

SOLAR ENERGY IN IRAQ: FROM OUTSET TO OFFSET

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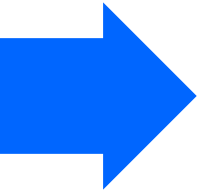
IRAQ ENERGY FORUM
28 – 29 March 2018



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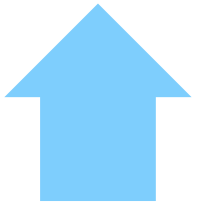
Iraq Electricity

Iraq Electricity Sector



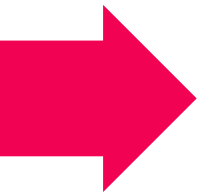
15,000 MW

Peak generated electricity (August 2017)



220,000 bbl/day

Crude oil burnt to generate electricity



\$11 million/day

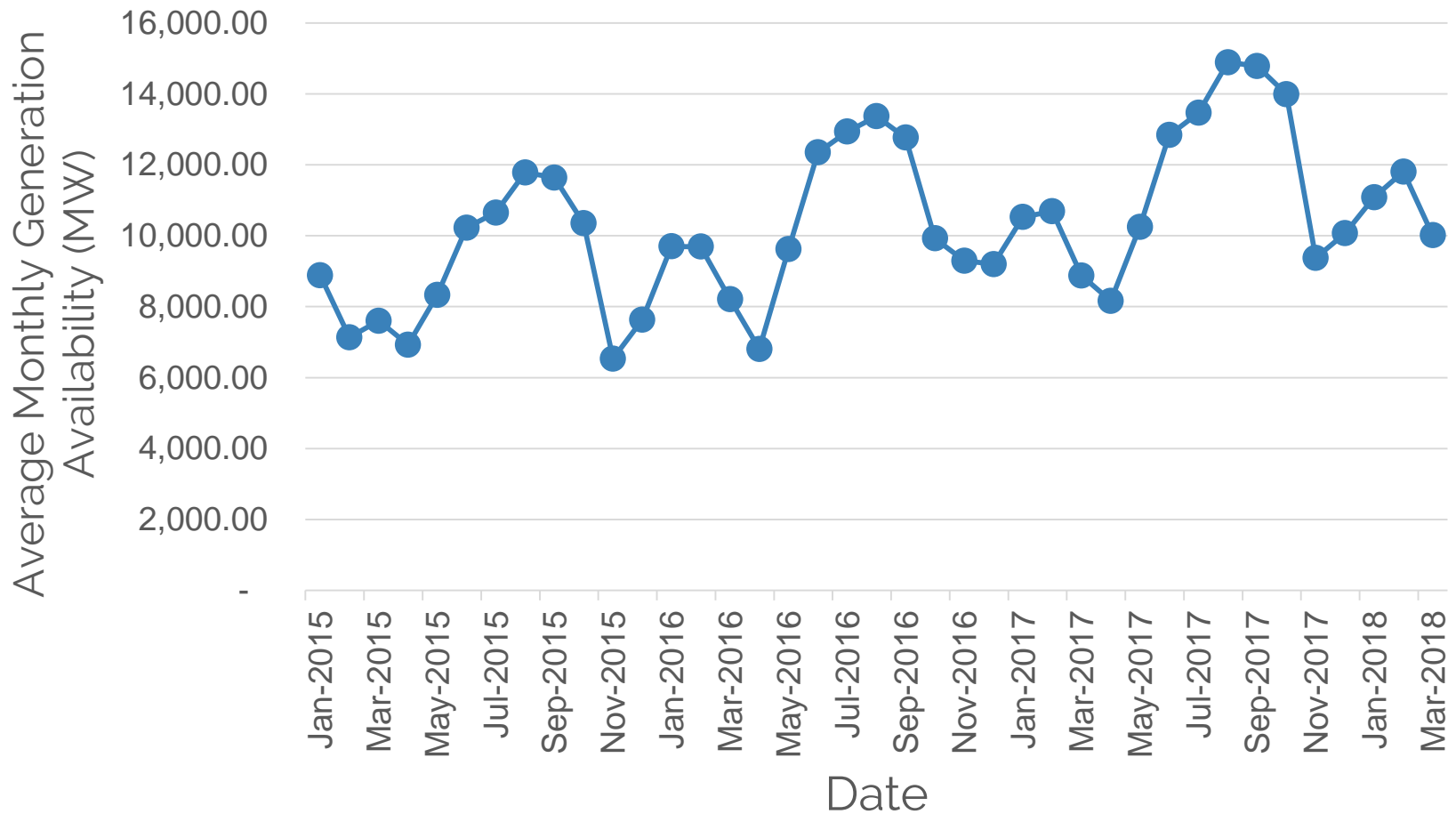
Cost of burning crude oil @\$50/bbl



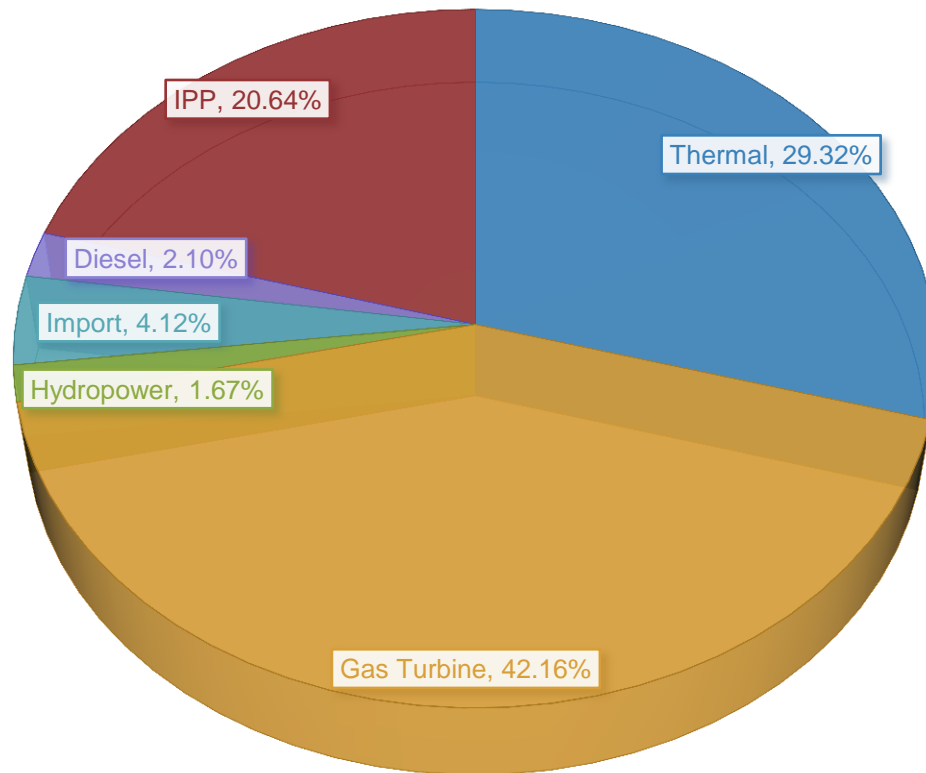
US\$5.6 Billion

Need to spend on reconstruction

Average Monthly Available Capacity

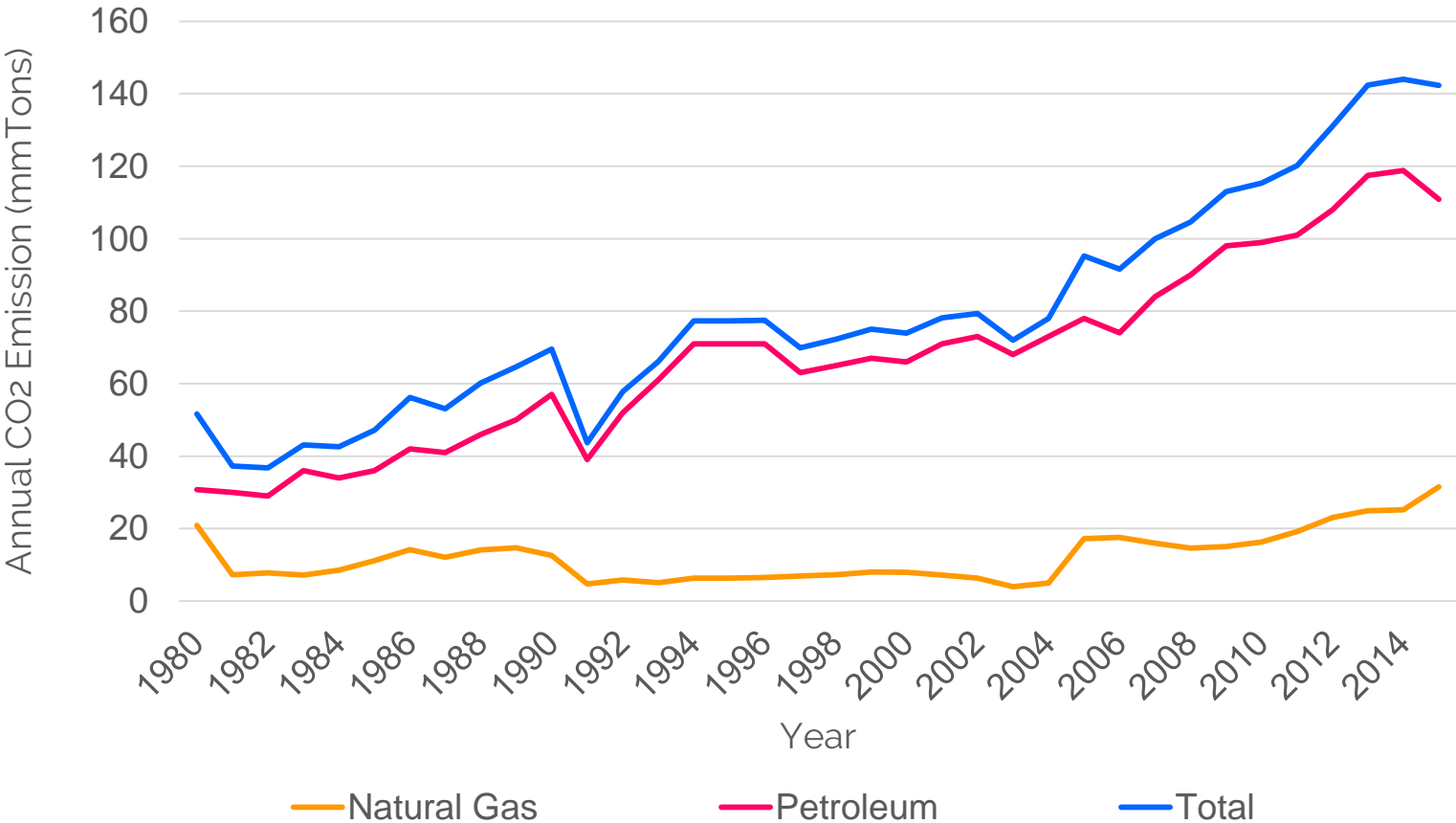


Electricity Generation March 2018



Less than 2% of total power generation comes from renewable energy, mainly hydro stations.

Iraq Annual CO2 Emission



How to Reduce 1 mm Tons CO₂ Emission?



750 MW

New build CCGT replacing oil fired power station



500 MW

Converted from oil to gas fired



216,000

Cars not driven for one year



2.5 million

Barrels reduction in oil production



2.

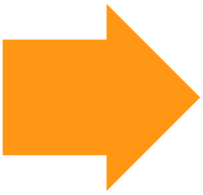
Iraq Solar Energy Potential

Why Renewable Energy?



*Iraq needs a strategy for diversification of the energy mix towards **alternative sources**, including renewables, as it would **free up** oil and gas production for export to finance a reconstruction program. Transition to renewable energy would contribute in carbon-dioxide (CO₂) **emission** reduction and brings a wide spectrum of **socio-economic** benefits to the country including job creation and contribute to developing local economies.*

Solar Energy Resources Facts



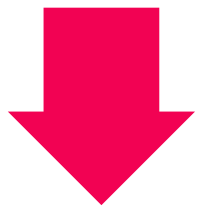
2,200 kWh/m²

Iraq's average Annual Global Horizontal Irradiation (GHI)



75%

Global Price drop of utility-scale solar PV between 2010 and 2017.



\$ 0.03/kWh*

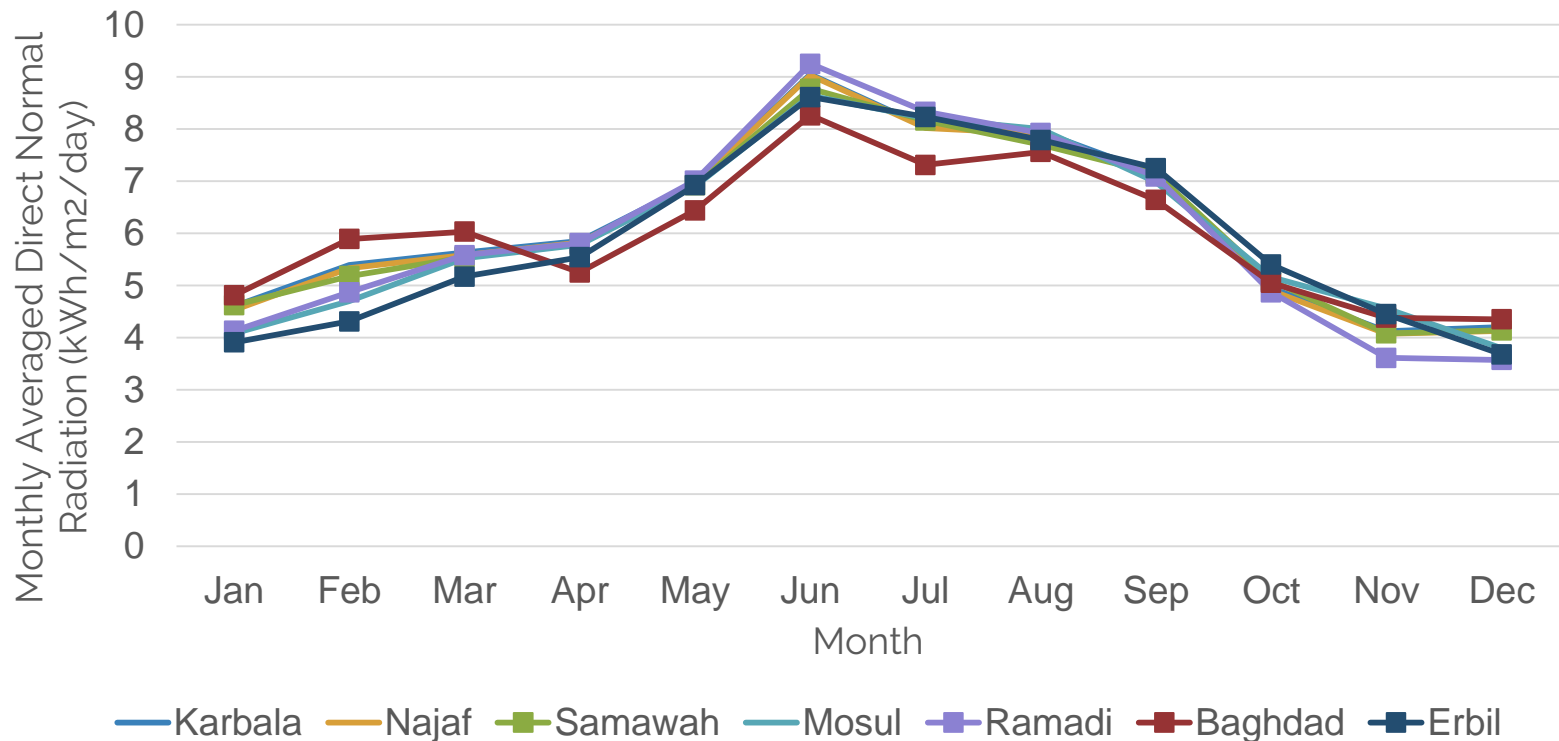
Global weighted average LCOE (2018 onward)



291 GW

global installed PV capacity (2016)

Average Direct Normal Irradiation (DNI)



Location	Karbala	Najaf	Samawah	Mosul	Ramadi	Baghdad	Erbil
Average Annual Global Horizontal Irradiation (GHI) [kWh/m²]	2,248	2,233	2,226	2,200	2,193	2,190	2,171

Iraq IPP Renewable Energy Plan



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Potential locations were identified by MOE in *Dhiqar, Baghdad, Diwaniya, Muthana, Anbar, And Salahudin* provinces for developing PV Solar IPP projects.



3.5 US¢/kWh

15 year fixed feed-in tariff offered to investors.



695 MW

Total expected capacity of the planned 9 PV solar power stations (2017).



8

Months is the duration from signing contracts to completion (November 2018).

Iraq IPP Renewable Energy Plan

Province	Project	Capacity (MW)
Muthana	Sawa-1	30
Muthana	Sawa-2	50
Muthana	Khadher	50
Najaf	Haydariyah	100
Anbar	Remadi	100
Anbar	Falluja	40
Anbar	Amireya Sumud	50
Anbar	Qarma	50
Babel	Iskandariya	225
TOTAL		695

GCC States IPP Renewable Energy Plan

Whilst Iraq has embarked upon a feed-in tariff Approach, GCC states have opted for internationally financed PPP approach using **capacity**, **energy** and **deemed energy structures**.



Dubai - Solar Park III (800 MW)	2.99 US¢/kWh
Abu Dhabi - Sweihan (1177 MW)	2.42 US¢/kWh
Saudi Arabia Sakaka (300 MW)	\$1.78 US¢/kWh

GCC States IPP Renewable Energy Plans

2020: 5% of generation
2030: 15% of generation
CSP 5.7 GW, PV 4.6 GW,
Wind 0.7 GW

Kuwait

Bahrain

2020: 5% of capacity

Qatar

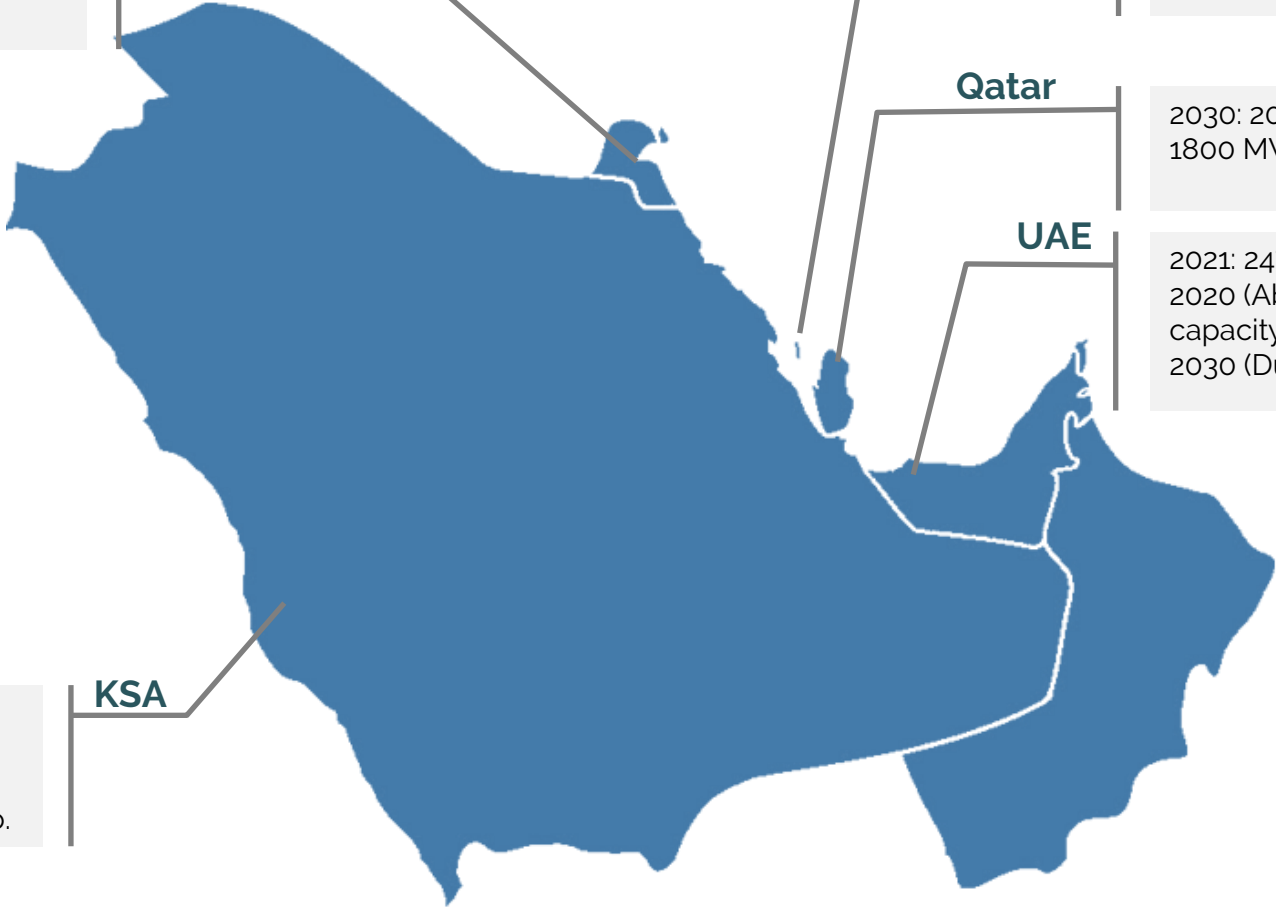
2030: 20% of capacity
1800 MW

UAE

2021: 24% clean energy
2020 (Abu Dhabi): 7% of
capacity
2030 (Dubai) 5GW solar PV

KSA

2022: 9.5GW
2040: 54GW, 41GW
Solar, 9GW Wind,
3GW W2E, 1GW Geo.



3.

Solar Energy Investment Challenges

Why Iraq is failing to attract classic international IPP RE investors ?

- Unclear legislation for investment and operation in the electricity sector (unlike oil sector).
- No sound regulatory frameworks for trading electricity.
- Lack of support to the investors from international bankers and financing institutions.



What is required are contract frameworks similar to ones used by GCC states

What's the issue with Local Banks?

Private Investors currently rely on local banks to raise all of the debt - not an optimal strategy.

Debt tenor: Local banks are often reluctant or lack experience in financing larger infrastructure projects. This results in debt tenors being shorter (5-10 years rather than the 20 year tenors we see in PPP projects).

High coupon rate: Local banks are likely to demand higher coupon rates.



Shorter debt tenor and a higher coupon rate results in higher priced electricity

4.

Energy Offset Program

What is an Energy Offset Program?



Energy Offset Program is an agreement, between oil and gas investment companies and the government, that obliges the companies to invest in *renewable energy* to satisfy a secondary objective of increasing the level of electricity *generation electricity* from renewable energy.



Why Energy Offset Program?

To encourage foreign companies to invest in non-oil and gas industry

What is Energy Offset Balance?

The **Energy Offset Balance** is a percentage of energy extracted from the main contract.



Energy Offset Program Objectives



Power Generation

Contribute to reducing the gap between demand and supply for electricity.



CO2 Reduction

Reduce carbon emission from oil and gas



Attracting Foreign Investment

International debt, commercial focus, world class operations and maintenance,



Technology Transfer

PV technology transfer and integration into the power system,



Socio-economic Development

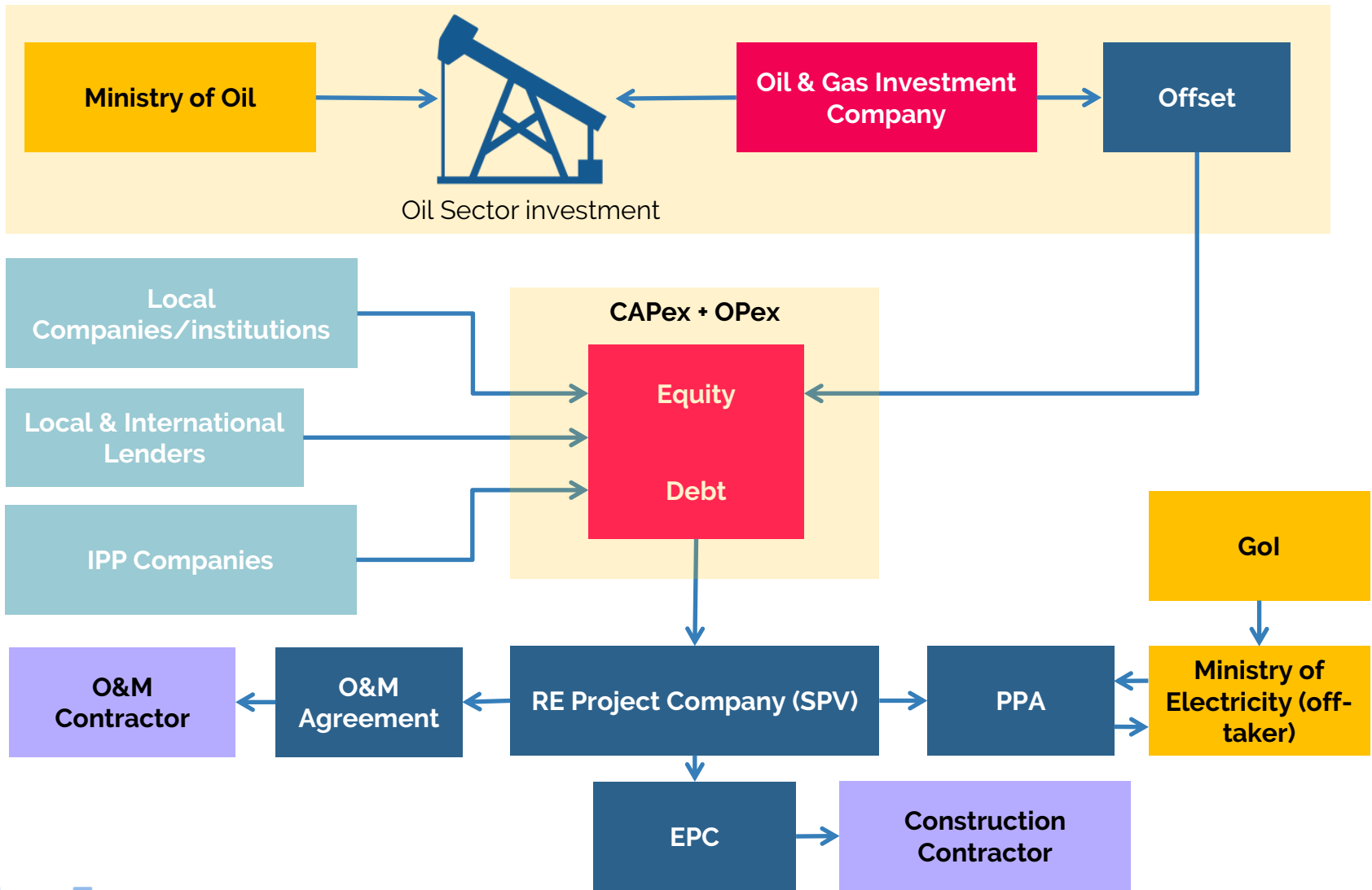
Promotion of Projects that contribute to the advancement of Iraqi economy and local communities

Energy Offset Math

Oil Production Per Day	bbl/day	300,000
Oil Price	\$/bbl	\$55
Revenue Oil per day	\$/day	16,500,000
Equivalent Energy	MWh	486,000
Energy Offset Cost	\$/day	165,000
Offset Percentage	%	1.0
Energy Offset Per Day	MWh	4,860
Feed-in Tariff	\$/MWh	3.5
Revenue from Electricity per day	\$/day	408,240
% Elect/Oil Revenue Ratio	%	2.47



Energy Offset is about Partnership



Energy Offset Obligation & Opportunity



Obligation Offset program is an obligation requiring foreign entities signing oil & gas investment contracts with the GoI to develop renewable energy in Iraq to reduce carbon emissions.



Opportunity Offset program will provide commercial opportunities to accelerate development of renewable energy to tackle power shortage in the provinces which oil & gas companies are operating and provide local jobs.



Moving forward...

- 1) Deploying offset policy** in the oil law to promote renewables and trigger foreign investments in the sector.
- 2) Creating an investor friendly environment** to attract foreign investment.
- 3) Institutional development** to support sustainable renewable energy deployment.
- 4) Technology transfer** through joint ventures, partnerships and consortiums to support the expansion of the untapped renewable energy sector.
- 5) Fulfilling socio-economic goals** while developing local industry.

Thank you

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