

# Levering into Middle Eastern and African gas markets with LNG

Prepared for Flame



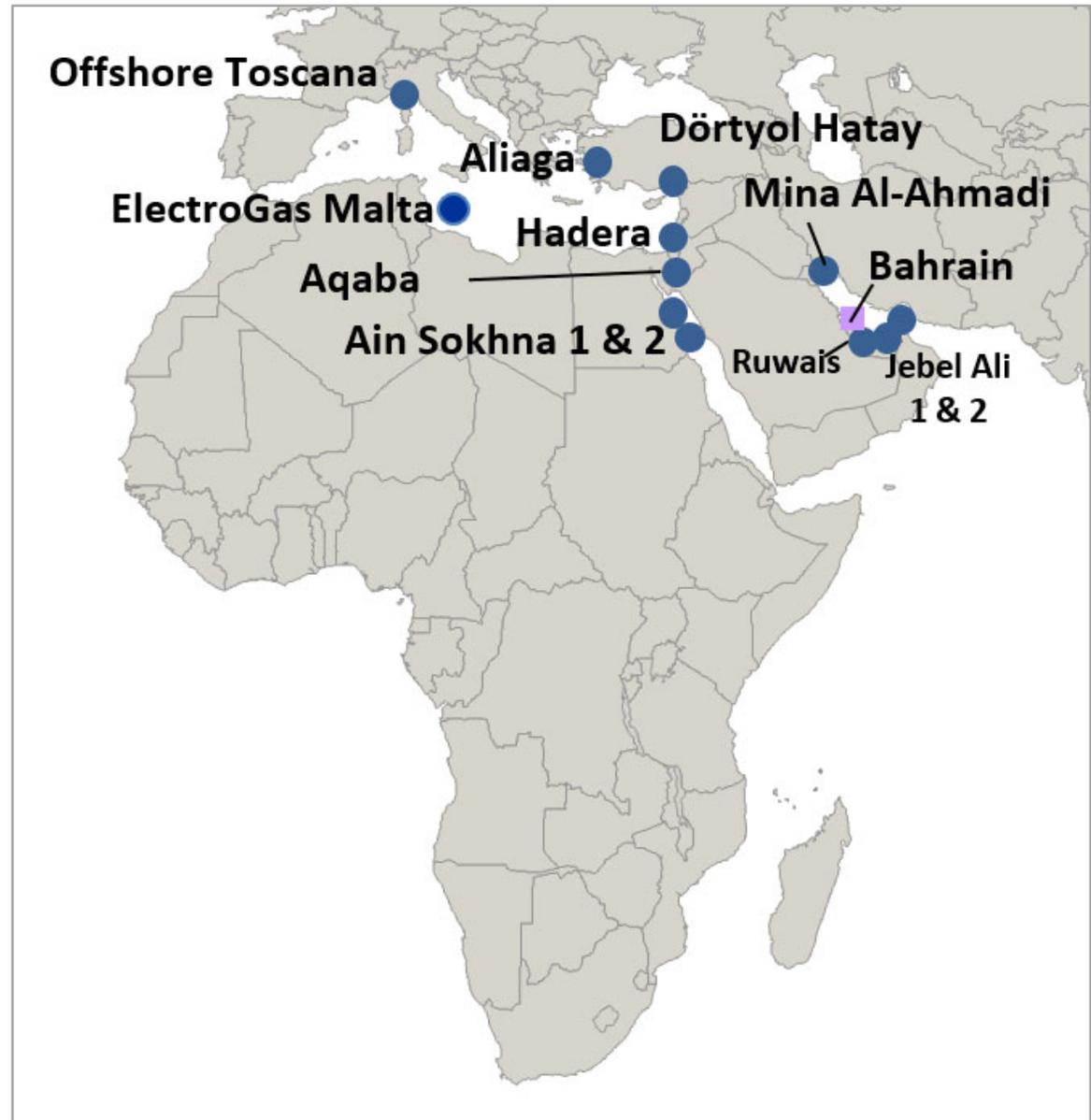
14 May 2019

# Growth story for LNG into the Middle East has largely played out

- LNG has largely been inserted into the available opportunities – with summer cooling load as a key driver
- With gas resources in the East Med, role of LNG will be diminished in the Near East
- Over time, from an economically rational perspective, solar penetration will increase, leaving the potential for gas at the beginning and end of day. The 'California duck' comes to the Middle East
- In the longer term, concentrated solar power (CSP), which is dispatchable, could begin to compete with gas as costs fall. It's already deployed in Spain, Morocco, Egypt and Dubai
- Enduring advantages of gas to power remain: fast construction schedules, mid-merit economics, fast ramp rates for intermittency cover
- Strong creditworthy counterparties in the Middle East, with clear leadership, making sensible decisions
- New LNG opportunities are about aggregating demand
- LNG to power and renewables are policy led in the Middle East, so advocacy – making your case directly is important

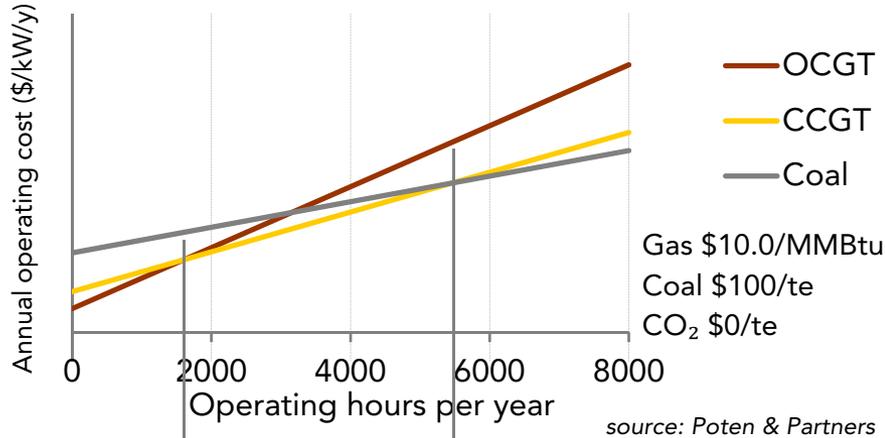
# Existing FSRUs and FSU

- Cyprus – delays in decision making; the inertia when there's the possibility of your own gas
- Israel - backup
- Lebanon - fuel displacement
- Egypt – the LNG play is disappearing
- Jordan – will end up being supplied by pipeline
- Dubai – replacement of liquid fuels; security of supply

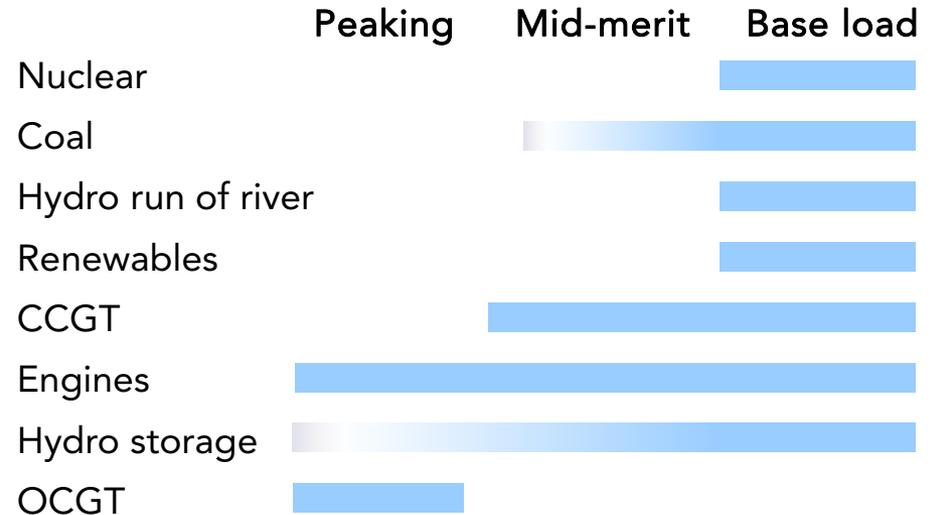
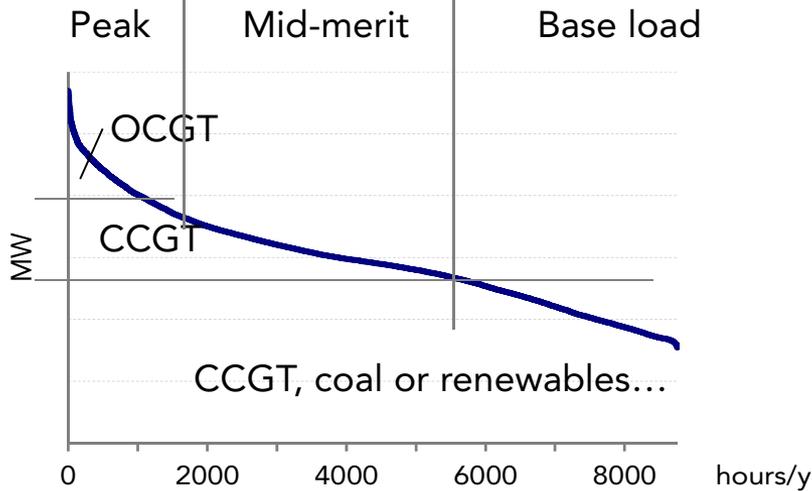


# Enduring advantages of CCGTs

Annual cost of plant operation, \$/kW/y

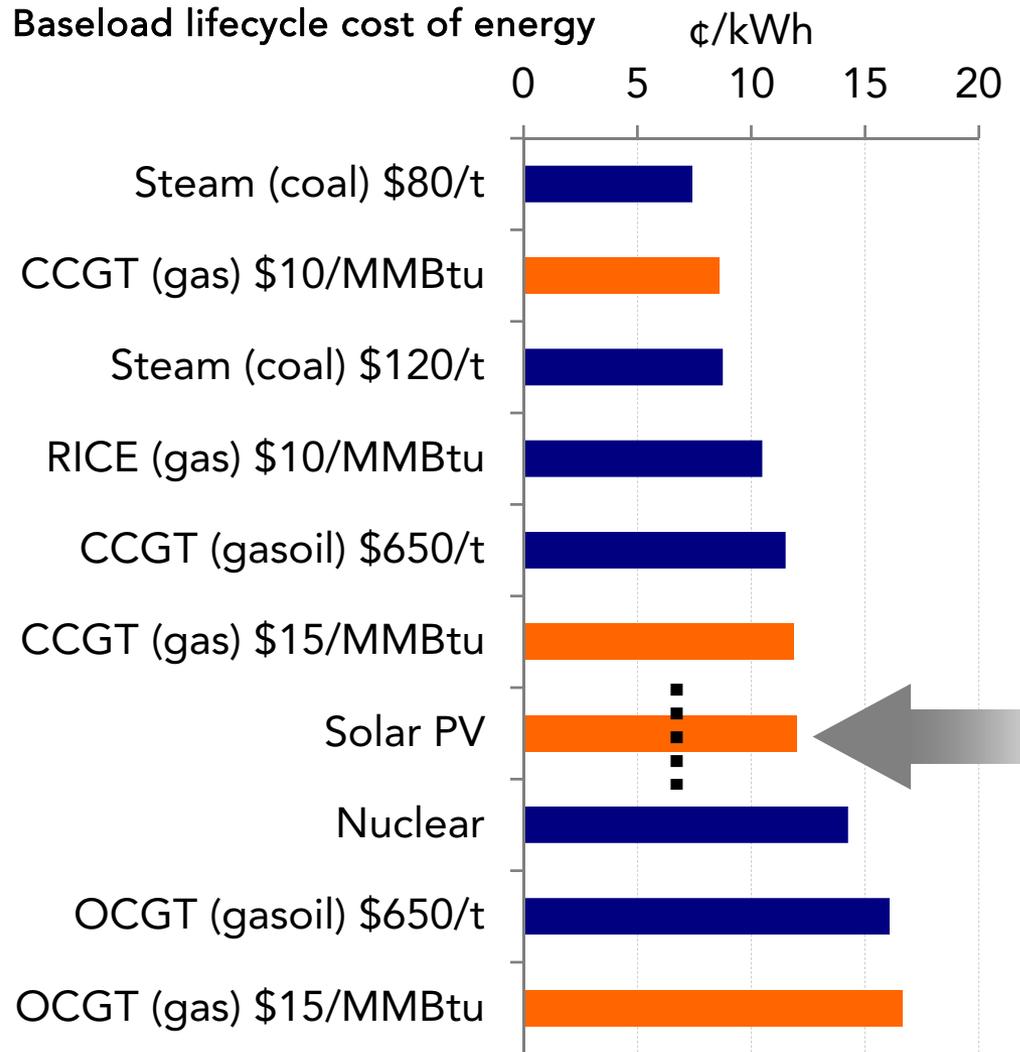


Load duration curve



# But the risk is that gas gets squeezed by solar

- With renewables, still need some form of reliable power
- Solar takes the diurnal (daytime) load, and gas gets squeezed into the beginning and end of day
- Dual benefit of solar is that it could be built out to exceed demand with the surplus used for desalination by reverse osmosis



RICE: reciprocating internal combustion engine.

# Longer term gas' peaking role could be compromised

- CSP, using molten salt, allows you to generate power after daylight hours
- In Chile, the cost of energy from dispatchable CSP with heat storage is less than gas-fired CCGT with LNG
- Current global installed capacity is small, but proven at utility scale (60MW plants)
- Eventually, batteries could eliminate peaks in demand that could be serviced by gas
  - e.g. Arizona Public Service Electricity Company

Abu Dhabi, largest CSP plant in the world, 100 MW



Source: Shams Power Company

# LNG players need to be thinking in terms of 'wrapped solutions'

- For long-term success in the Middle East, LNG companies may need to partner with renewables players so that you can deliver an electricity solution regardless of the power source
  - The example of Siemens
  - Total is a partner in the Abu Dhabi's Shams 1 CSP

# From an LNG import perspective, Africa is a difficult story

- There are opportunities for gas as a substitute fuel in North Africa
- In Sub-Saharan Africa, history of LNG to power hasn't been good
- Many attempts to do LNG projects which haven't succeeded. This is because of downstream institutional issues
- There needs to be political stability and project management capacity
- Gas to power is also small in scale, so sizing LNG to available power demand is the economic challenge
- There are no creditworthy electricity companies; private finance isn't available
  - Not just hire of the vessel (\$30-40m/year). Customers need to be able to stand behind the face value of the contract to purchase LNG; could be billions of USD.

# Core problem in Africa is that electricity sectors are challenged

- Governments want to make cheap electricity available. Tariffs are not commercially viable. Subsidies always lead to shortages
- Electricity utilities are not collecting what they're owed
  - e.g. Nigeria 1/3 of consumers have meters that work, 1/3 of consumers have meters that don't work, and 1/3 of people have no meters
- Non-technical losses are huge - theft
- General issues of governance at utilities, e.g. commercial project structuring
- Performance varies in Africa, but many electricity utilities are simply not financially viable. They can't invest because no one will lend them money because they won't get it back
- Necessary infrastructure and metering investments not made
  - Utilities need to make long-term investment: maintain and repair, install meters, make sure they get the money in. Then they become viable, then they can start building out.
- LNG could work with liquid fuels displacement, but the broader problem is the total quantum of gas demand. It's not big enough to sustain LNG chains
  - Could happen in Cote d'Ivoire. Potentially hundreds of MW of gas-fired power.

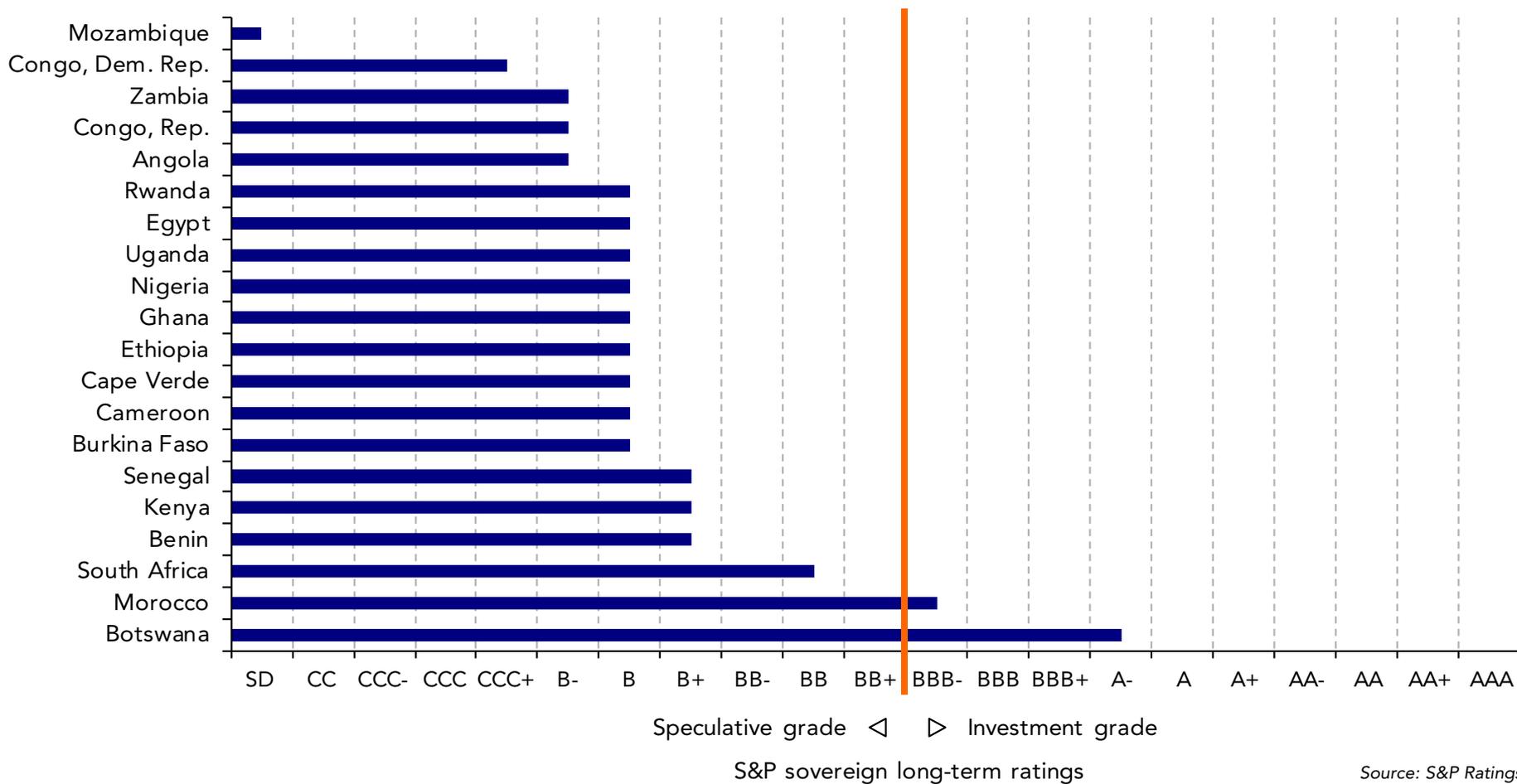
# Planned/ prospective FSRU terminals

- Morocco – big project, roles to be structured
- Senegal – window has gone
- Sierra Leone – not much of a power sector; large mineral resources in the area
- Cote d'Ivoire – government engagement; role of Chinese (coal)
- Ghana – ECG not financially viable; politics; Chinese (Bui hydro)
- South Africa – ESKOM is in a precarious situation



# Lack of credit capacity in Africa

## Sovereign credit ratings





# K-Electric of Pakistan is a case study in how electricity utilities can be turned around



## PROCUREMENT OF REGASIFIED LNG REQUEST FOR EXPRESSIONS OF INTEREST

K Electric Limited (the "Company") is developing a 900 MW gas based, combined cycle power project at Bin Qasim Power Station, situated at Port Qasim, Karachi, Pakistan (the "Project"), to be operated as a base load plant. The Company is considering an integrated approach for regasified LNG (hereinafter "RLNG") procurement to meet the gas requirement for the Project, under which the selected RLNG supplier will be responsible for supplying approximately 150 MMscfd of RLNG at the plant gate of the Bin Qasim Power Station. The Company is seeking an expressions of interest (EOI) from interested parties to participate in the bidding for RLNG supply for the Project.

Please submit your EOI by email to [aamir.rizwan@ke.com.pk](mailto:aamir.rizwan@ke.com.pk) with the subject line "RLNG EOI" no later than 11th July, 2017. The EOI should be submitted by post in a sealed envelope to the address provided herein below and by email from your official email ID identifying the party interested in bidding, providing a contact person for such interested party, designation, official address, phone number and email address for future correspondence. If the bidder is a consortium, the above information must be provided for each member of the consortium along with the designation of the lead partner. Only one EOI can be submitted for each consortium.

Any party responding to this request for EOI must be a shareholder in a company or a terminal developer that:

- (i) either
  - a. holds a valid provisional construction license, granted by Oil & Gas Regulatory Authority (hereinafter "OGRA"), for an RLNG receiving terminal in Pakistan; or
  - b. have applied to OGRA for the provisional construction license before the submission of Bids to the Company; and
- (ii) has obtained a No Objection Certificate from Port Qasim Authority for conducting feasibility, QRA and other studies to establish RLNG Floating Terminal at Port Qasim;

Any RLNG supplier that holds letter of commitment for at least 150 MMscfd terminal capacity from any of the terminal developers meeting the conditions set out in (i) and (ii) above is also eligible to submit EOI.

The EOI must include as an attachment (i) an affidavit certifying that the interested party/consortium meets the eligibility criteria stated above and (ii) copies of relevant documents demonstrating fulfillment of eligibility criteria. Any EOI without such affidavit and desired documents shall not be considered.

Other detailed evaluation criterion shall be stipulated in the RFP.

Only parties submitting an EOI in accordance with the above requirements shall be eligible to participate in the bidding process for the Project. The Company reserves the right to reject any or all of the EOIs it receives and shall not be under obligation to disclose its reason for doing so.

**Aamir Rizwan**  
 Director, Business Development  
 KE House, 39B, Sunset Boulevard, DHA Phase II,  
 Karachi, Pakistan.



**F.I.R.**

**INDIVIDUALS / INSTITUTIONS ENGAGED IN ELECTRICITY THEFT**

FILE NO DATED	PLACE OF OFFENCE	NAME OF ACCUSED
17/2009 14.01.09	UNIVERSAL PAPER INDUSTRIES C/O 1215, K.I.A, Karachi	Naseem S/O Naseem
2/2009 19.01.09	COTTON WEST D/16 1216 K.I.A, Karachi	Muhammad Jaseem S/O Ghousuddin
1/2009 15.01.09	MY LAND BUILDERS 1/11 76/1, Defence View, Phase-II & II, Karachi	Fazalullah S/O Hidayatullah Shahidullah S/O Saadullah (Chained S/O's are Cr.Pc)
4/2009 12.01.09	HIGHWAY FOUR Plot 25, Sector 2/A, Beakrish Goth K.I.A, Karachi	Abdul Qadir S/O Rafiq Khan (Arrest through warrant)
17/2009 22.09.09	HIGH TOWER 2/10, K.C. H. Society, Karachi	Shahid Tariq S/O Abdul Jaffar (Bail before arrest)
12/2009 28.09.09	AYYUB MERCANTILE FARM Near Begum Faran Dui, Mal Tago Khanpuri, Maanoo Goth, Karachi	M. Ayub S/O M. Younis
13/2009 15.4.09	CINCLASCOPE Opposite Male Billing Zone, Malir, Karachi	M. Munir S/O M. Ayub
14/2009 15.07.09	FLAT No.102 Babe-Urman Building, 13/5, BMCHS, Bansal Road, Karachi	Sikandar S/O Jiddiq
15/2009 15.07.09	FLAT No.103 Babe-Urman Building, 13/5, BMCHS, Bansal Road, Karachi	Iqbal S/O Abdul Aziz
17/2009 15.07.09	FLAT No.401 Babe-Urman Building, 13/5, BMCHS, Bansal Road, Karachi	M. Sohail S/O M. Siddiq
18/2009 15.07.09	FLAT No.401 Babe-Urman Building, 13/5, BMCHS, Bansal Road, Karachi	M. Sohail S/O M. Siddiq
16/2009 18.07.09	FLAT No. C/7 Crystal View 2 B/14, Block 1, Gulistan-e-Jahangir, Karachi	Yaqoob S/O Saeed
17/2009 18.07.09	SHOP No. 6 Crystal View SB 2/11, Block 1, Gulistan-e-Jahangir, Karachi	Jahangir S/O Abdul Latif
10/2009 11.48.09	CAPT GRAND 5.2/1 Opposite Metroplex Hotel, Abdullah Haroon Road, Karachi	Shaukat Muhammad S/O Muhammad Ahmed
11/2009 12.48.09	HOUSE No.17/601 Central Bus Stand University Road, P.B., Karachi	Sulaiman S/O Moini
18/2009 27.08.09	LEO (E) 17001, FOR ADVANCED SPURHS Plot 25, Khyabun-e-Rahat, Phase-II, Defence, Karachi	Taqi Jaseem S/O Abdul Jaseem Mrs. Raihan S/O Taqi Jaseem
11/2009 26.09.09	FLAT No.11 Block-5, Noman Grand City, Gulistan-e-Jahangir, Karachi	Arif Mughal
43/2009 03.10.09	LOOMIS FACTORY Plot No.1/5, Block 22, F.F Area, Cabool Town, Karachi	Asif Bekir
45/2009 03.10.09	ENGINEERING FACTORY Plot No.1/5, Area 5/1, New Karachi	Aliq Hakeem S/O Rameez Ali
34/2009 16.10.09	Source Iner Cancer Club Khyabun-e-Rahat, Phase-V, DHA, Karachi	Abdul Wahab (Owner of Club)
82/2009 19.10.09	LINK MARKET Plot No.2/1/1/2, Plumbar Street, Banjhore Town, Karachi	Sikandar Ali S/O Jaffer Ali

## THE CONSEQUENCES OF STEALING "ELECTRICITY" ... DISGRACE AND POLICE "ARREST".

KESC has already begun decisive action against those who steal electricity. FIRs are now being registered against such offenders. This helps us move towards ensuring a continuous and constant supply of electricity to our customers.

You too, should fearlessly report such individuals to us without hesitation. We will unmask them, bring them into the public eye, then hand them over to the law and their rightful destination.

For more information, visit our website  
[www.kesc.com.pk](http://www.kesc.com.pk)



# Development agencies have a role to play in establishing conditions that could assist LNG

- Development agencies can mobilize funding for capacity building in Africa, which yield long-term dividends
- There has to be stable energy policy. Parties need to know what is going to happen
- The right institutional framework is needed, with clear roles for entities involved
- Project management capability in government
  - e.g. Ghana. Three attempts at an LNG project, and it fell apart because it wasn't tied together.
- Electricity sectors have to be made viable, which means that they can afford to pay for fuel. Any LNG project is ultimately about selling electrons – and that's where it needs to be creditworthy
  - With entry of Meralco, watch Ghana.

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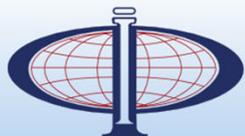
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