the United Nations International Maritime Organisation, every year there are approximately 100 deaths on tankers, all of which occurred in the enclosed space of the cargo area.

Rather than the dramatic explosions on tankers occasionally documented by the media, it is the cargo area that poses the greatest risk to life on a tanker. As Captain Kyaw Min explained, entering the cargo area, which on average holds about 30,000 tonnes of chemicals, is absolutely prohibited until the cargo itself has been emptied.

"After discharge and while en route to the next port to pick up the new cargo, we do the cleaning. Only once this has been completed can we go in to check. Even then a person should never enter alone – a minimum of two is necessary."

The entire tank is cleaned according to stringent requirements set by international conventions and industry bodies. There are various procedures, including steaming and spraying the area with chemicals. The walls are then washed and samples sent to a laboratory to test for traces of harmful chemicals.

Another reason why the cleaning is so rigorous is that a tanker may subsequently carry a differ-

ent type of cargo that could have fatal results if mixed. For example, if lubricant oil were to mix with ethanol, "Everyone would die," said Captain Than Nyaing Tun, MTM's head of training and personnel.

In addition to the above mentioned risks, the cargo area lacks natural light and has depleted oxygen levels – sometimes to the point where fainting is a likelihood. The Safety of Life at Sea Convention of 1974 (known as SOLAS) requires that a wide variety of personal protective equipment must be on onboard. There are also different types of firefighting equipment.

"Each time there is an accident, SOLAS is amended to make it more and more stringent," said Captain Mow Kyaw, MTM's training principal.

An important step in improving the safety of seamen on tankers worldwide is the Maritime Labour Convention, which came into force on August 23. In addition to tightening up safety requirements, it also includes measures to better ensure the wellbeing of seamen, such as adopting social security requirements set by the International Labour Organisation (ILO).

Senior Captain Zaw Naing Cho has a total of 25 years of experience on tankers, including 15 years with MTM. He studied chemistry at university and was initially hoping to secure a government post.

"But I decided against it in the end," he said. "I feel more free out at sea."



A breathing apparatus set is worn when entering the enclosed space of the cargo area. It prevents suffocation due to lack of oxygen and poisoning due to harmful chemicals. Photo: Jessica Mudditt





# How electricity changed my life

*Ma Thein Nu has lived two-thirds of her life without electricity. Now 66, she will never forget the day electricity arrived in her village near Sittwe in Rakhine State. From facilitating late-night parties to keeping ghosts at bay, electric lights made life easier and better, she says. And when she and her family lost their home during ethnic conflict last year and found themselves living without electric power again, the grandmother of three realised just how much she'd come to rely on electricity. Ma Thein Nu told her story to Fiona MacGregor*

FIONA MACGREGOR

fionamacgregor@hotmail.co.uk

**W**HEN I was a young woman all we had to live by was candle-light. I was 42 before we got electricity in our village and the first time they switched it on, everybody started to celebrate. My daughter was 12 at the time and she and all the other children were singing and dancing – I felt like singing and dancing too.

Inside I felt very proud. I can't explain exactly why I felt that way, but I knew something significant had happened.

Some things didn't change a great deal: After all, it was only an electric light. We still cooked by burning wood and much of life went on as before. But in other ways things immediately got better.

I don't think electricity signifi-

cantly altered the important things in our culture, but what did change, and what was so wonderful, was that we were able to mix together socially in the evenings.

Before we had electricity, life was quite boring. In the evenings the only thing to do was to sit under your house with your family. When it got dark we would all go to bed. And that was how it was night after night.

So in those days we would be in bed by about 7pm. After we got electricity I wouldn't go to bed till 10pm, 11pm, even midnight, even though I am not so young anymore. Living with electricity is good fun. We can stay up talking late into the night, and friends and neighbours can visit or we can visit them. Life is much more interesting.

It was quite a while after we got electricity that the first people in our village got a television. That was very exciting. Everyone would

go to the house where the television was and the people had a video so we could all watch the films. Sometimes 20 people would all be crowded round the television.

I've heard people say that television can change people, but I am not sure that's true. Some of the girls wanted to wear short skirts and clothes like the people they saw in the films, but I don't think it really changed them. One thing I do remember, though, was seeing the big houses the people in the movies lived in and thinking, "How are we ever going to get something like that?"

After our house was burned down [during the Rakhine State ethnic violence of 2012] it was like going back to the old days – once again living without electricity. I realised what an important role it had come to play in my life, and I really can't think of anything good to say about a life without it, apart



Ma Thein Nu is waiting for an electricity supply to power a light and socket in her new house. Photo: Fiona MacGregor

from perhaps not having to pay for it. Candles are cheaper!

But having electricity also allows us to do more work in the evening to earn money. My daughter and granddaughters learned how to make beaded crafts from an NGO. Because we've not had electricity since we lost our house, they've only been able to do that during the day if they have time. When we get our lights back on they'll be able to do it in the evening too.

One thing I'd forgotten about was how scary it can be when it is dark and you have no electricity.

If it's dark I am so scared of ghosts, but when we have electricity I can put the light on and I am

not frightened at all.

I feel proud that we are going to have electricity again soon. Life has been very hard since we lost our house and having electricity will help us feel we are getting back to normal again.

The government built these new houses for people who lost their homes and we moved in here about two weeks ago. They are still building things and there is no electricity yet, but we've told we're going to get it very soon.

In the meantime, my son-in-law has made something with a battery so we can have some light, but it will be much better when the electricity is working again.

## The high cost of harvesting sunlight

*Solar power is catching on among the very rich and – via government development projects – the very poor. But what about those in the middle?*

KHIN SU WAI

jasminekhin@gmail.com



IN developed countries, solar power is taking off as an environmentally friendly, cost-saving alternative to traditional sources of power. For those in developing countries like Myanmar, however, many of whom lack more reliable sources of power, solar power is more than a lifestyle choice; it's a necessity. But it's also a relatively recent option, one which – despite obvious benefits – remains, for the time being, too pricey for all but a few.

In 2008, while researching solar power for a university paper, I found it nearly impossible to find even a 1-foot-square solar panel. Even a big city such as Mandalay had only a couple of shops selling solar panels. By late 2010 and 2011, however, solar panels started being imported from China in larger numbers, and more and more electrical stores started selling them. As the media began incessantly highlighting solar

power as a way to access electricity in rural areas, public awareness grew.

Today, solar panels have been installed everywhere from mountainous areas like Chin State to villages in central Myanmar. Under a rural development scheme initiated by the Ministry of Border Affairs, 16,000 villages have had solar panels installed since 2012, with priority given to autonomous areas and places away from the national power grid. Even Sittwe, in Rakhine State, may be converted to solar power, according to a statement by MP U Aung Mya Kyaw which was published in the Rakhine independent news website Narinjara.

Other reports elsewhere have praised solar as a natural source for electricity and lighting in development project sites in rural areas. All these changes raise one question: Has solar power become indispensable in Myanmar?

U Zaw Win Min – manager of Sun Power, based in Yangon's Lanmadaw township, which has been in the solar panel market for 15 years – said that for all solar

panels' benefits, they have yet to really light up the market.

"People still need to know more about solar power and the right attitude they should have toward using it," he said.

The major factor casting a shadow over solar's future in the private sphere, he said, is the price tag.

"A person would have to earn about K3 million a year to be able to give priority to electricity, lighting and other lifestyle things. Those earning less than that will automatically spend their earnings

on food, medicine and education."

He said the costs are especially challenging in precisely the areas which could benefit most from solar energy, as the high start-up costs prevent people from benefiting from solar's long-term savings.

"We did some surveys in the rural areas," U Zaw Win Min said. "It is difficult for [rural people] to buy solar panels even by installment, let alone by down payment."

"They spend K100 or K200 for candles and are reluctant to spend K20,000 or K30,000 on solar panels."

Panels made in Singapore, Thailand and Japan are typically higher quality, he said, but come with a higher price tag compared to those imported from China, Taiwan or India. While the panels Sun Power imports from Singapore sell for K2000 a watt, Chinese-made panels go for around K500 a watt.

The difference adds up quickly – panels range from 5 to 10 watts up to 300W, with most being 200W – and U Zaw Win Min said the price difference makes it impossible to compete with Chinese brands.

In addition to companies like Sun Power, the Ministry of Industry 2 sells a range of solar panels, enough to power eight 3W bulbs, four 5W bulbs or six 7W bulbs. But solar power requires voltage regulators and batteries to store the power as well, and the prices of these materials also depend on the voltage and watts. The system also requires maintenance to keep the batteries and panels in good working order.

The high costs limit solar panel use to government projects and private donation ceremonies. U Zaw Win Min said the market could grow further if more donors were willing to help with initial investments by pushing the start-up cost to below, for example, the K200 it might cost to replace a fluorescent bulb.

For now, it's only the most affluent – or the most dedicated – individuals who can fit solar panels into their budget. Still, things are changing: As expensive as solar power seems today, prices have fallen 50 percent over the past five years, according to U Zar Ni of Manlay Zar Ni Electronics in Mandalay.

"Sales of solar panels increased three times in the past five years," U Zar Ni said, adding that sales have been brisk since 2010.

And as prices drop, it's becoming easier for the average middle-class city-dweller to make the jump to the benefits of solar.

"Many are buying more solar panels because they realise the benefits are greater than the amount of money spent on the system."

– Translated by Myo Lwin

*It's only the most affluent – or the most dedicated – individuals who can fit solar panels into their budget.*





နာချင်ရာ နာစမ်း . . .

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**Digital Blood Pressure Monitor**

လက်မောင်းပတ် ဒစ်ဂျစ်တယ်  
သွေးပေါင်ချိန်တိုင်း ကိရိယာ



**ES\*P311**

၁ နှစ်  
ဘာမယ်

- ✓ မှန်ကန်တိကျသော တိုင်းတာချက်
- ✓ ရိုးရှင်းလွယ်ကူသော အသုံးပြုနည်း
- ✓ ခေတ်မီဆန်းသစ်သော နည်းပညာ

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တန်ဖိုးမခရမယောင့်ရသူတို့အတွက်

နေ့စဉ် ကိုယ်လက်လှုပ်ရှားမှုအခြေအနေနှင့်  
ကယ်လိုရီ သုံးစွဲမှု ပမာဏကို တိုင်းတာဖော်ပြပေးမည့် ကိရိယာ



**MEDISAFE™ MINI**  
Blood Glucose Reader

သွေးချိုတိုင်း ကိရိယာ



၁ နှစ်  
ဘာမယ်

- သွေးစက်ကုတ် နာကျင်မှုလျှော့ချခြင်း
- မှန်ကန်တိကျသော အချိန် (၁၀) စက္ကန့်အတွင်း သိရှိနိုင်ခြင်း
- သွေးချိုတိုင်းတာမှုရလဒ်ကို mg/dl (သို့) mmol/L ဖြင့်  
ဖော်ပြပေးနိုင်ခြင်း
- သုတေသန သွေးစက်နှင့် ဖိစက်မှုမရှိဘဲ သွေး  
အဆင့်မြင့်တင်ပေးခြင်း
- Memory အမှတ်တံဆိပ် (၁၅၀) အထိ ထိန်းသိမ်းနိုင်ခြင်း
- စစ်သင်တန်းကို အလွယ်တကူ သိရှိနိုင်ခြင်း

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တိကျလျင်မြန်စွာ တစ်စက္ကန့်အတွင်း တိုင်းတာနိုင်သည့်

**TERUMO Ear Thermometer**  
EM-30CP LB/R



၁ နှစ်  
ဘာမယ်

Just 1 second



အသက်အရွယ်မရွေး အသုံးပြုနိုင်ပါသည်။

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