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Energy Storage & Transmission

By



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Lecture (7)
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Introduction for Green Energy & policy

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Introduction

- The primary energy sources of Egyptian energy sector are fossil fuel products liquid and natural gas.
- The energy consumption growth rate is ranging between 6-7% annually ,the projected consumption by 2022 will be almost tripled (3 times) for natural gas and will be one and half times (1.5 times) for fossil fuel products. The overall consumption will be doubled (2 times).

Cont.

- New and renewable energy resources in Egypt include mainly solar, wind and biomass.
- **The Egyptian strategy for energy supply and use aims to:**
 1. Increase sustainable sources of energy to meet the growing needs of economic growth and development
 2. To increase the renewable energy share of the total energy demand to 20% by 2020 with contribution 12% from wind.

Cont.

3. The strategy stresses on adopting energy production policies for rationalizing and raising the efficiency of energy uses
4. Revising energy pricing structures in both the industrial and household sectors. These pricing structures aim at protecting limited-income groups from any unaffordable costs for their energy needs.
5. Awareness for rationalizing energy utilization at homes, factories as well as other various services sites.

Electric Energy Consumption in Egypt

- Electricity consumption in Egypt has rapidly increased from 49 TWh in 1996-1997 to over 127 TWh in 2010-2011.
- With the current growth rate of more than 7% per year, Egypt would need to double its current generation capacity by 2020.
- Increasing demand-side efficiency is one of the cost effective options to help lower future demands and reduce potential supply shortages, improve energy security, and mitigate harmful emissions without compromising economic development.
- Energy efficiency gained a prominent role at the political level with the formulation of a quantitative target to save 20% of today's consumption by 2020.

Current Status of the Egyptian Grid

□ Egyptian Grid 2017 Indicators:



Installed capacity
45,192 MW



Max load
30,400 MW



Transmission grid
45,000 Km



Generated energy
186,320 GWh

Current Status of Renewable Energy

1. Wind Power Indicators:

Installed capacity
750 MW

Generated energy
12600 GWh

Fuel savings
2.7 Mton

CO2 Reductions
6.8 Million tons



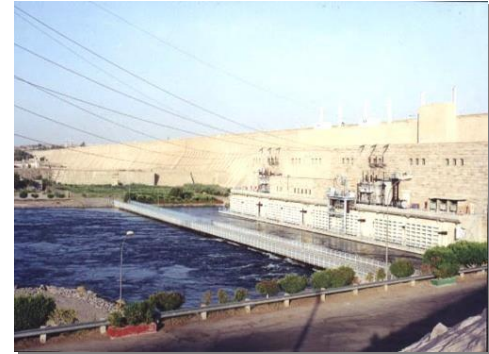
Cont.

2. Hydro Power

Installed capacity
2842 MW

9%
Of 2016
Generation Mix

- Currently, 32 MW Hydro Power Project in Assuit governorate is under implementation.
- It's planned to establish pumping & storage plant with 2400 MW in Attaqa - Suez to be operated by 2022

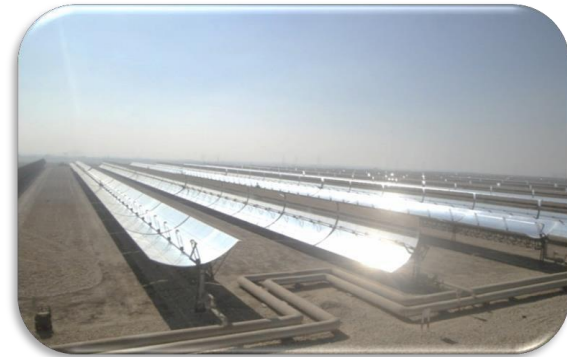


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3. Solar power indicators

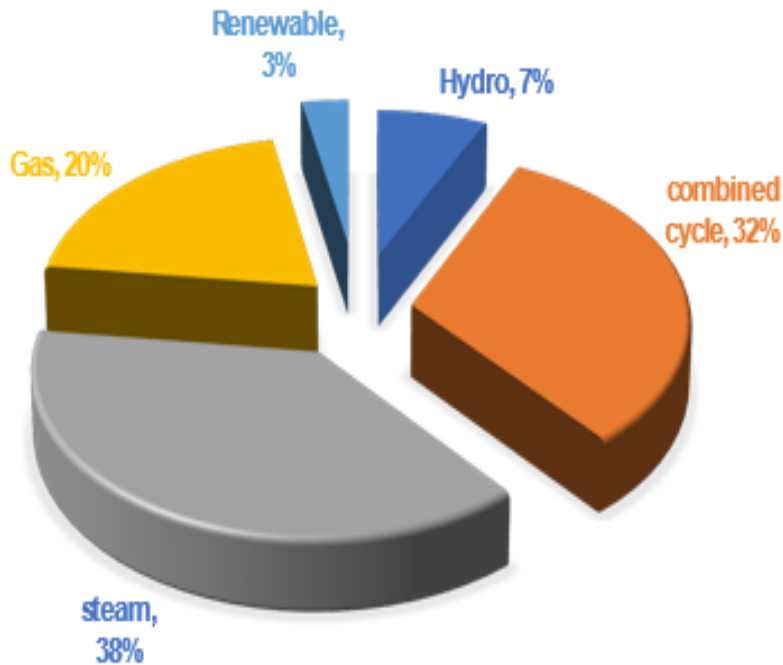
**CSP Installed
capacity
140 MW**

**PV Installed
capacity
≈ 80 MW**

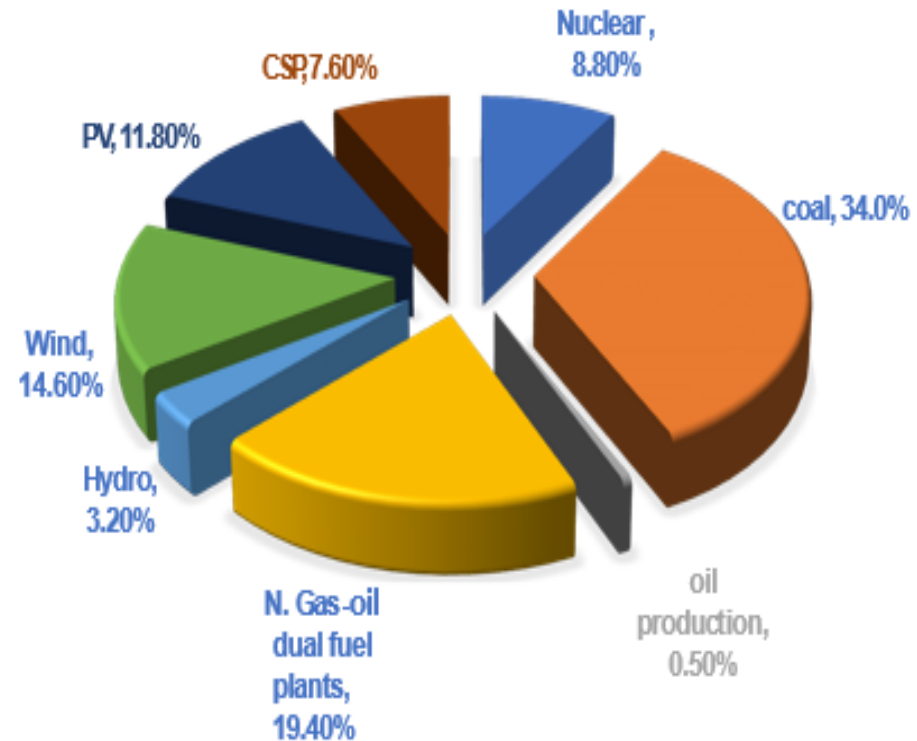


Egyptian Generation Strategy

2016 Generation Mix



2035 Generation Mix



Renewable Energy Generation Plan

- The New & Renewable Energy strategy aims to increase the share of generated energy from renewable energy to 20% out of the total generated energy in Egypt by 2022,
- Out of which 6% from hydro sources, 12 % from wind energy and 2% from other renewable energy sources especially the solar energy.
- The strategy includes the construction of wind projects with the participation of the private sector to bring the total installed capacity to 7200 MW by 2022.

Cont.

- **The Egyptian Electricity Holding Company is coordinating with the New and Renewable Energy Authority (NREA) in Generation planning considering the share of renewable energy in the generation mix and Network planning needed for the evacuation of the generated power from renewables.**

2022 Egyptian Plan

- According to a report by the International Energy Agency, the increase of amount of electricity produced from renewable sources increased from just over 13% in 2012 to 22% the following year.
- They also predict that to hit 26% by 2020. In terms of total generation, renewables accounts for 19% of our present usage.
- Most long-term forecast models predict that use will triple between 2012 and 2040, with a greater amount should the planet hit 2° of warming.

Generation Plan by 2022

- The Egyptian RE strategy is targeting 20% of the electricity generation by year 2022 as follows:-

Source	Capacity (MW)	Energy (TWh) & %
Wind	7110	30.6 (12%)
Solar	2870	2.2 (2%)
Hydro	2800	14 (6%)

Meaning of Energy policy

- **Energy policy** is the manner in which a given entity (**often governmental**) has decided to address issues of energy development including energy production, distribution and consumption.
- **The attributes of energy policy may include:**
 1. legislation.
 2. International treaties.
 3. Incentives to investment.
 4. Guidelines for energy conservation.
 5. Taxation and other public policy techniques.

Energy Efficiency policies

- **Regulatory policies**

Labels, Minimum Energy Performance Standard (MEPS).

- **Economic instruments**

- Direct (financial incentives): subsidies, soft loans.

- Indirect (fiscal incentives): tax credit, tax reduction.

- **Cross-cutting measures**

voluntary agreements, mandatory training professionals

Renewable Energy policies

1. Regulatory Policies

Feed-in tariff / premium payment

Electric utility quota obligation / RPS

Net metering

Biofuels obligation / mandate

Heat obligation / mandate

Tradable renewable energy credits

Tendering

2. Fiscal incentive and public financing

Capital subsidy, grant, or rebate

Investment or production tax credits

Reductions in sales, energy, CO₂,
VAT, or other taxes

Energy production payment

Public investment, loans, or grants

Roles of energy-based policies

A. Overall role

- Contribution for defining low carbon emission development strategies, sustainable development throughout a range of policy options (regulatory & economic mechanisms, etc.).

B. Specific roles

- Setting suitable strategies for facing the low clean energy access
- leveraging grid access issues and energy security in rural and urban areas.
- Improving the private and public governance of energy systems.
- fostering regional and national contribution to climate change mitigation agenda

Co-benefits of the energy policy for mitigation climate change

1. **International**

- Green house emissions.
- Moderated energy prices.
- Natural resource management.
- Development goals

2. **National**


- Job creation
- Reduced energy
- Energy security
- Economic effect

3. **Sector**

- Industrial productivity and competitiveness.
- Energy provider and infrastructure benefits.
- Increased asset values.

4. **Individual**

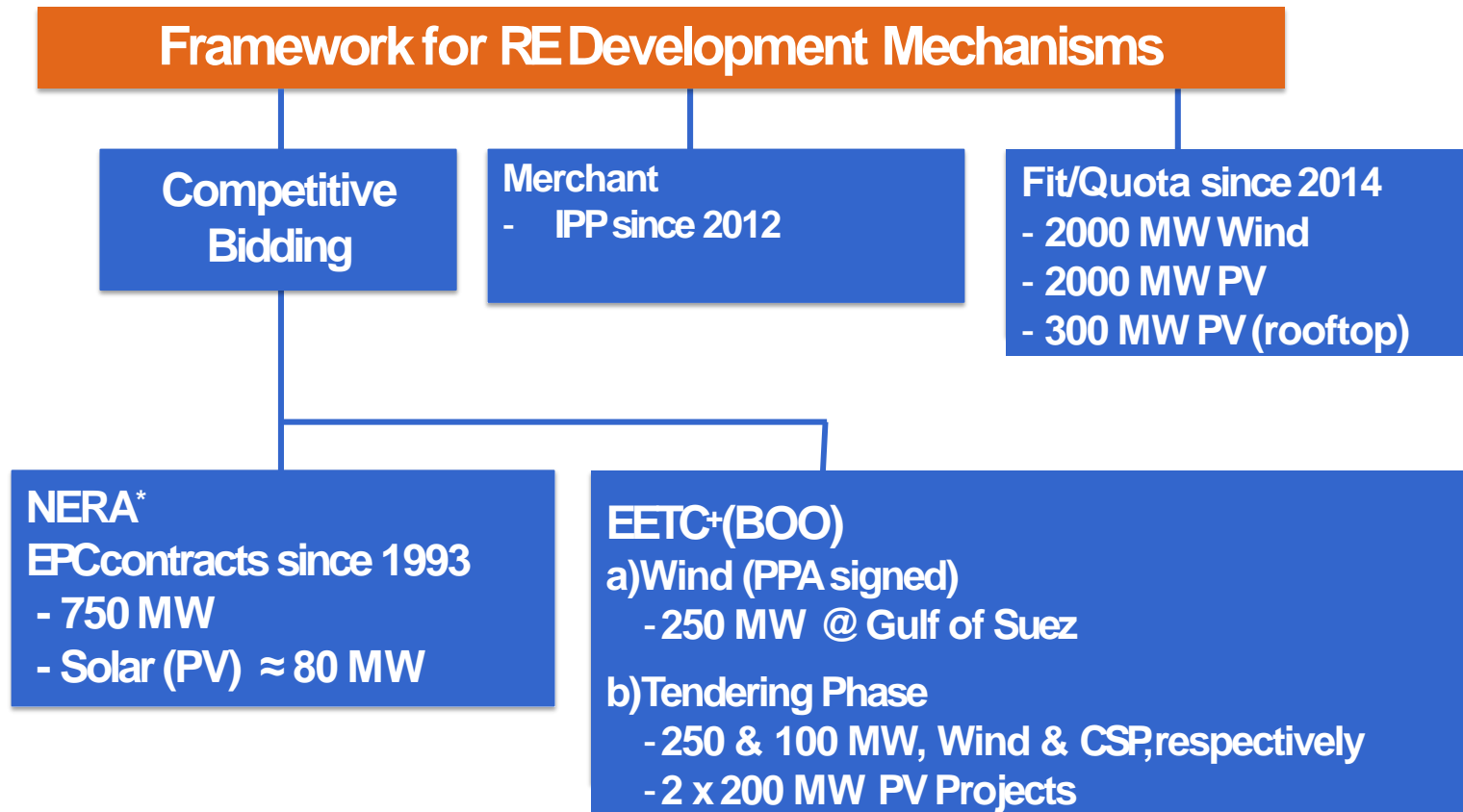
- Health and wellbeing.
- Energy access.
- Increased disposable income.



*Economics and politics
of
Renewable Energy Systems*

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Renewable Energy Development Scheme



+ EETC: Egyptian Electricity Transmission Company

* NREA: New and Renewable Energy Authority

Difference between EPC & BOO &

- **Engineering, Procurement and Construction (EPC)** is a particular form of contracting arrangement used in some industries where the EPC contractor is made responsible for all the from design, procurement, construction, commissioning and handover of the project to the end-user or owner.
- **BOO (build, own, operate)** is a public-private partnership (PPP) project model in which a private organization builds, owns and operates some facility or structure with some degree of encouragement from the government.

RE Competitive Bidding Projects

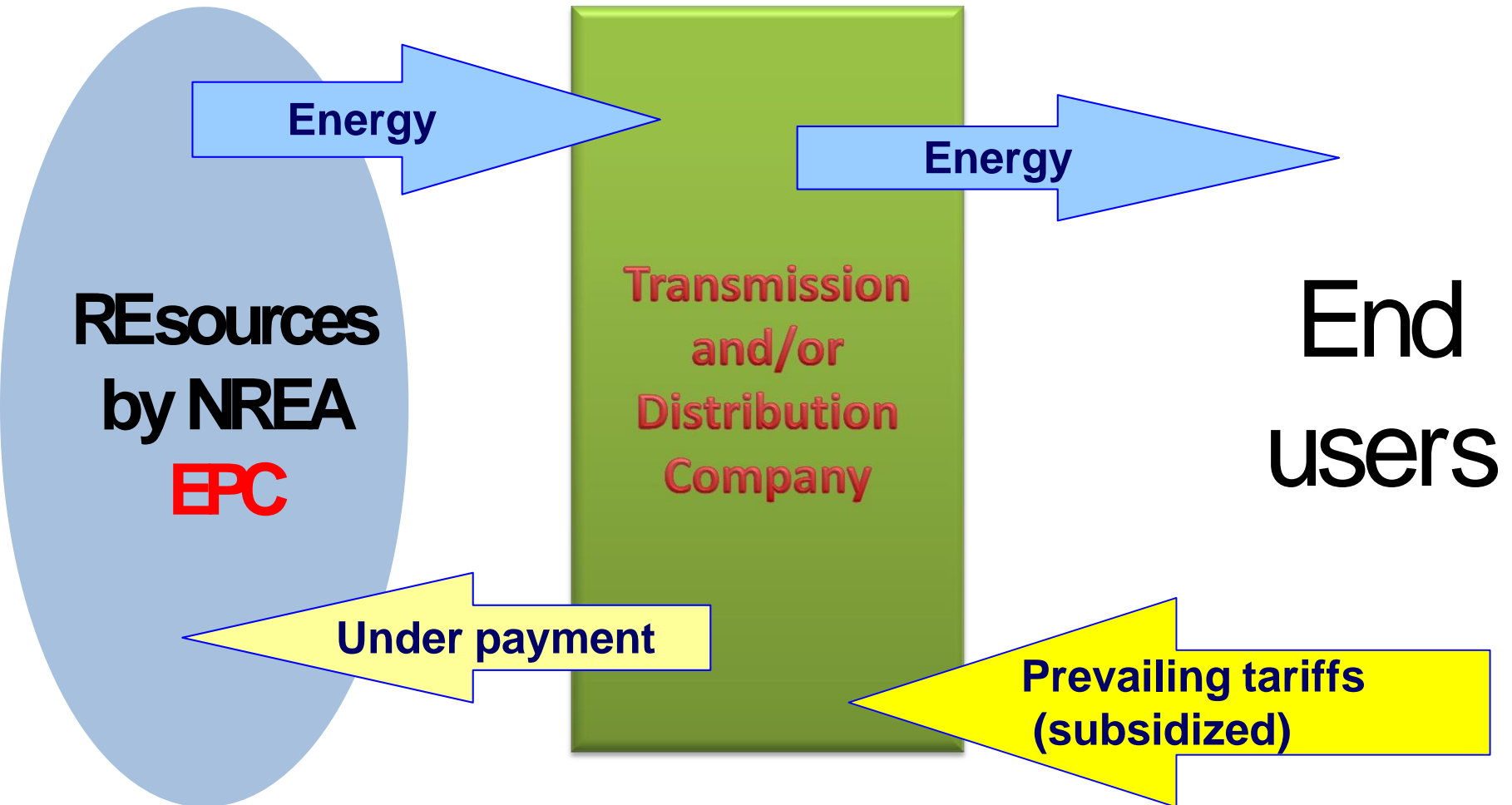
EPC Projects

- **2 grid connected PV projects, around 20 MW each, in Hurghada & Kom Umbo**
- **264 off grid small scale PV projects**
- **40 MW of Wind power expansion of Gabal Elzeit (1)**
- **220 MW of Wind power Gabal Elzeit (2)**
- **120 MW of Wind power Gabal Elzeit (3)**
- **200 MW of Wind power in Suez Gulf**
- **2000 MW (Siemens wind power projects)**



Competitive bidding on the supply side

EPC Contract



RE Competitive Bidding Projects

BOO Projects

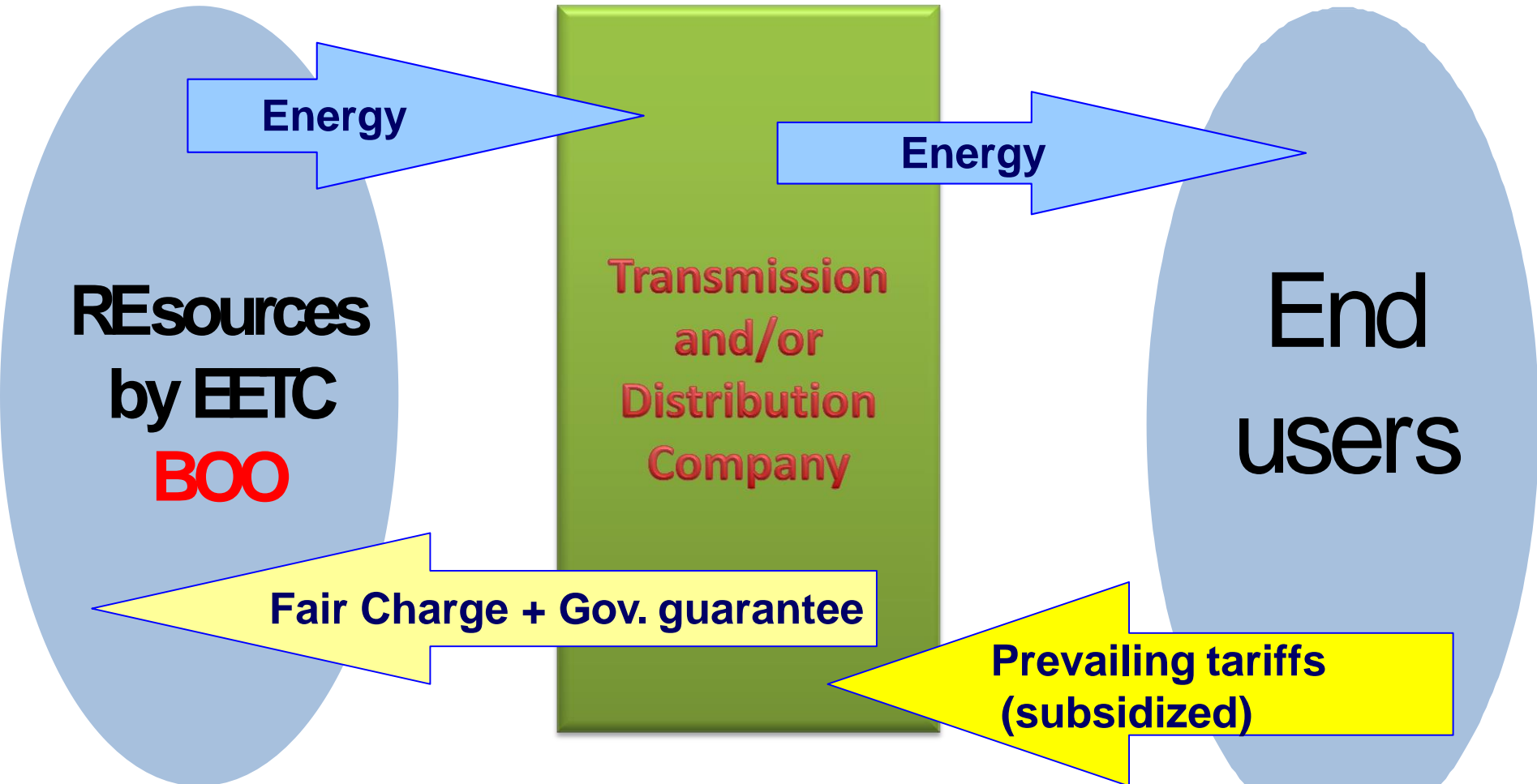
- 250 MW of Wind Power in Suez Gulf
- 250 MW of Wind power in the west of Nile
- 200 MW of PV in the west of Nile
- 200 MW of PV in Kom Ombo
- 100 MW of CSP in the west of Nile

500 MW
Solar

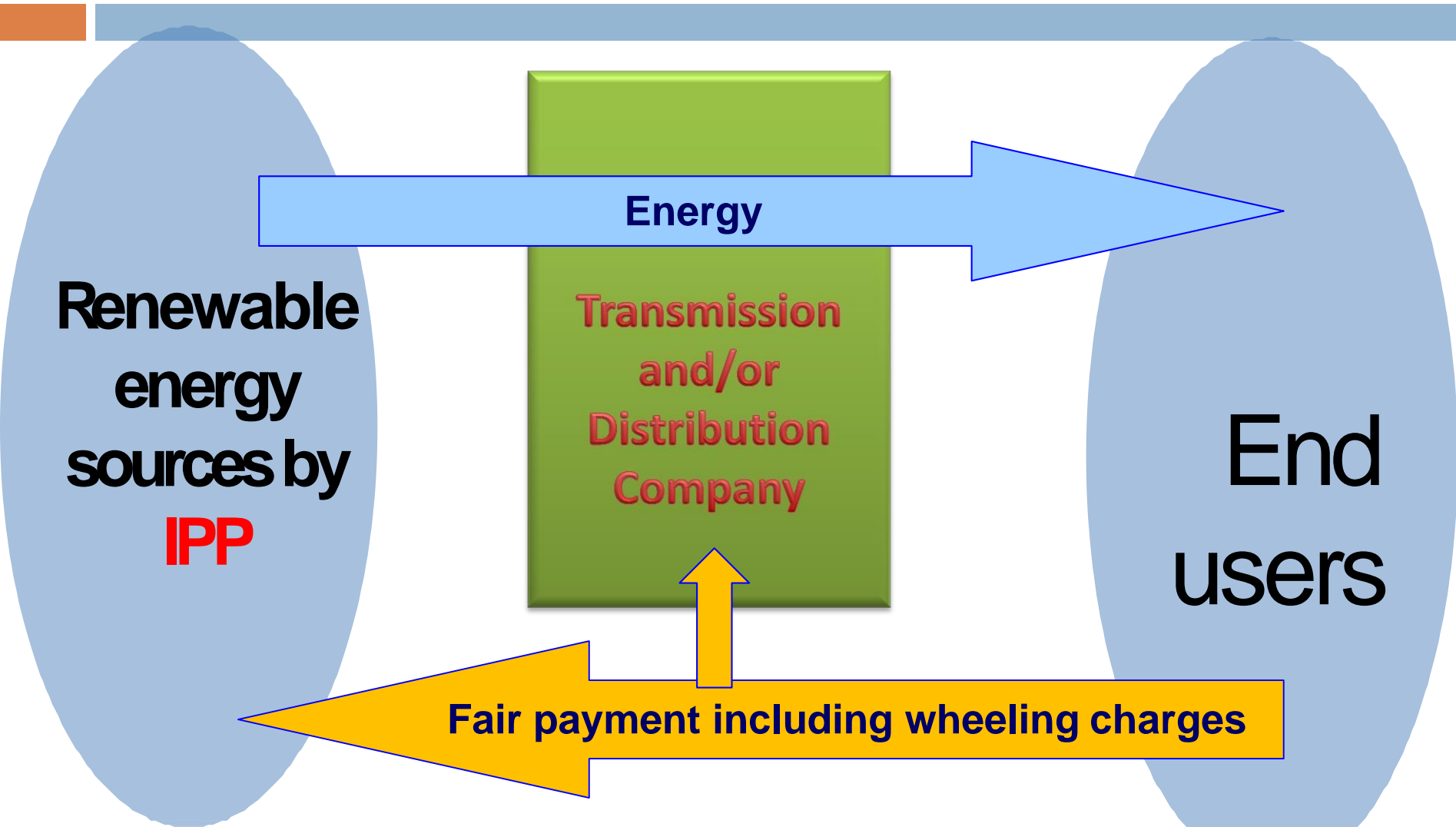
500 MW
WIND



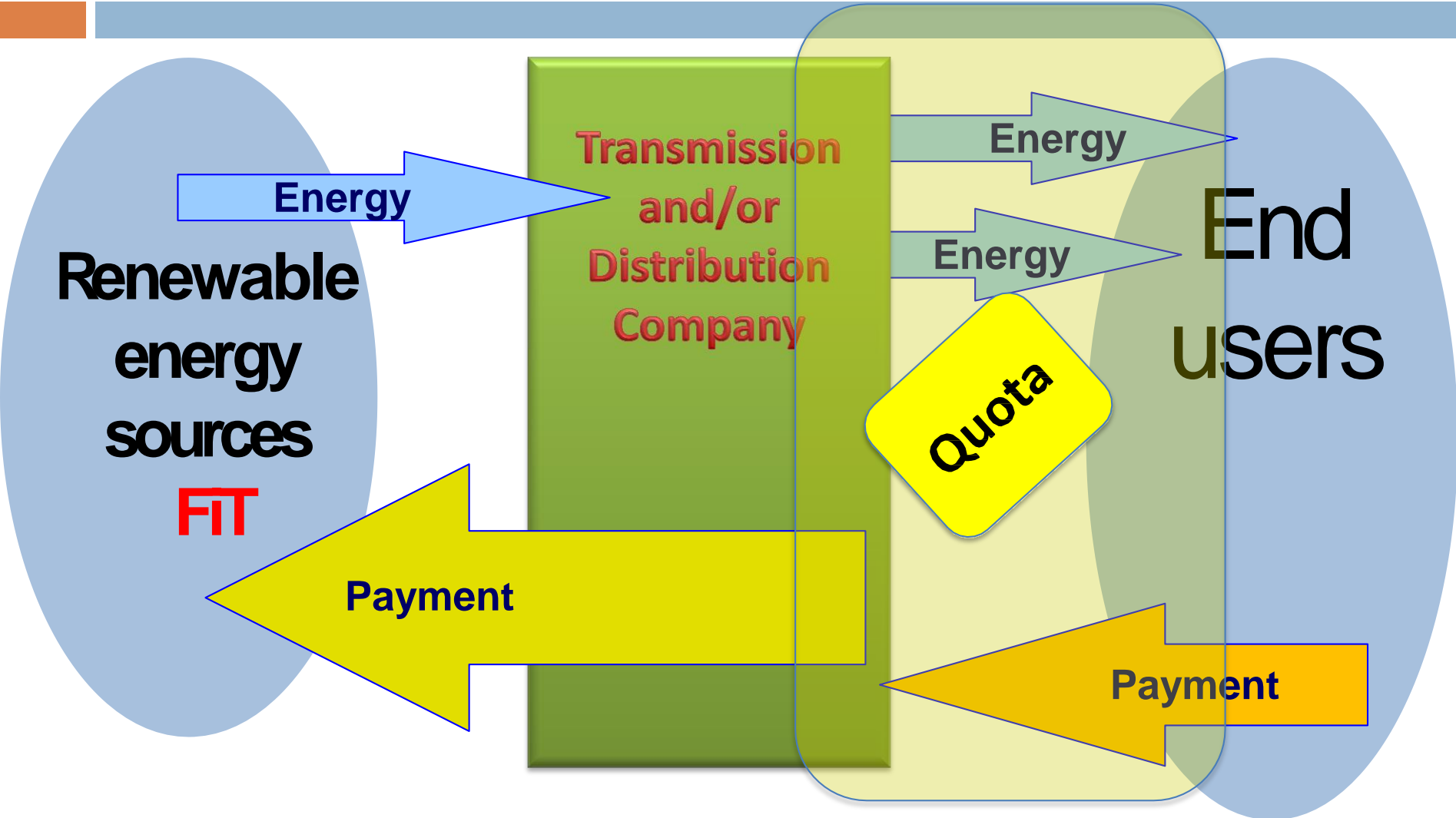
Competitive bidding on the supply side



Bilateral agreements (merchant scheme)



Quota



RE Feed in Tariff Projects

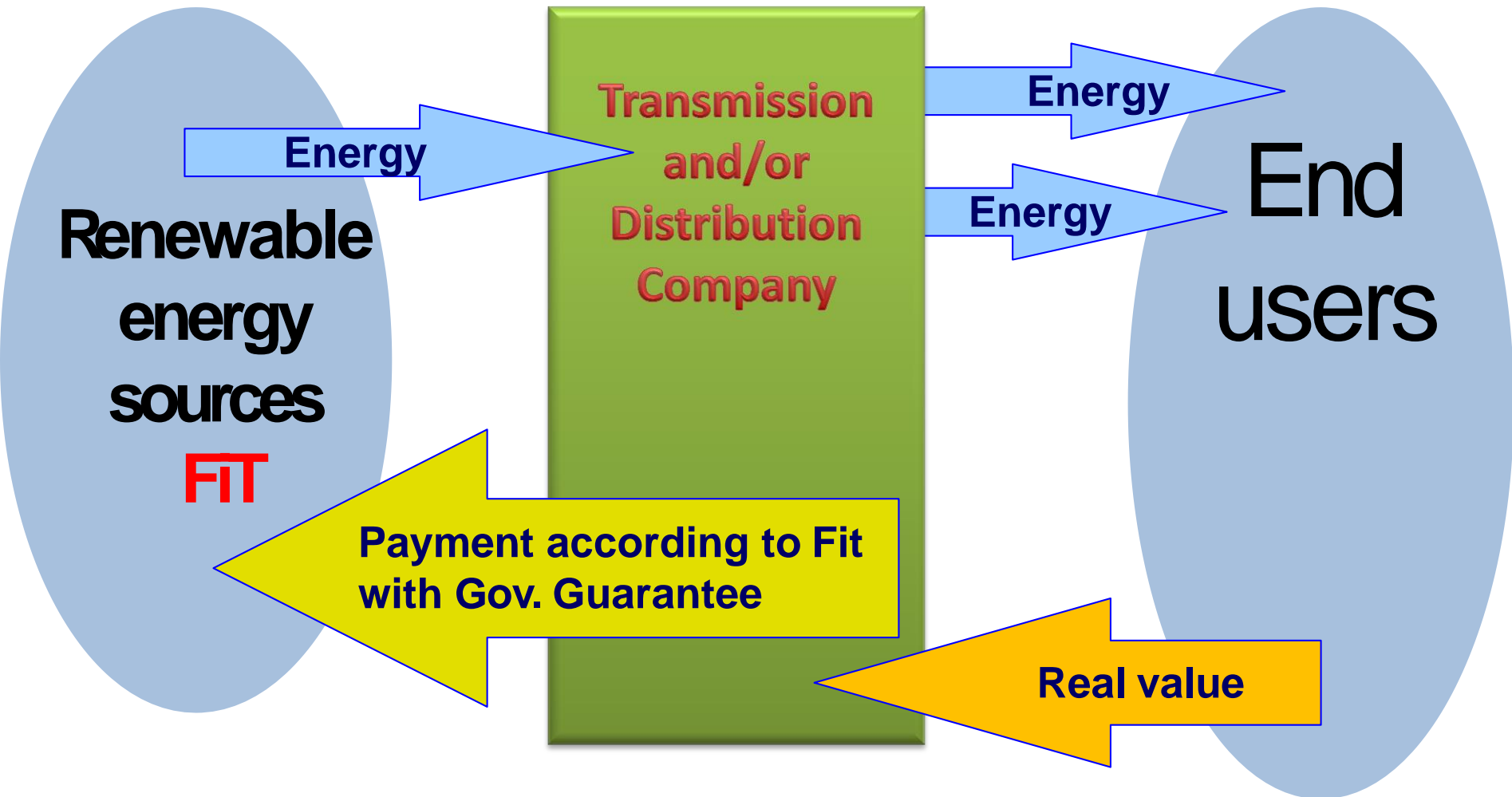


Wind power
2000 MW

Solar power
2000 MW

PV Rooftop
300 MW

Feed in Tariff



Feed in Tariff Scheme

- In 2014, The Cabinet has approved the Feed-in Tariff scheme for PV & wind with capacity less than 50 MW.
- The Regulatory Agency (Egypt ERA) finalized the regulation rules.
- In the first phase 3 contracts were signed with total capacity 150 MW .
- In 2016, A second phase of the Feed-in Tariff scheme for PV & wind has been announced and applied.

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Solar FIT

Contract Period 25 years

Plant Installed Capacity	FiT/ kwhr
Residential	102.88 pt.
Non Residential Less than 500 KW	108.58 pt.
500 KW – 20 MW	7.88 \$ cent
20 MW – 50 MW	8.40 \$ cent

Cont.

Wind FIT

Operational Hours	FIT \$ cent / kwhr
2500	7.96
2600	7.65
2700	7.37
2800	7.11
2900	6.86
3000	6.63
3100	6.42
3200	6.22
3300	6.03
3400	5.85
3500	5.69
3600	5.53
3700	5.38
3800	5.24
3900	5.10
4000	4.97

Operational Hours	FIT \$ cent / kwhr
4100	4.85
4200	4.74
4300	4.63
4400	4.52
4500	4.42
4600	4.33
4700	4.23
4800	4.15
4900	4.06
≥ 5000	4.00

Contract Period 20 years

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Laws and Regulations

1) Constitution / Article 32

- To get optimum benefits from renewable energy, promote its investments, and encourage R&D, in addition to local manufacturing.

2) Law No. 203 of Year the 2014

- To Motivate Production of Electricity from Renewable Energy Sources.

3) Electricity Law, July 2015

- It governs the electricity sector in Egypt.

4) Cabinet Decree No. 1947 of the Year 2014 on Feed-in Tariff -1st Round

- It establishes the basis for Feed-in Tariff for energy produced from renewable energy projects and encourage investment in renewable energy.

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Cont.

5) Prime Ministerial Decree No. (2532) of the Year 2016 on Feed-in Tariff- 2nd Round

Regulations to Avail Land for renewable Energy Projects

6) Prime Ministerial Decree No. (37/4/15/14) of the Year 2015

Regulations to Avail Land for renewable Energy Projects.

7) Investment Law No. 8 of the Year 1997

On Investment Guarantees and Investments

8) Presidential Decree No. 326 of the Year 1997

It establishes the Electric Utility and Consumer Protection Regulatory Agency, affiliate of the Ministry of Electricity and Renewable Energy, responsible of the issuance of permits and licenses for generation, transmission and distribution.

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Cont.

9) **Law 4 for the Protection of the Environment**

- The law formulates the general policies for protecting and promoting the environment.

10) **Law No. 102 of the Year 1986**

- Establishes the New and Renewable Energy Authority, NREA. NREA has the primary role in promoting and developing renewable energy in Egypt.

11) **Companies Law No. 159 of the Year 1981**

- It establishes the requirements for incorporation of an SPV and the general rules for its management.