



# Why Iran is an opportunity for investment ???



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**Huge amount of solar radiation in Iran**

**higher efficiency for system Solar Projects Overview**

**Available requirement land Grid availability and infrastructure**

**Low construction overhead and manpower overhead Projects Resume**

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**Grid and Iran Electricity market**

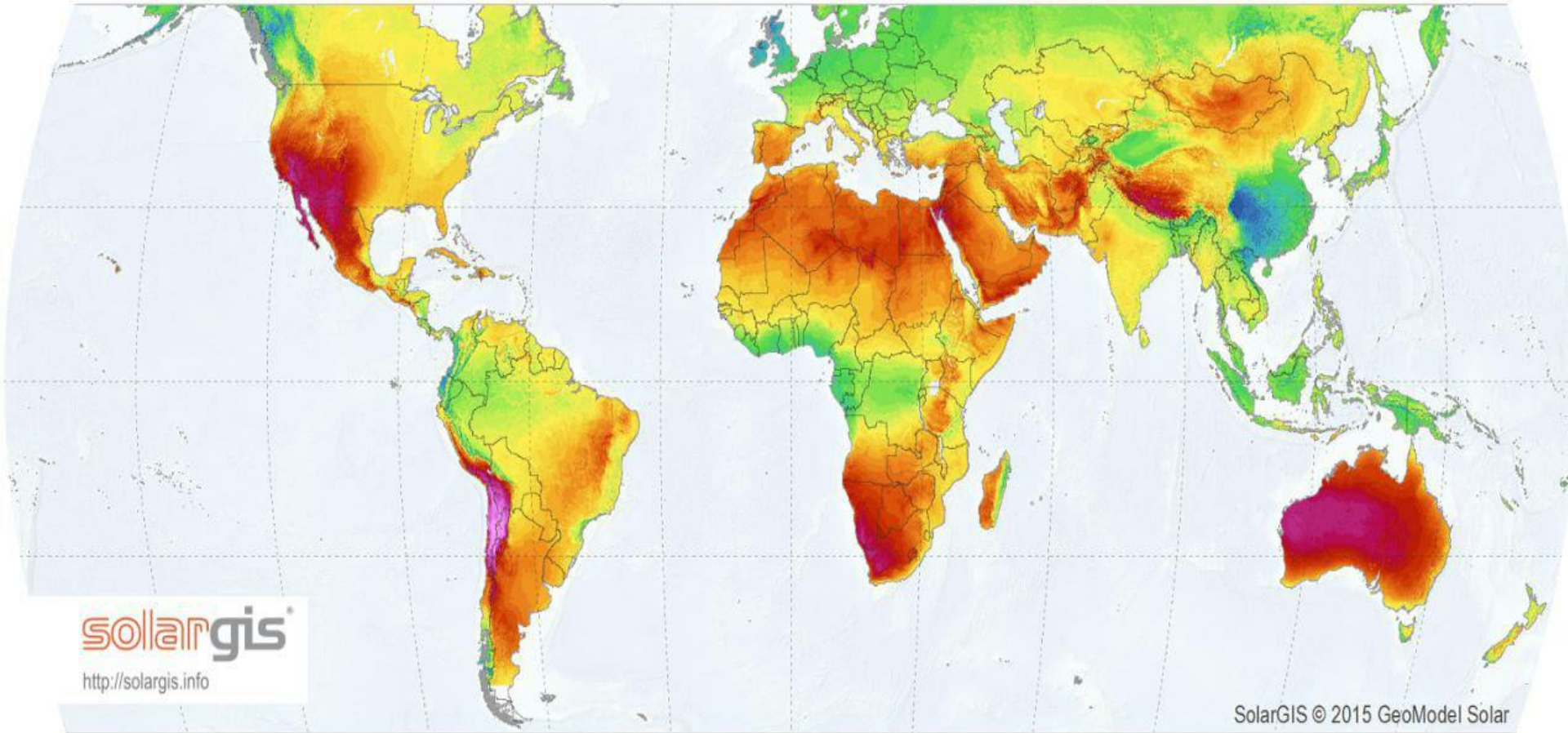
## **PART III**

**Optimizes Feed-in Tariff Deal**

# Global irradiation

DIRECT NORMAL IRRADIATION

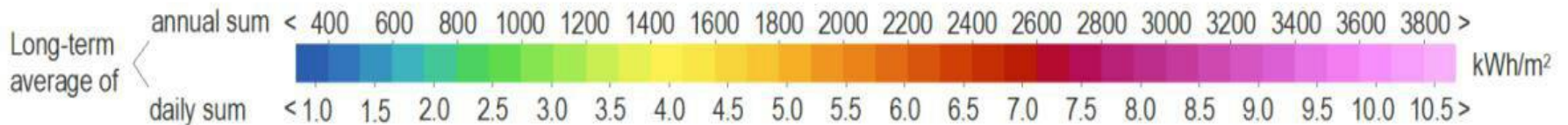
GeoModel  
SOLAR



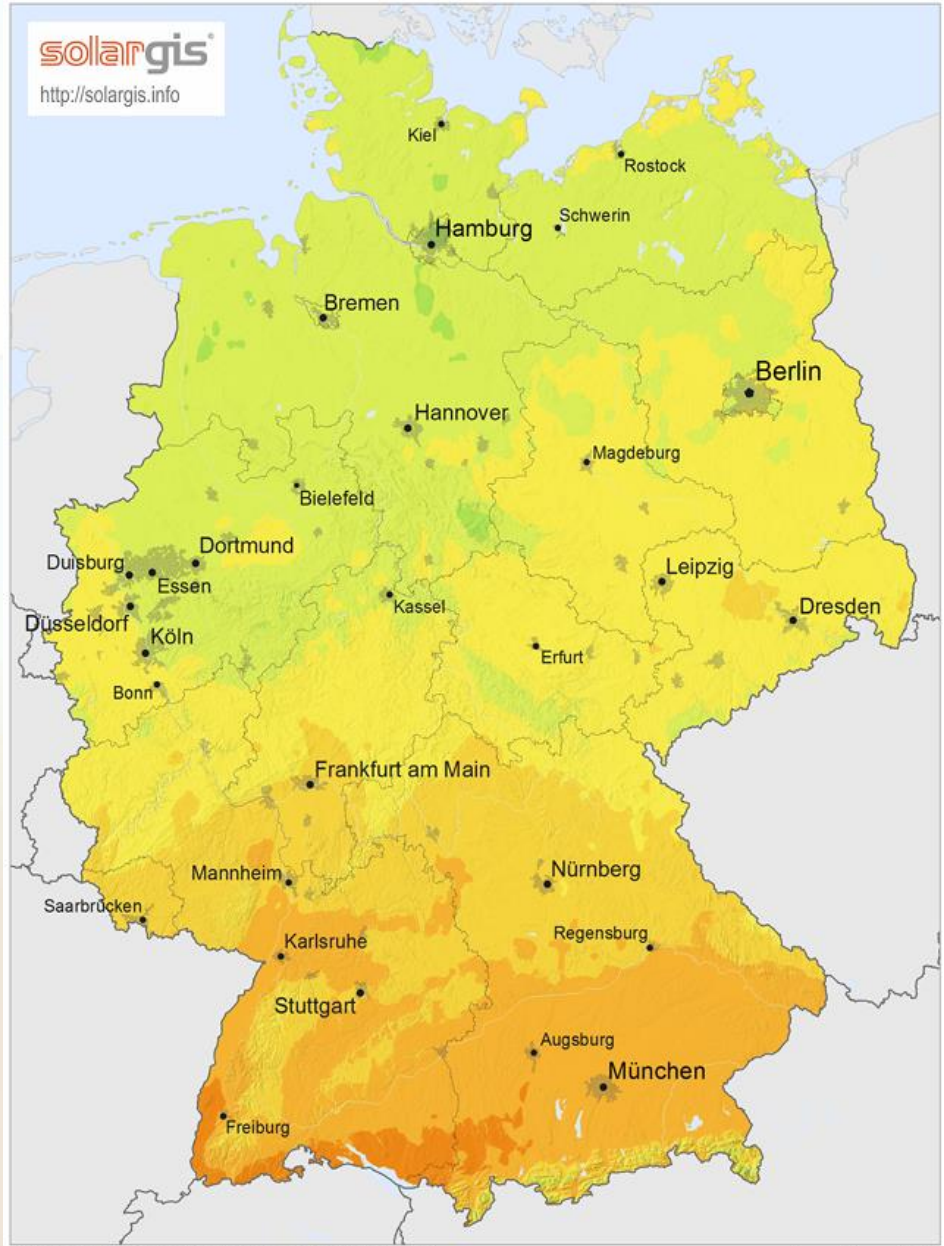
**solarGIS**

<http://solargis.info>

SolarGIS © 2015 GeoModel Solar

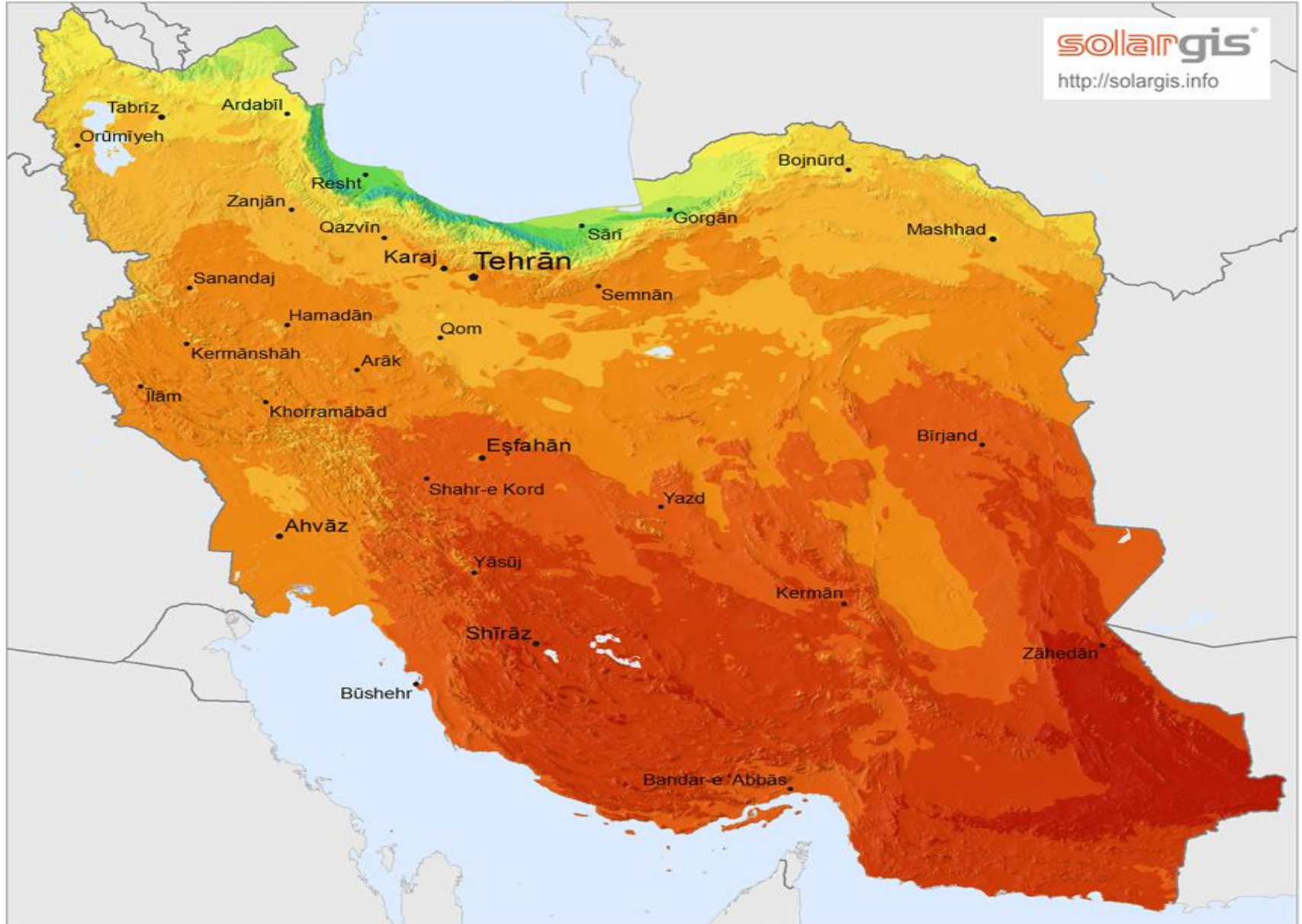






# Global Horizontal Irradiation (GHI)

Iran



Average annual sum, period 1999-2011

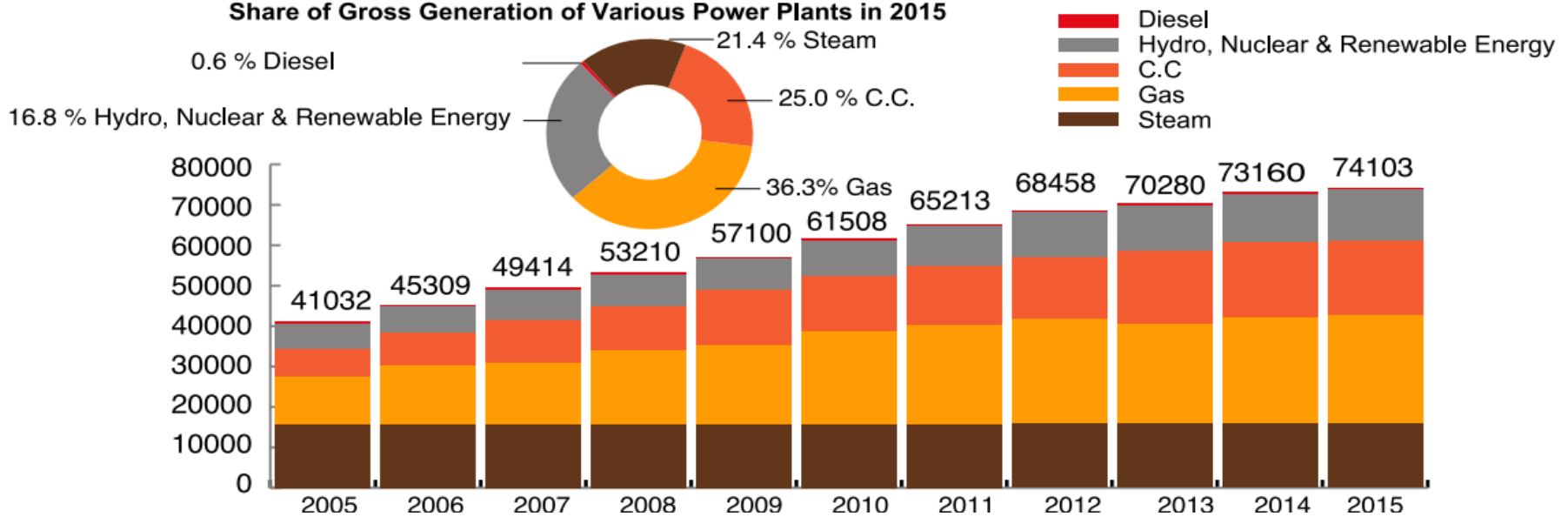
0 100 200 km



# Diagram of Installed Nominal Capacity of the Power Plants at the end of the Years 2005 through 2015

(MW)

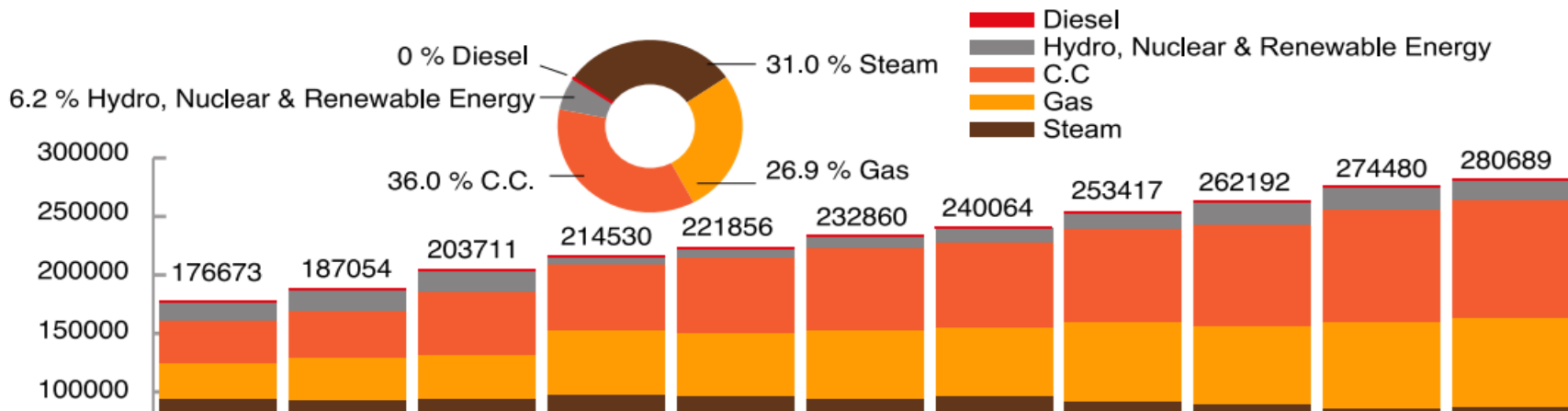
## Share of Gross Generation of Various Power Plants in 2015



# Diagram of Electricity Gross Generation of Power Plants In 2005 through 2015

(GWh)

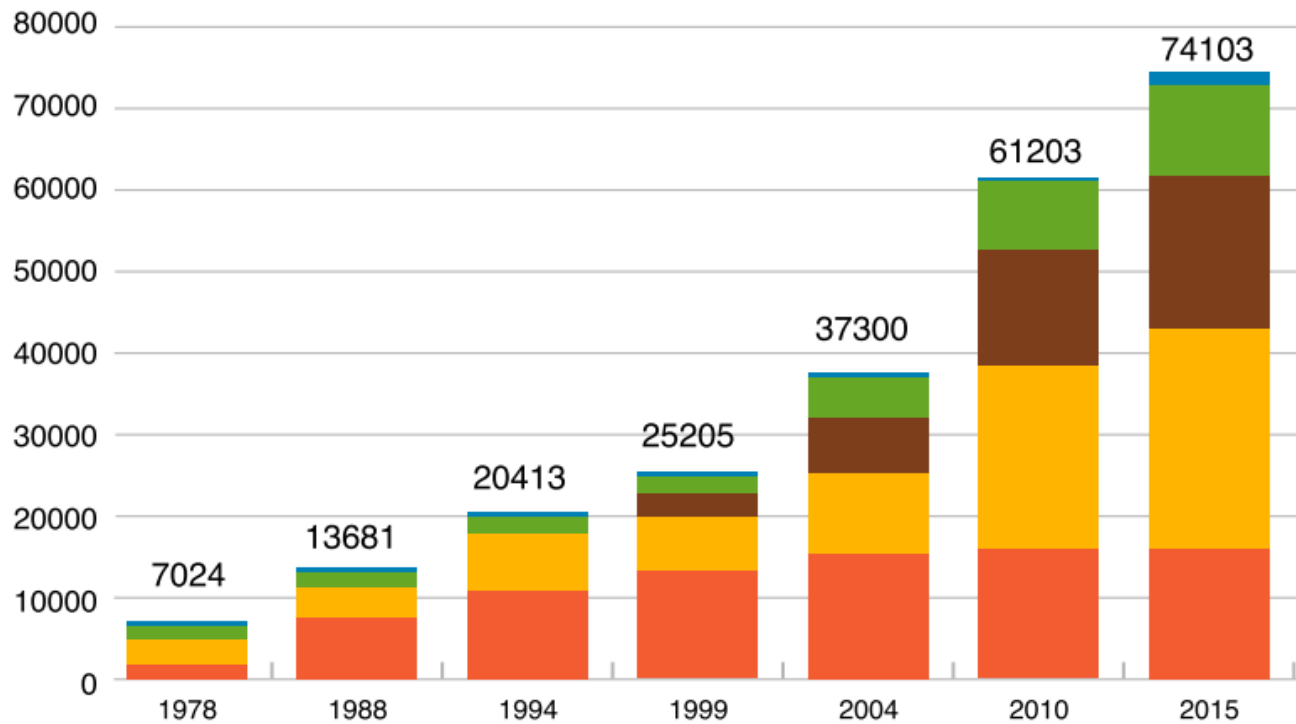
## Share of Gross Generation of Various Power Plants in 2015



(MW)

## Nominal Capacity by Power Plants Types

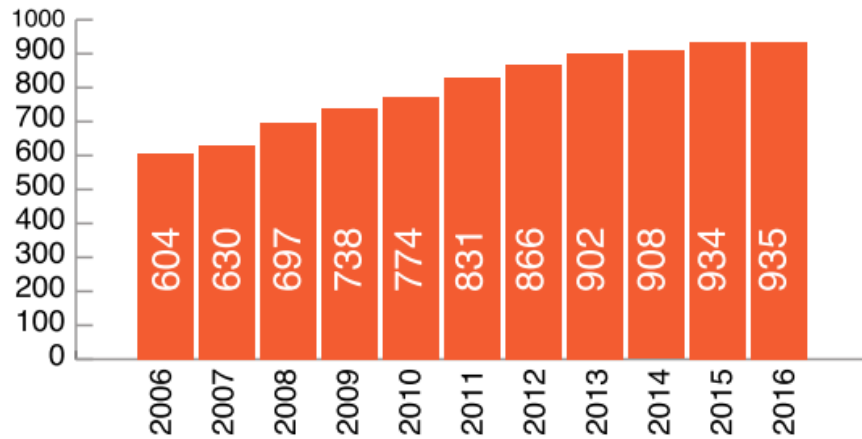
Steam Gas Combined Cycle Hydro Diesel, Nuclear & Renewable Energy





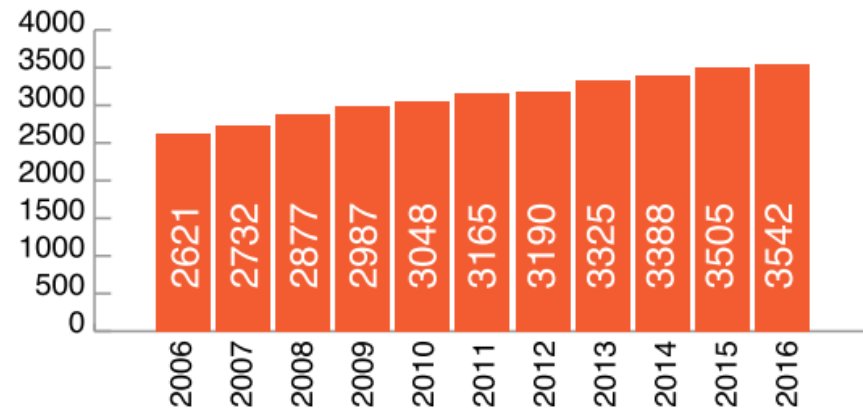
**Diagram of Trend of Per Capita Capacity at the end of march 2006-2016**

(W)



**Diagram of Trend of Per Capita Generation at the end of march 2006-2016**

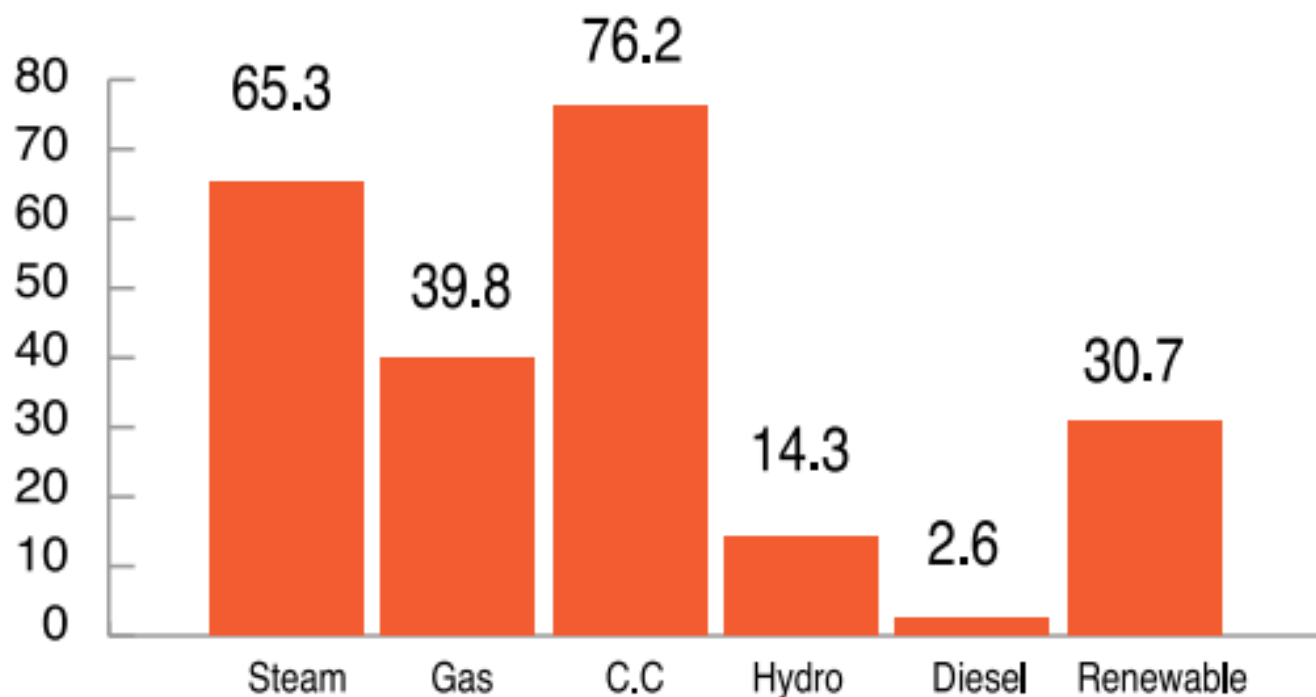
(Kwh)





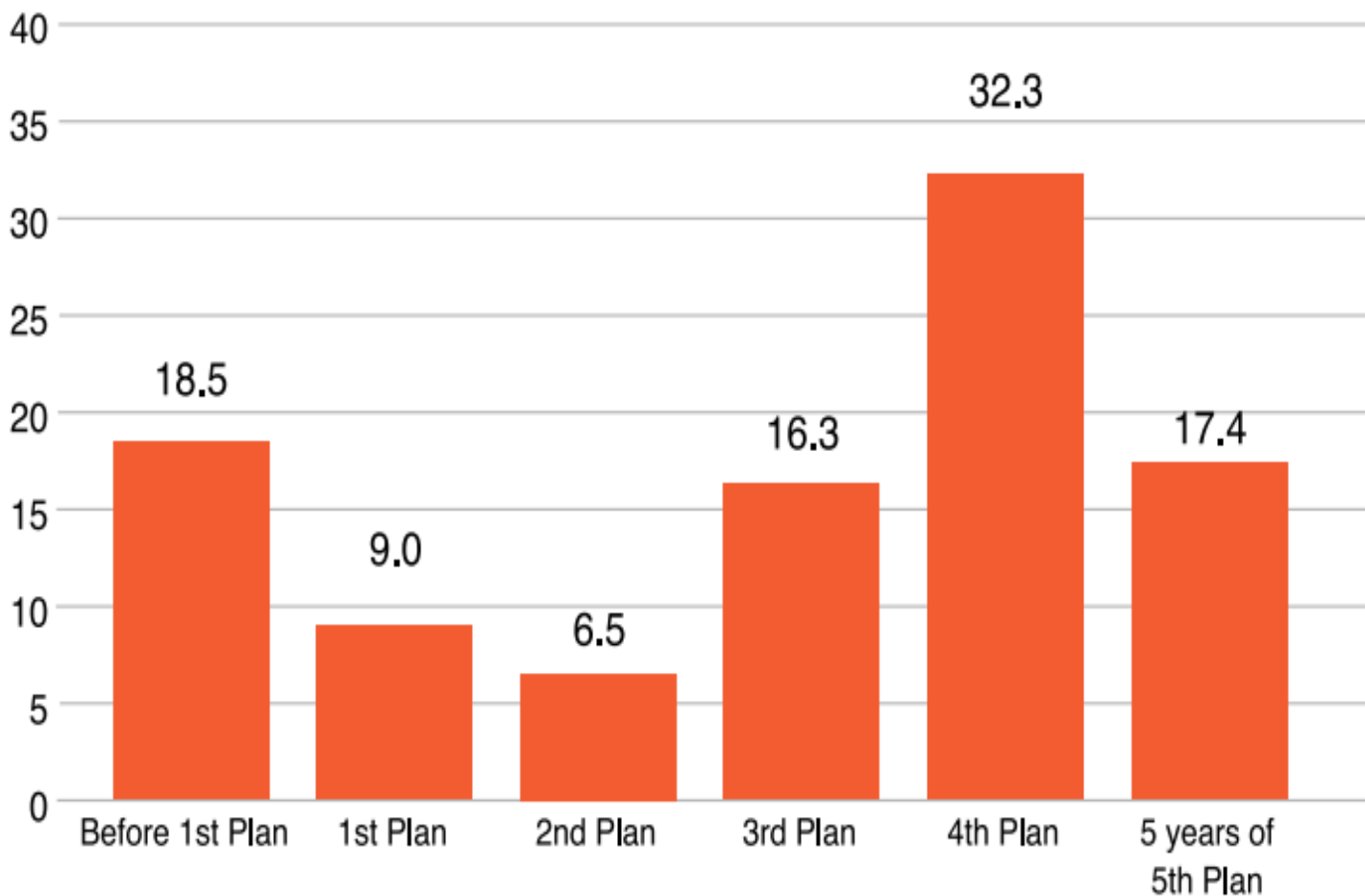
**Fig. (6): Diagram of Operational Coefficient of Average Nominal Capacity of Power Plants In 2015**

(Percent)



(%)

## Contribution of Nominal Installed Capacity

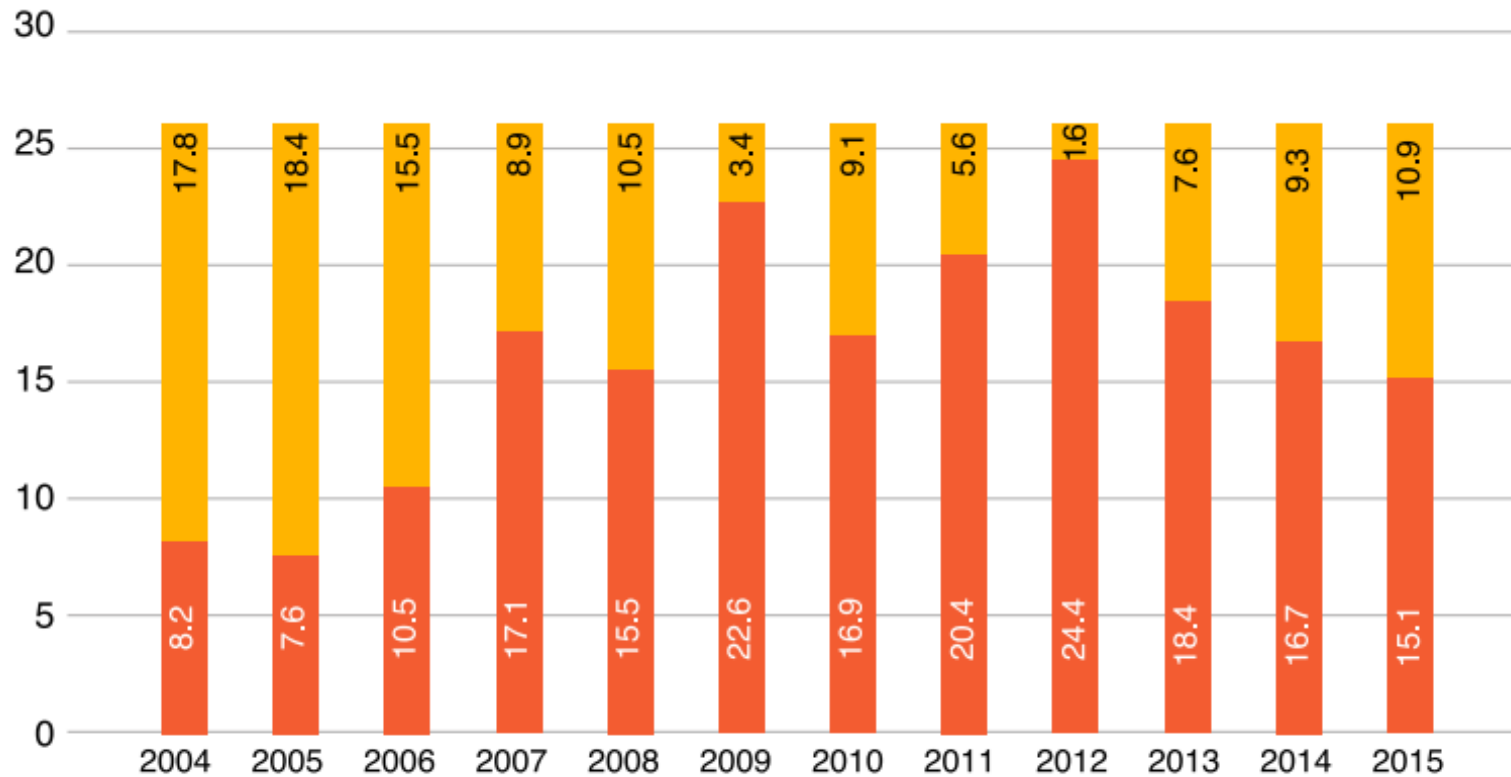


(%)

## Trend of Generation Reserve Factor

Available Generation Reserve Factor    Shortage of Generation Reserve Factor (to Preferred Level of 26%)

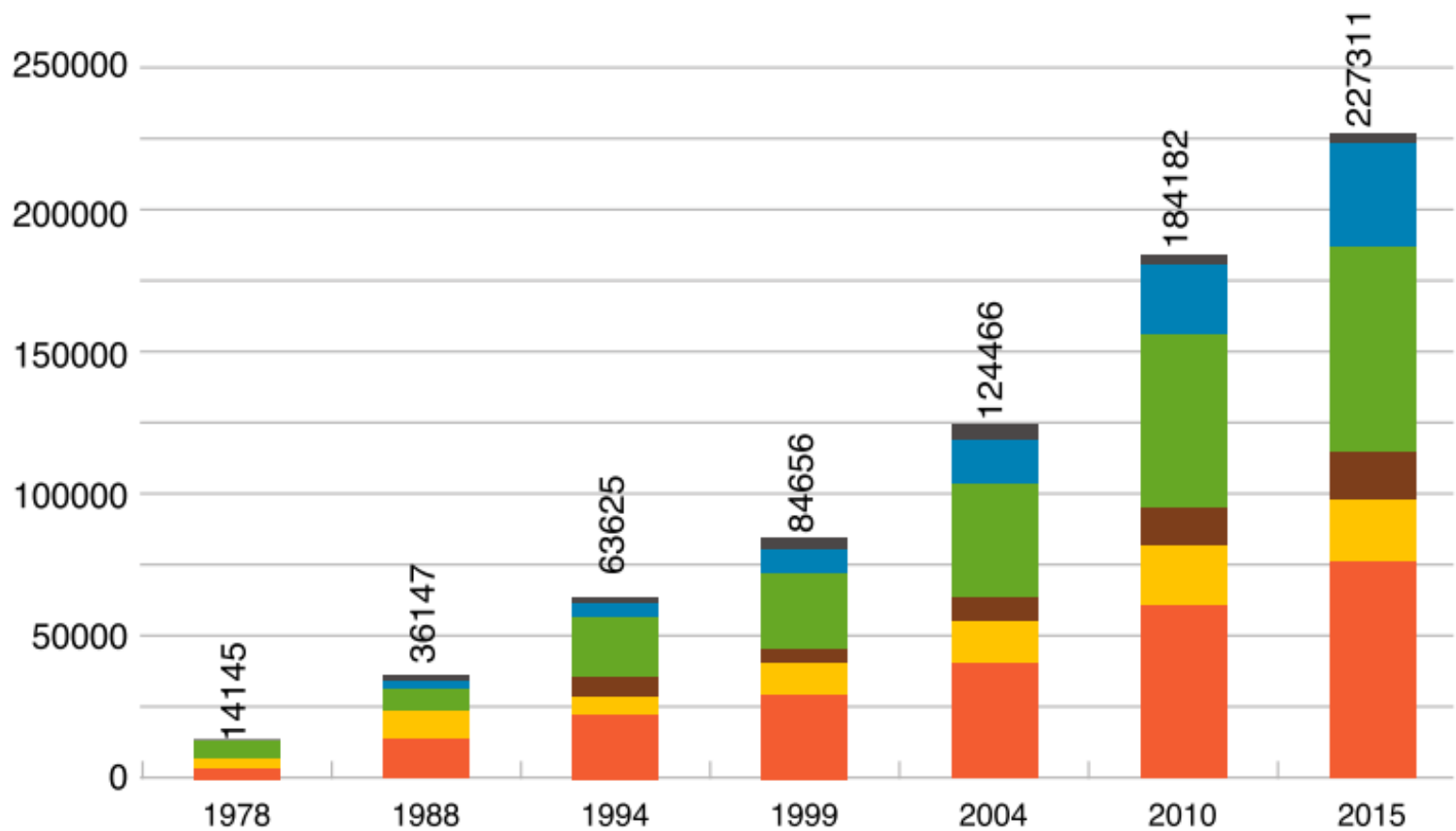
$$\text{Generation Reserve Factor} = \frac{\text{Operational Capacity} - \text{Peak Load}}{\text{Peak Load}} \times 100$$



(GWH)

## Electricity Sale to Various Consuming Sectors

Residential ■ Public Services ■ Others ■ Industrial ■ Agricultural ■ Street Lighting ■

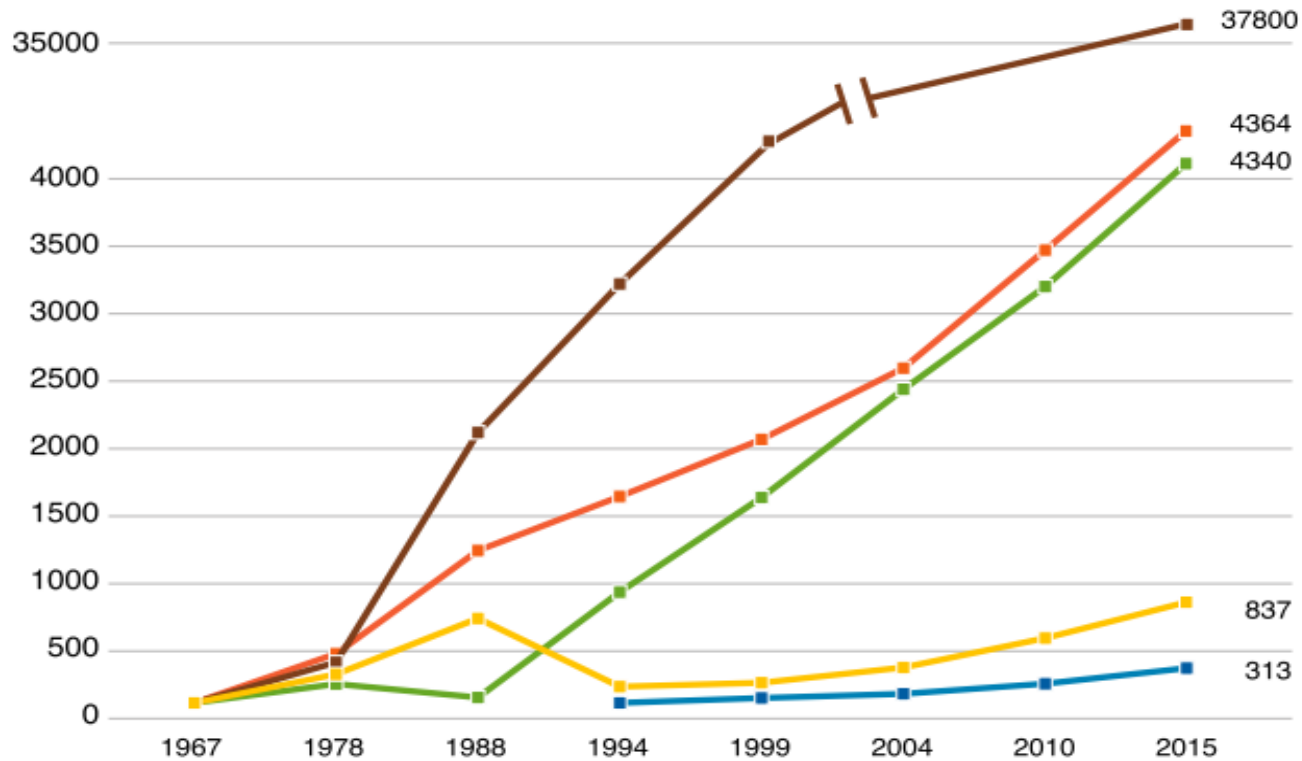




(1967=100 Base Year)

## Increasing Index of Number of Customers by Tariff

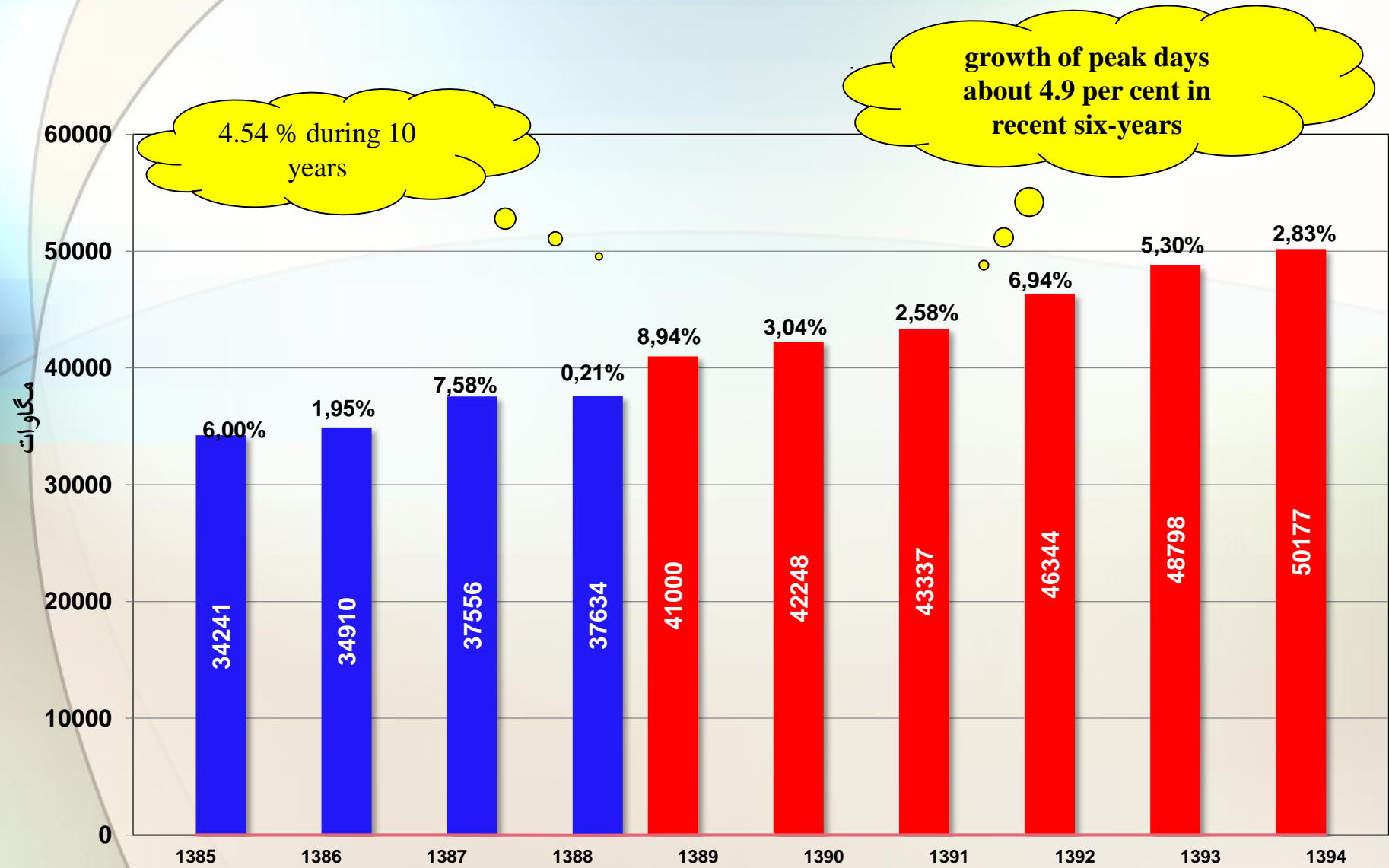
Residential ■ Public Services ■ Agricultural ■ Industrial ■ Other ■



(%)

## Contribution of Electricity Customers Number

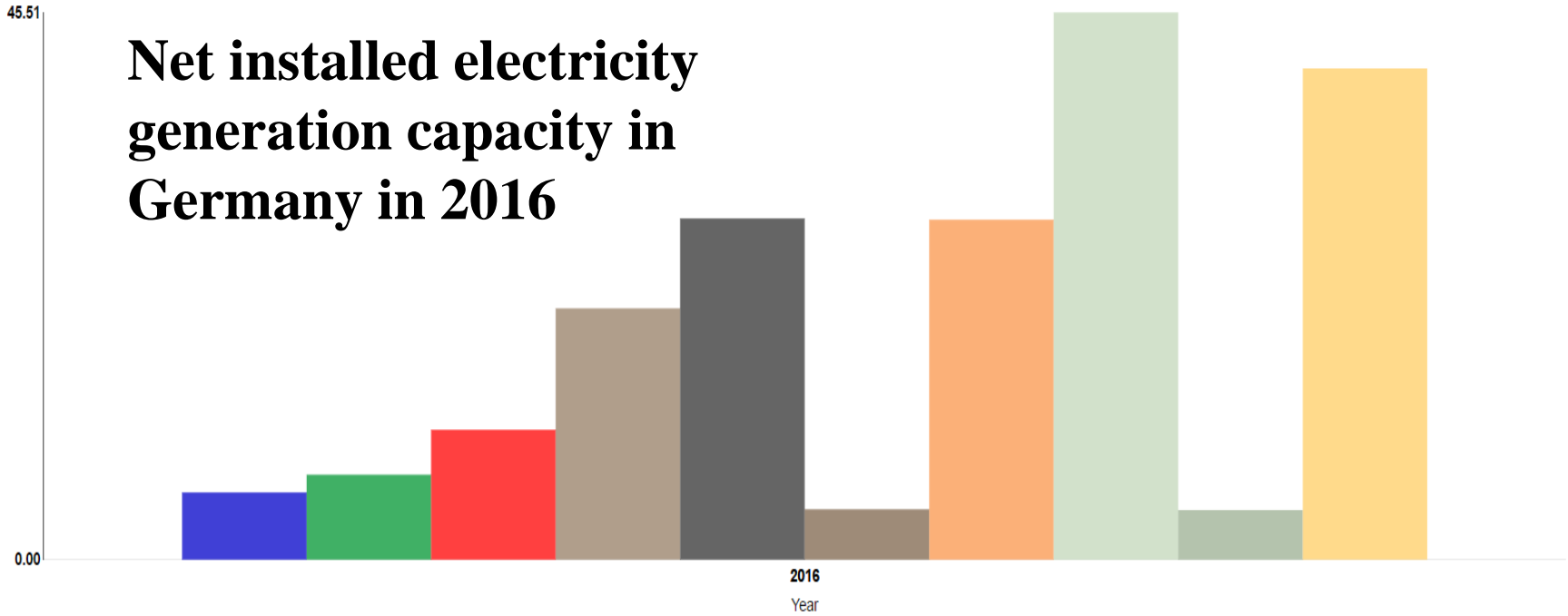
# Comparison of maximum demand during the past 10 years



Grouped Stacked

Hydro Power Biomass Uranium Brown Coal Hard Coal Mineral Oil Gas Wind onshore Wind offshore Solar

# Net installed electricity generation capacity in Germany in 2016



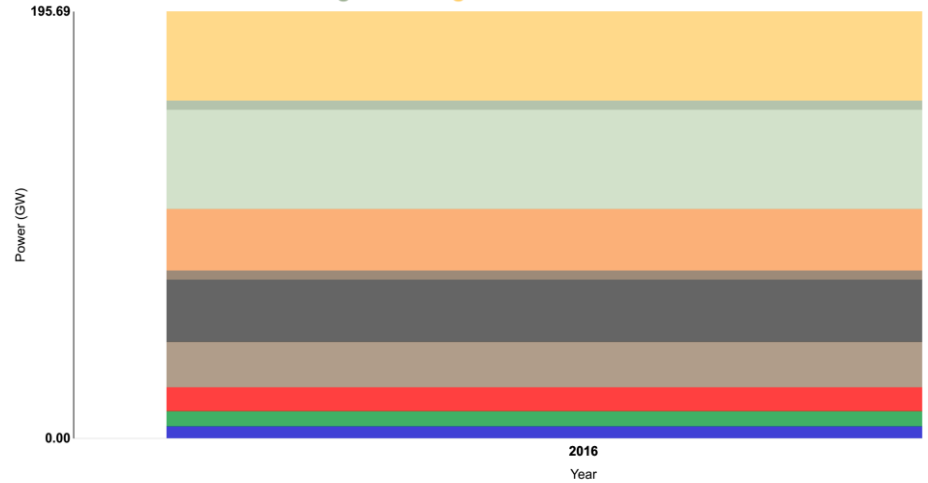
Datasource: AGEE, BMWi, Bundesnetzagentur  
Last update: 02 Feb 2017 23:13

6/4/2017

Installed power in Germany | Energy Charts

Grouped Stacked

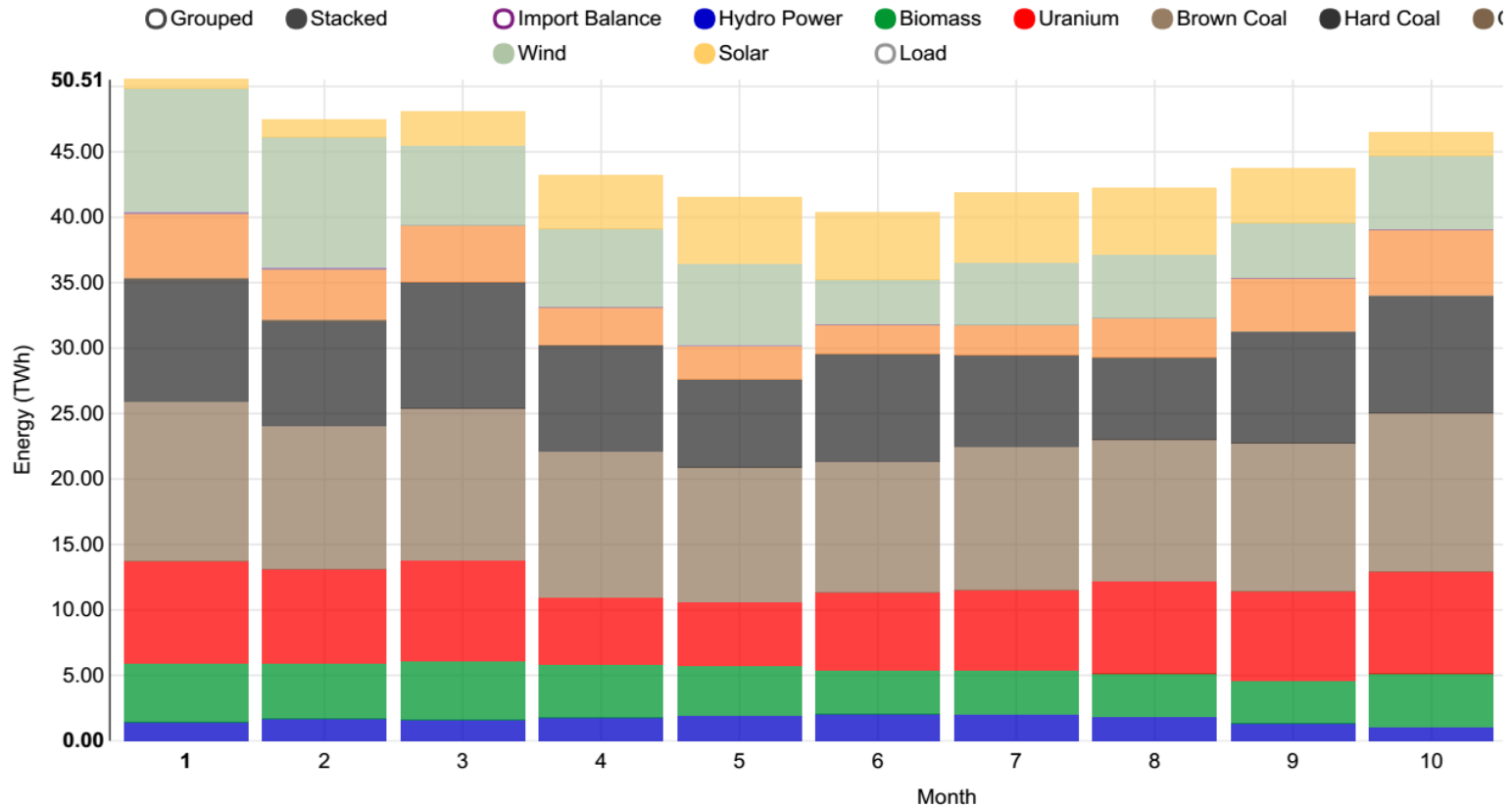
Hydro Power Biomass Uranium Brown Coal Hard Coal Mineral Oil Gas Wind onshore Wind offshore Solar



Datasource: AGEE, BMWi, Bundesnetzagentur  
Last update: 02 Feb 2017 23:13

## ENERGY CHARTS

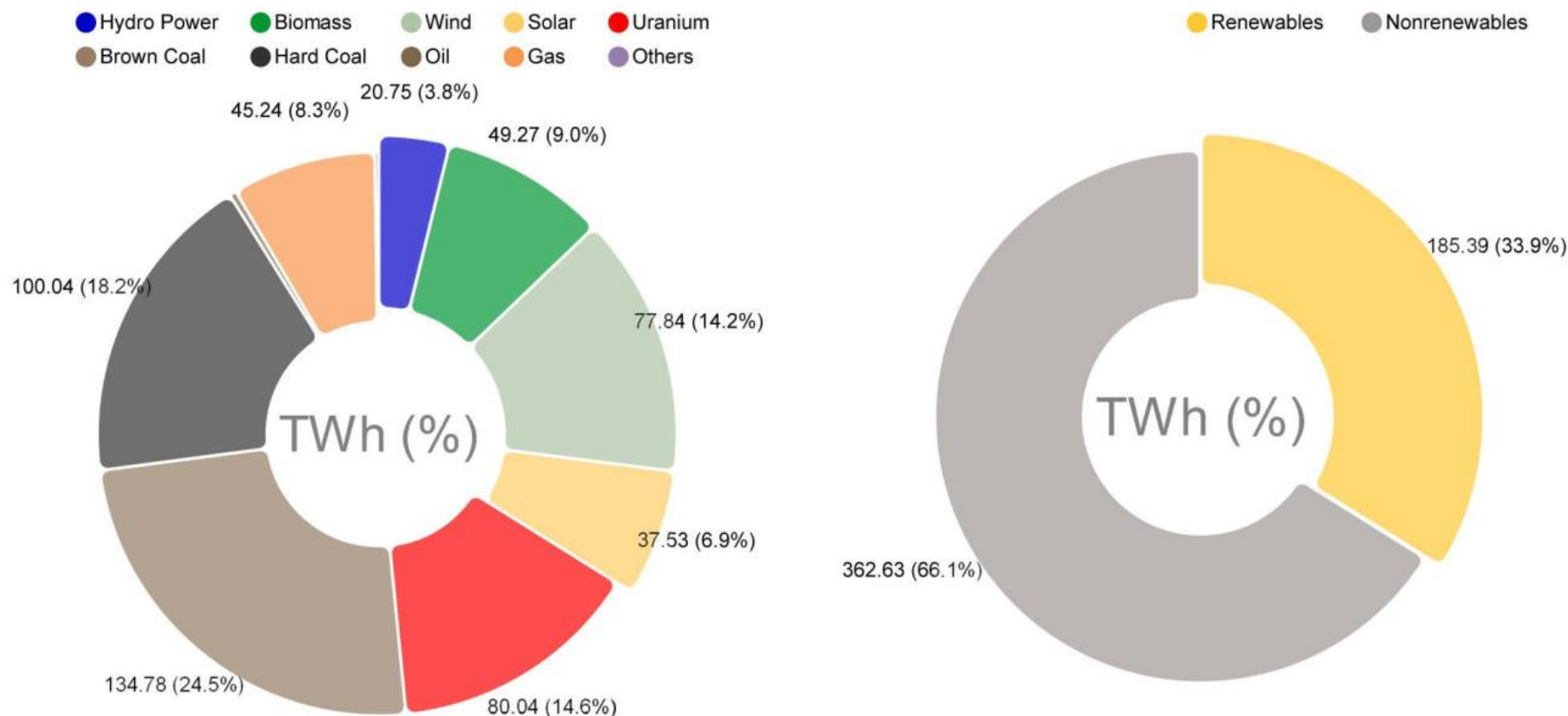
# Monthly electricity generation in Germany in 2016





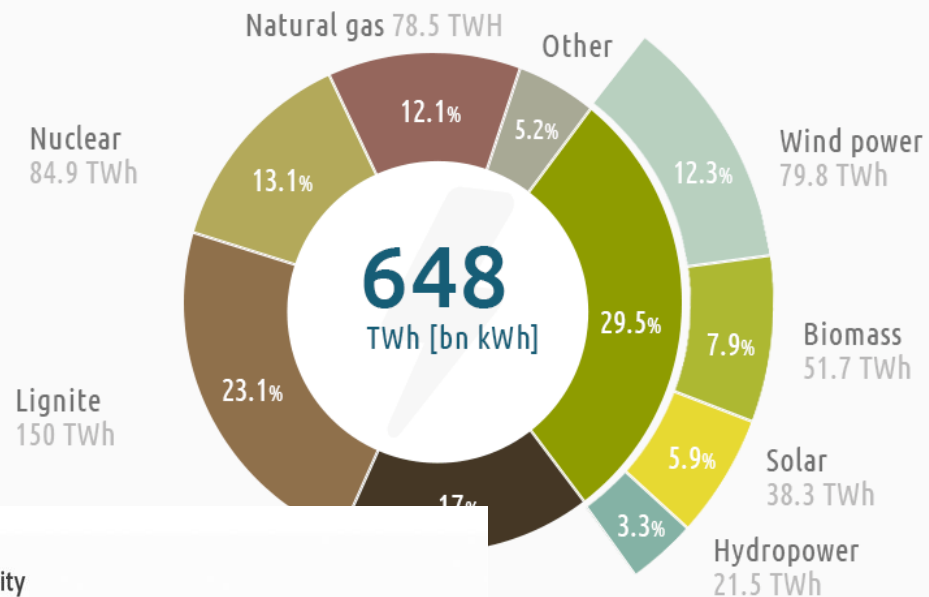
# German net power generation for public power supply

## Year 2016



Graphic: B. Burger, Fraunhofer ISE; data: DESTATIS and the EEX; source: [www.energy-charts.de/energy\\_pie.htm](http://www.energy-charts.de/energy_pie.htm)

## Share of energy sources in German power production

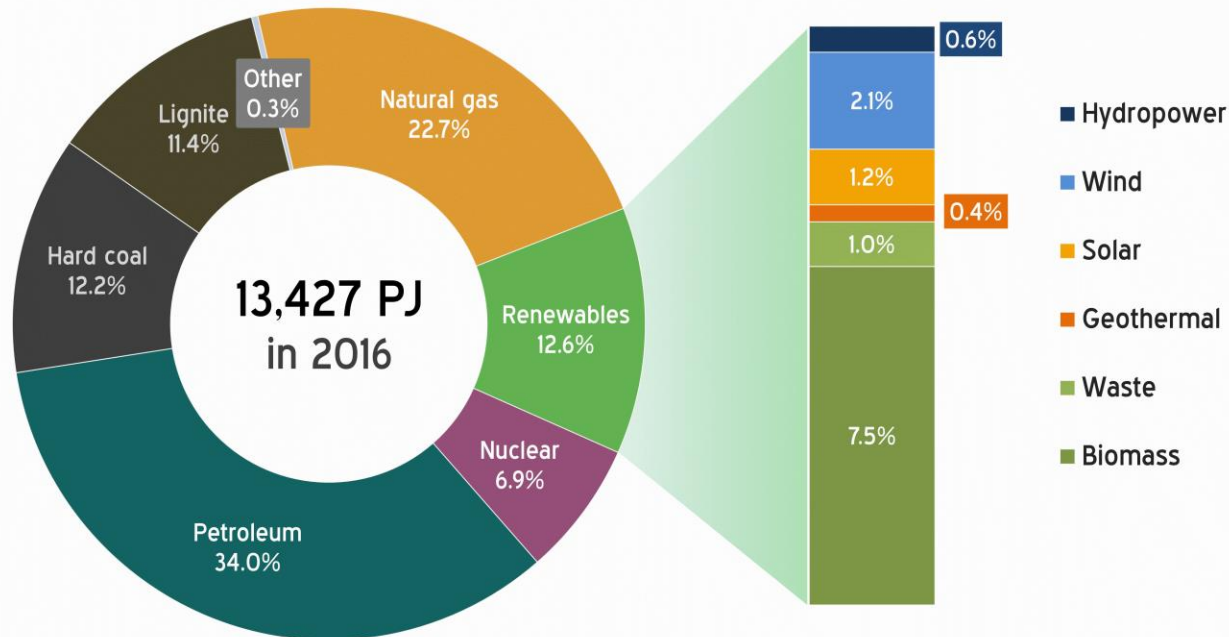


CC BY STROM-REPORT.DE

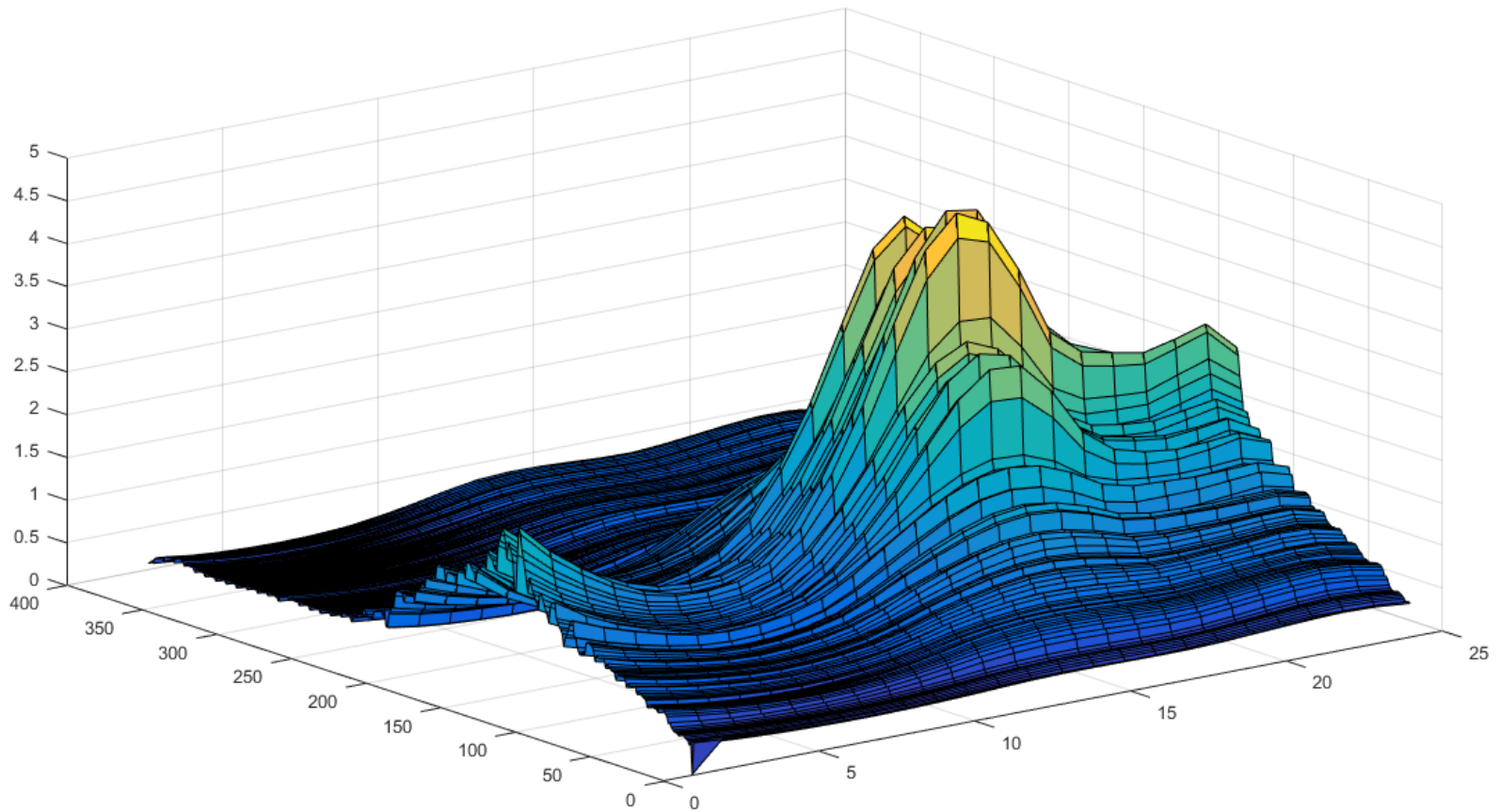
## Primary energy consumption mix in Germany 2016

In petajoules & percent, including heat and motor fuel, not just electricity

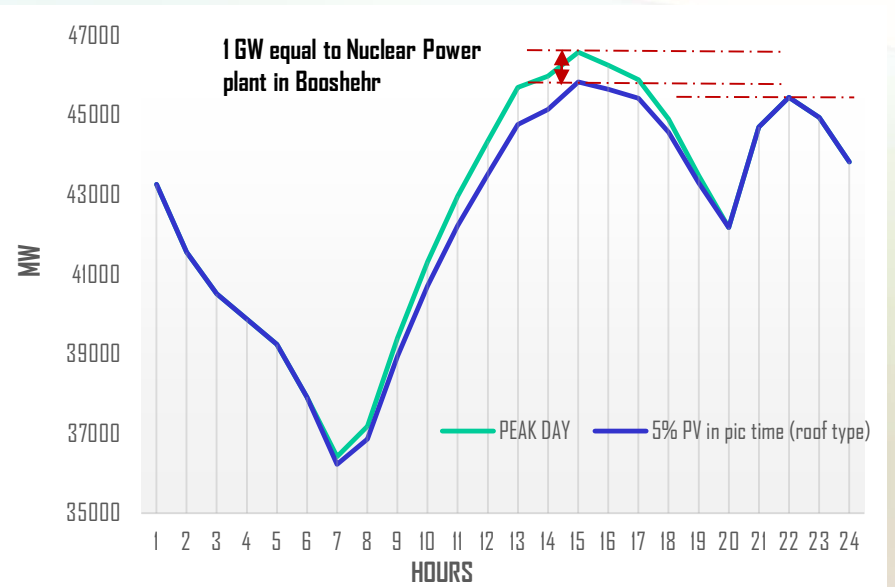
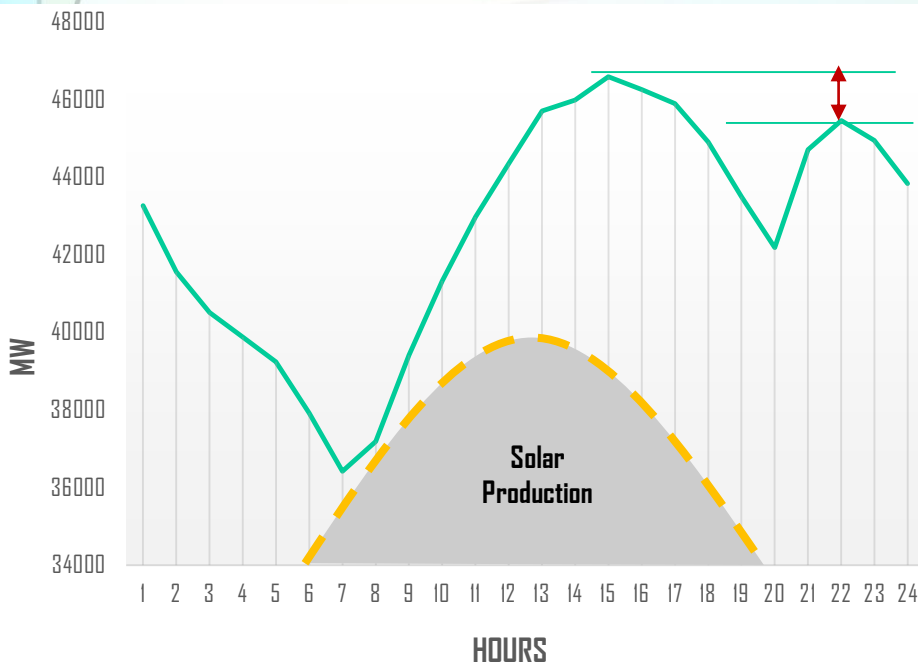
Source: AGEB, AGEE-Stat



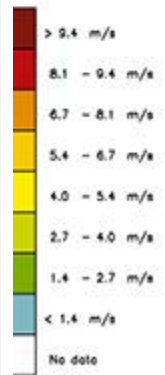
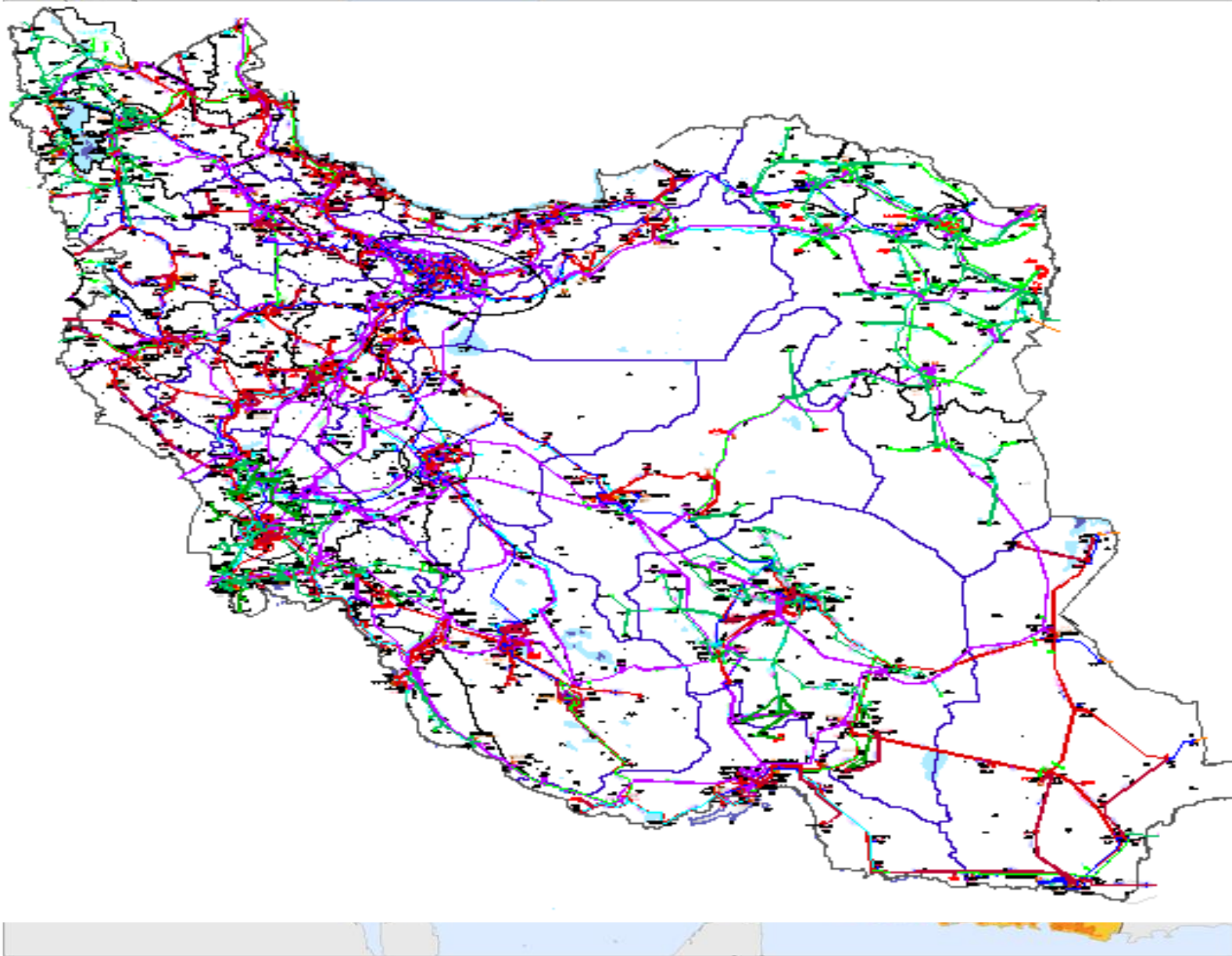
# Hourly Capacity payment factor



# PEAK SHADING With PV





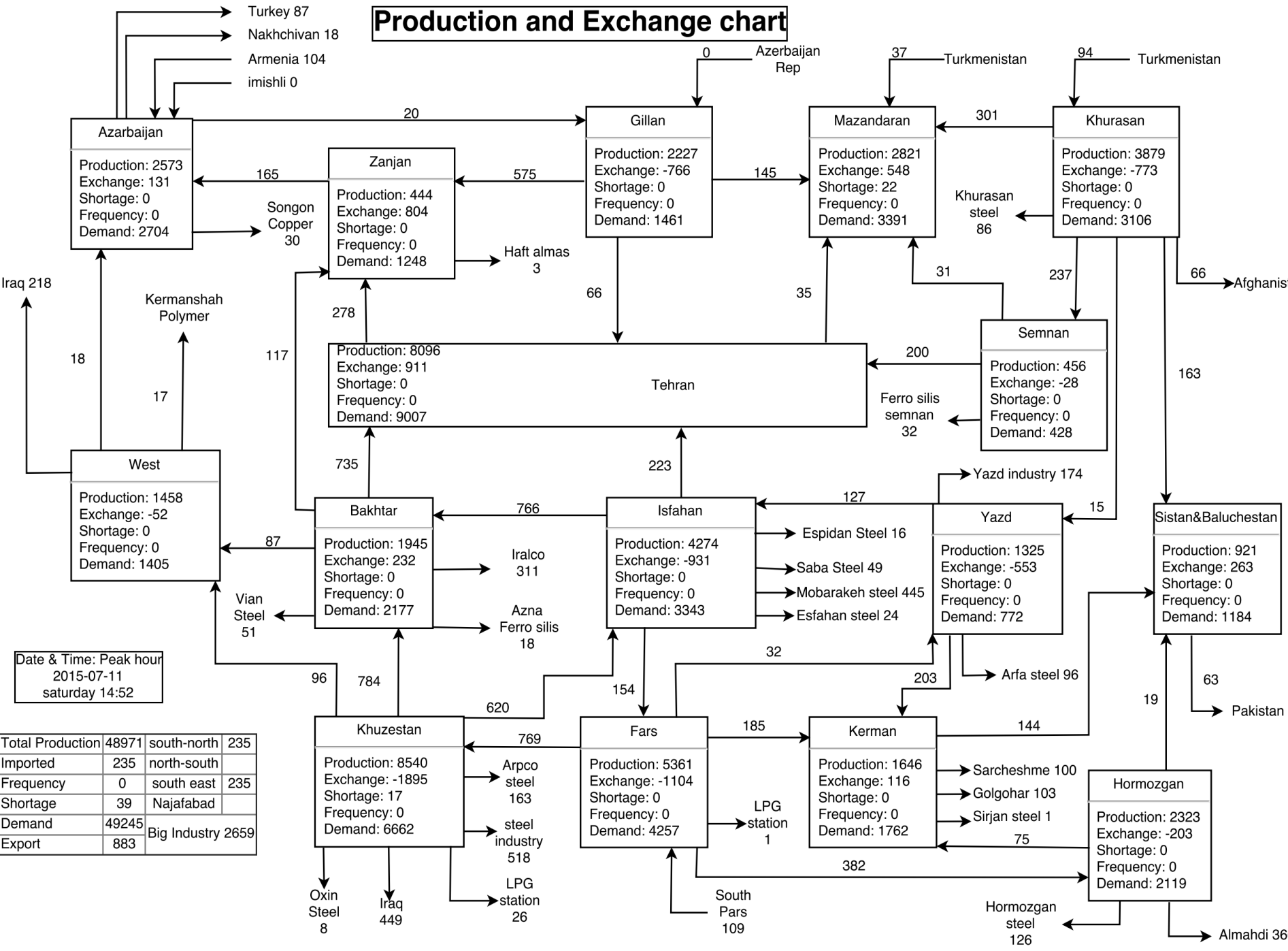


Average annual sum, period 1999-2011



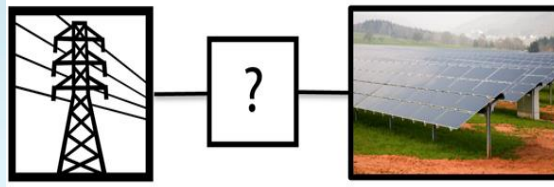
0 100 200 km

# Production and Exchange chart

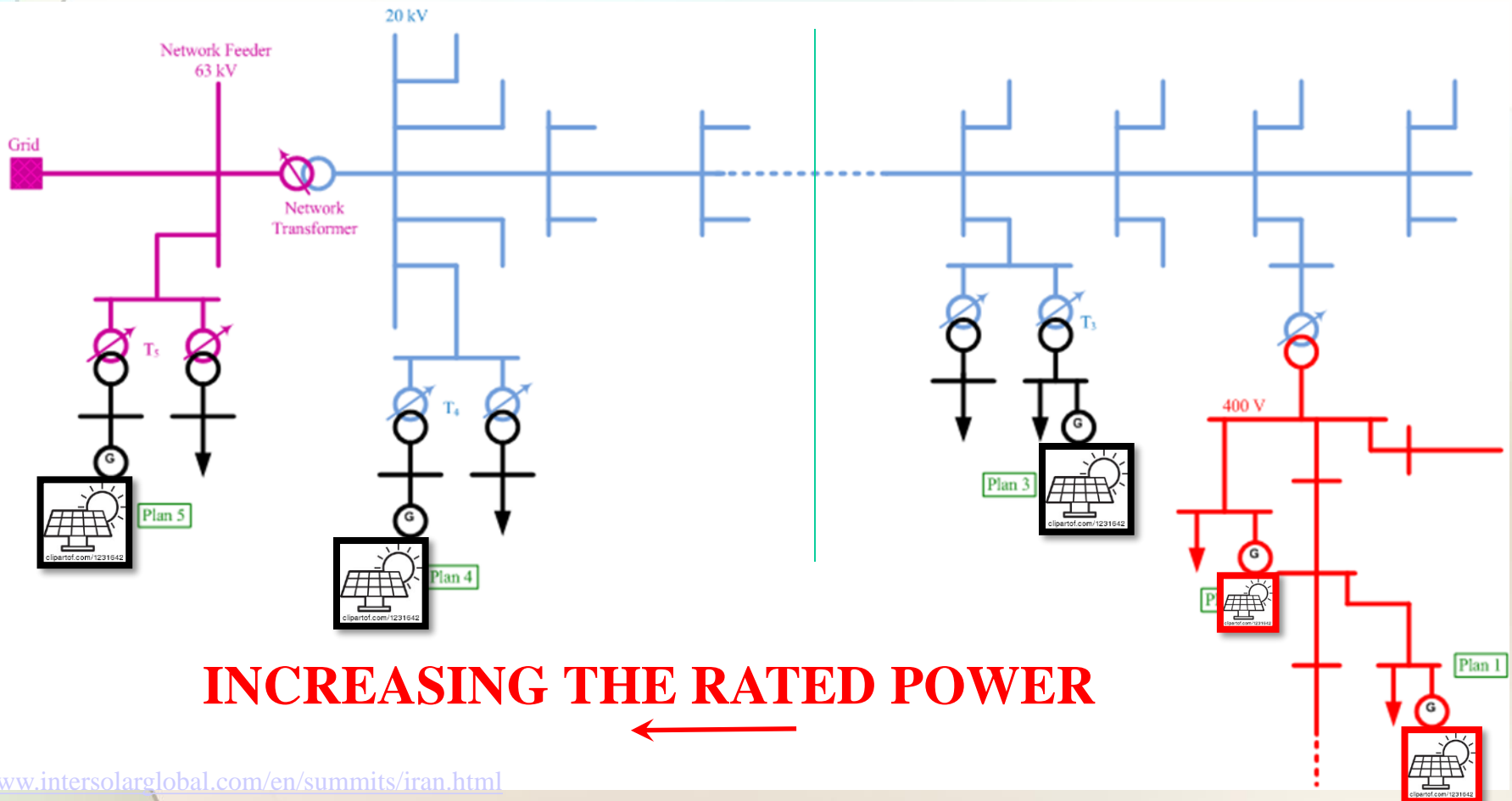


Date & Time: Peak hour  
2015-07-11  
saturday 14:52

Total Production	48971	south-north	235
Imported	235	north-south	
Frequency	0	south east	235
Shortage	39	Najafabad	
Demand	49245	Big Industry	2659
Export	883		

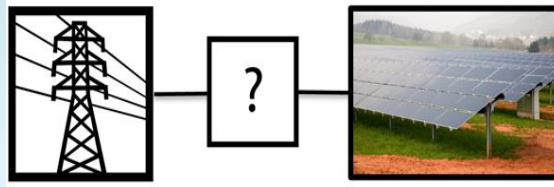


## INTERCONNECTION SCHEMES OF LESS THAN 25 MW DISTRIBUTED RESOURCES TO THE IRANIAN GRID

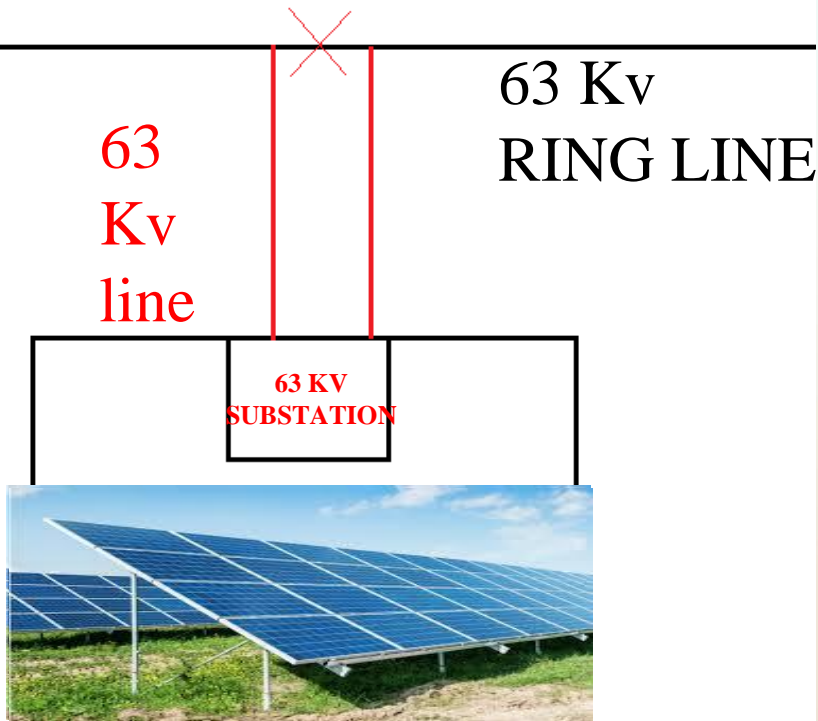


**INCREASING THE RATED POWER**

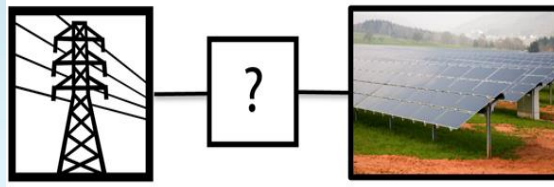




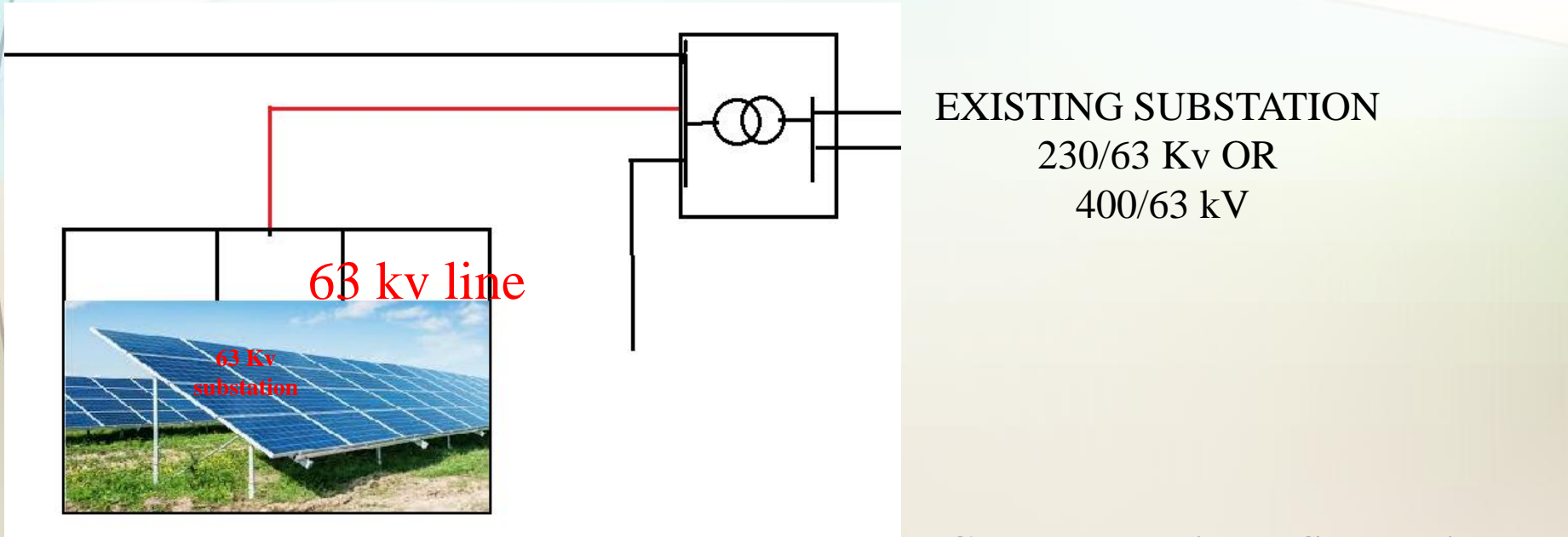
## INTERCONNECTION SCHEMES OF LARGER THAN 25 MW DISTRIBUTED RESOURCES TO THE IRANIAN GRID



- Construct private Substation
- 63 kV ring network connectivity available through entry and exit
- created 63kv substation and lines become a part of the national grid.



## INTERCONNECTION SCHEMES OF LARGER THAN 25 MW DISTRIBUTED RESOURCES TO THE IRANIAN GRID



- Construct private Substation
- Connect to transmission Bay
- Radial through a privated line 63



# **Guaranteed purchase rate for renewable electricity** **(focused on Solar Tariff)**

**According to Article 61 of the executive regulations of the law modifying the pattern of energy consumption**



# Article 61 of the executive regulations of the law modifying the pattern of energy consumption

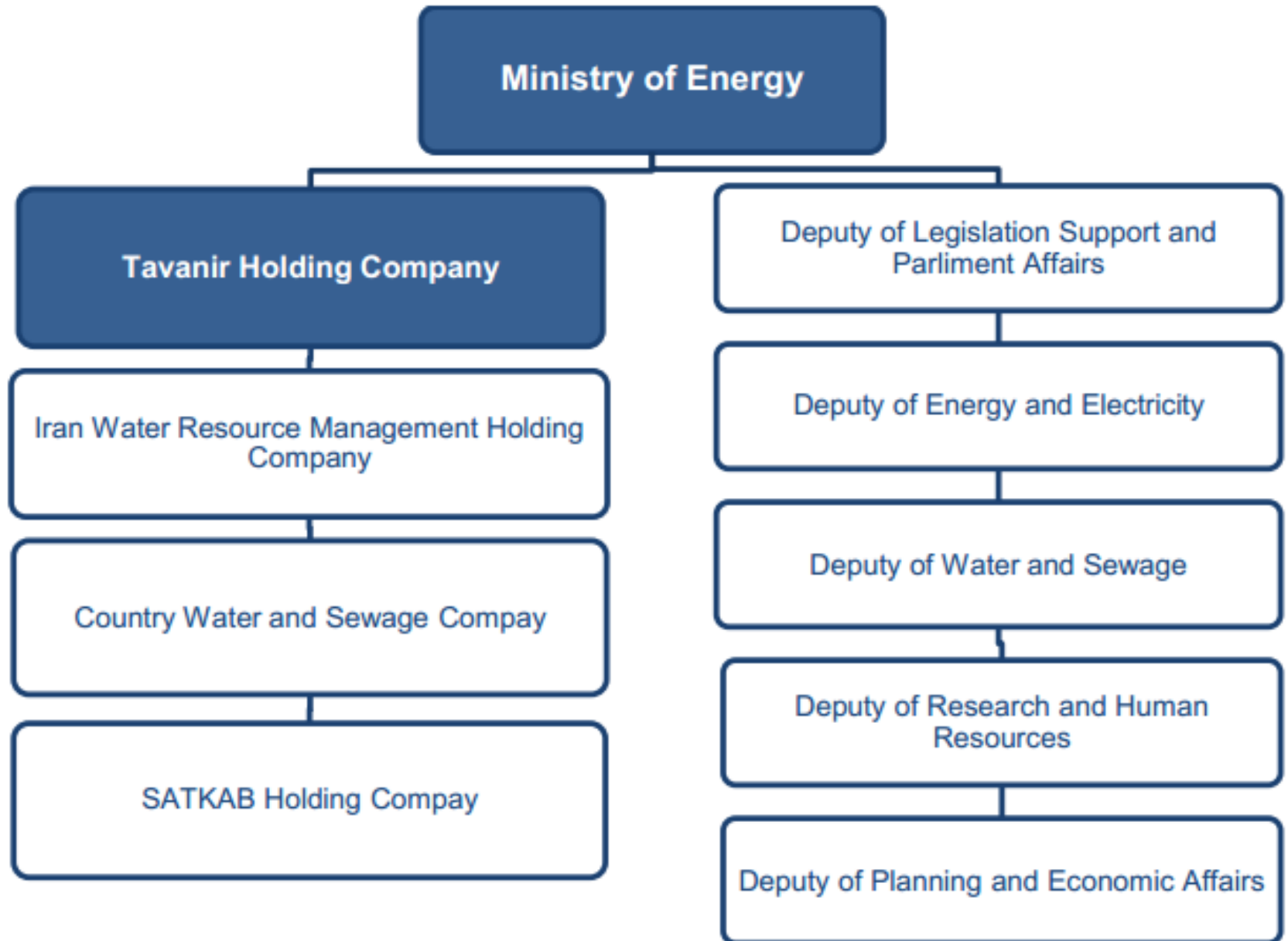
No. 52375ت/153440 dated 10/02/2016 esteemed cabinet

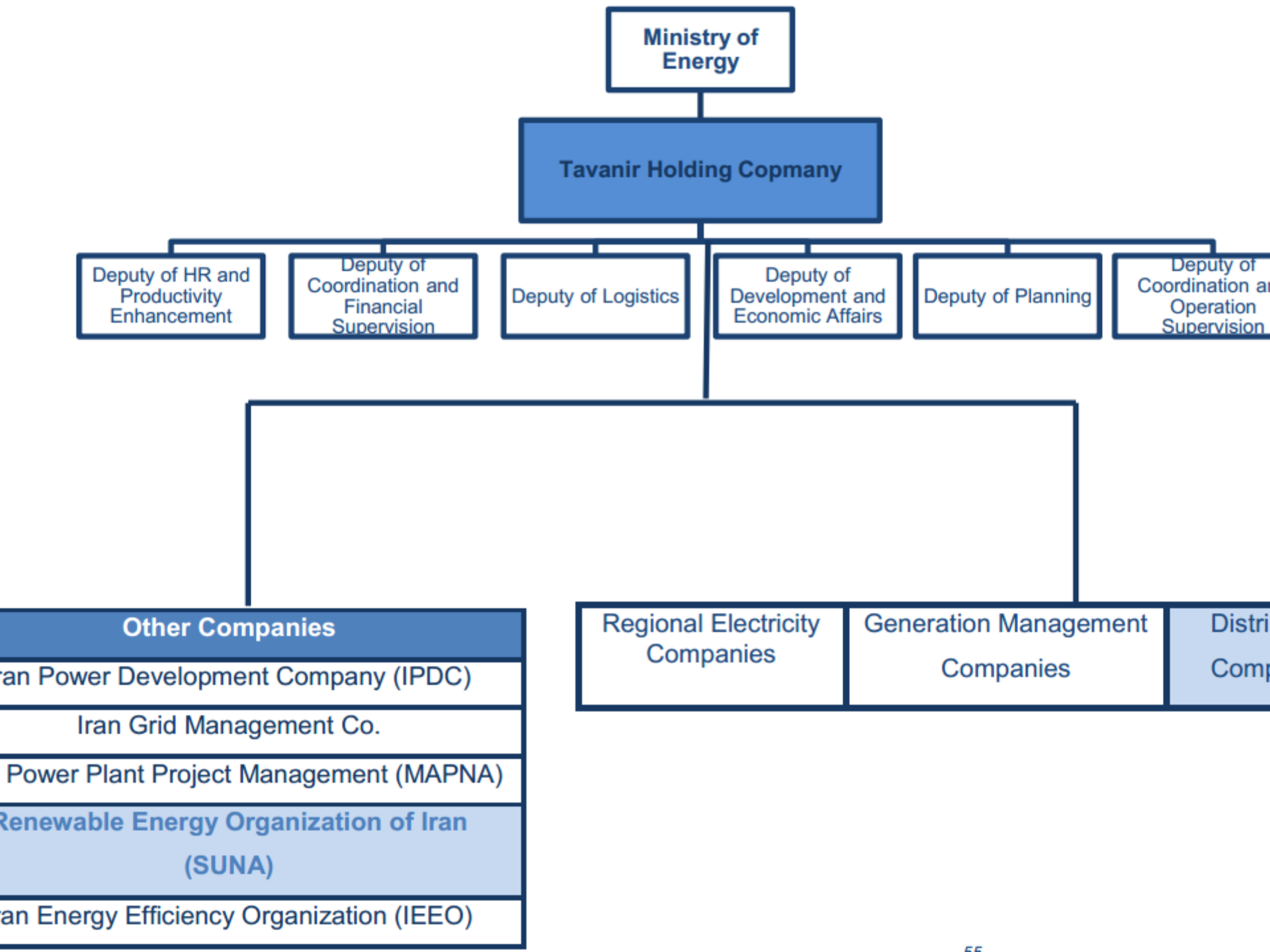
Energy Ministry is responsible to conclude long-term guaranteed purchase with private power plants producing electricity from renewable energy and clean sources, including:

- Biomass
- Wind
- **Solar**
- waste heat recovery in industrial processes
- Geothermal
- Small hydropower
- Ocean energy
- And the other types of technologies in different scales which connects the transmission and distribution network affiliated to ministry of energy



# 2015





# Ministry of Energy

2016

**Tavanir Holding Company**

Iran Water Resource Management Holding Company

Country Water and Sewage Company

SATKAB Holding Company

Deputy of Legislation Support and Parliament Affairs

Deputy of Energy and Electricity

Deputy of Water and Sewage

Deputy of Research and Human Resources

Deputy of Planning and Economic Affairs

Deputy minister and the head of renewable energy and energy efficiency organization

# Power purchase base tariff of renewable energy sources

$$\text{power purchase base tariff of renewable energy sources} = \text{The average price of energy conversion} + \text{fuel saving Value} + \text{Saving due to reduced emissions and water consumption}$$





$$\text{The average price for energy conversion} = \frac{\text{The total transaction value of power plants} - \text{The total cost of fuel for thermal power plants}}{\text{The total delivered energy thermal power plants to the wholesale market during the previous year}}$$

0.013  
\$/Kwh



860  
Kcal

Thermal value per Kwh

The value of  
fuel saving of  
per Kwh

=

Thermal value of  
one cubic meter  
of natural gas

×

The average  
efficiency of thermal  
power plants

×

The price of  
fuel saving

0.070  
\$/Kwh

8639  
Kcal

36.21  
Percent

0.258  
\$

**Base rate for guaranteed power purchase from renewable energy sources**

0.10  
\$/Kwh

=

**The average price for energy conversion**

0.013  
\$/Kwh

+

**The value of fuel saving**

0.070  
\$/Kwh

+

**Saving due to reduced emissions and water consumption**

0.019  
\$/Kwh



2015

0.155  
\$/Kwh

Base rate for  
guaranteed  
power purchase  
from renewable  
energy sources

0.011  
\$/Kwh

The average  
price for  
energy  
conversion

0.102  
\$/Kwh

The value  
of fuel  
saving

0.042  
\$/Kwh

Saving due to  
reduced  
emissions and  
water  
consumption

=

+

+

2016

0.10  
\$/Kwh

0.013  
\$/Kwh

0.070  
\$/Kwh

0.019  
\$/Kwh

2017

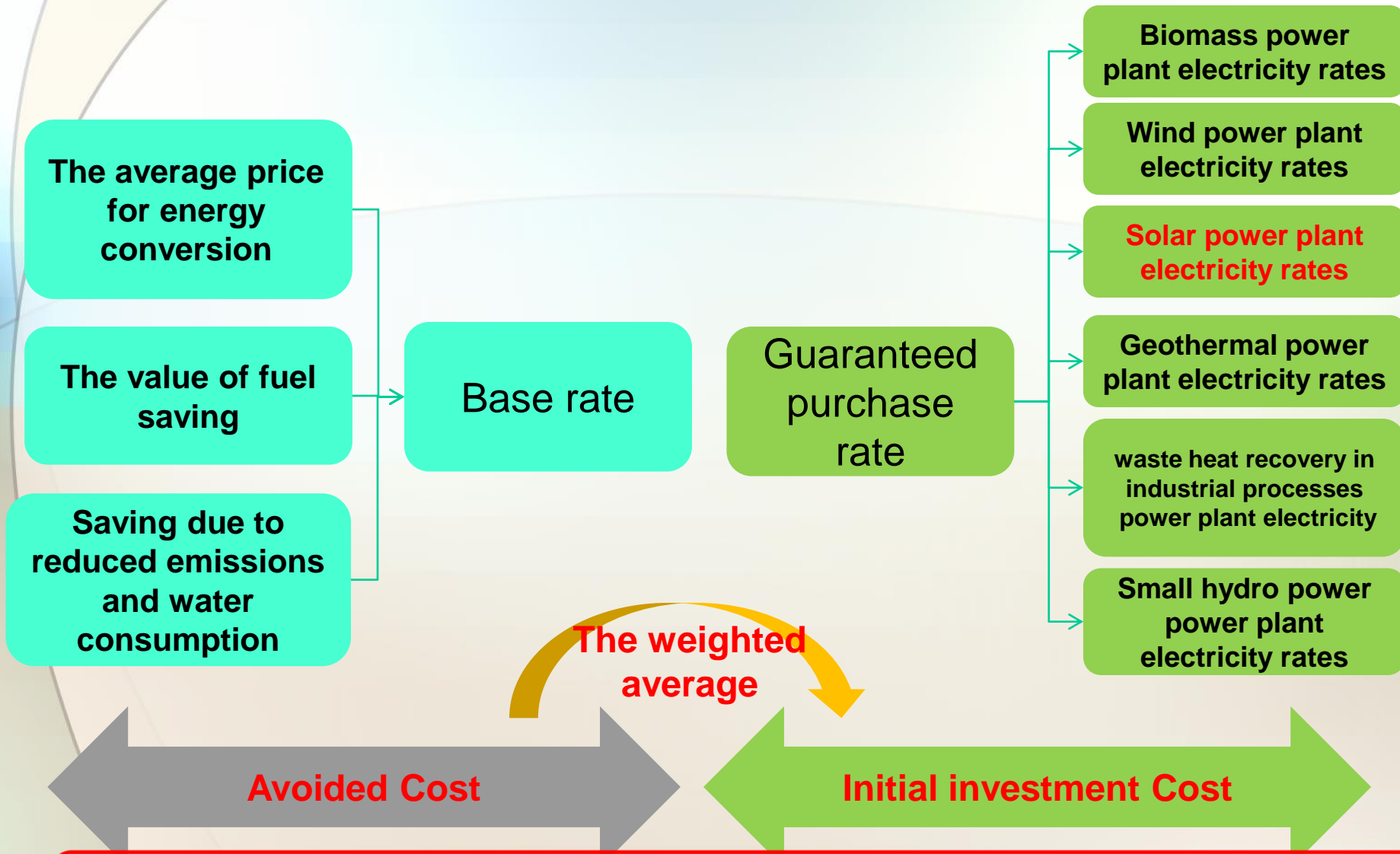
?

+

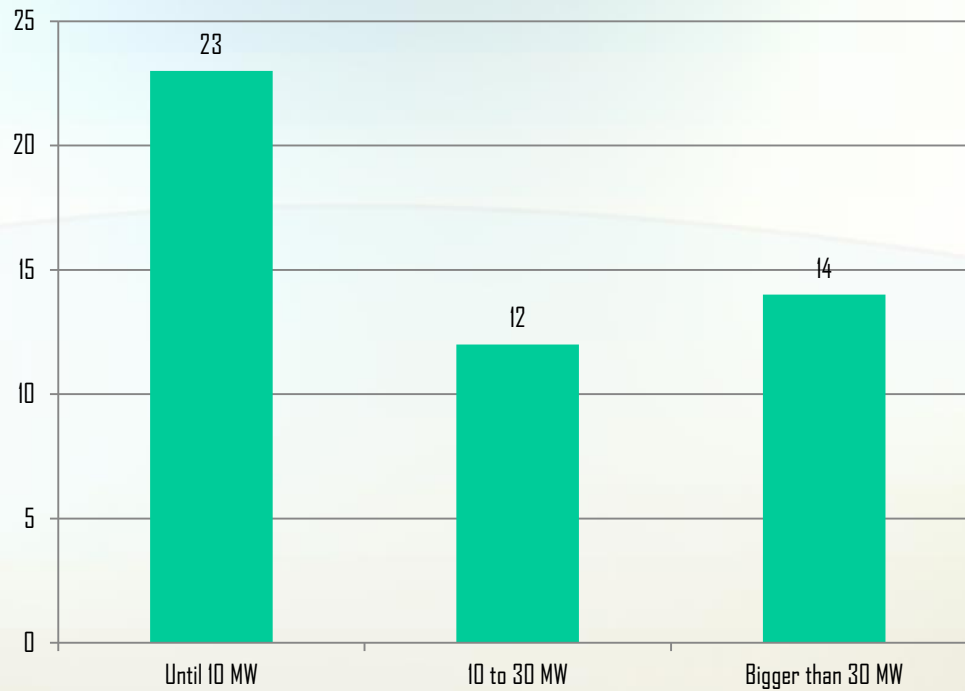
+

?

# Components in the base rate 2016



Article 2: Ministry of Energy is to is obliged to announce the guaranteed purchase of electricity rate from non- governmental (private) power plant types to declare such a way that their weighted average base rate is equal



$$\text{Average price} = \frac{23 * 10MW + 12 * 30MW + 14 * 50}{23 + 12 + 14} \approx 20 MW$$

**0.11**

**Solar farm-with the capacity of 30 megawatt and less**

Guaranteed electricity purchase tariff (\$/kWh)	Technology type
	<b>Biomass –Landfill</b>
	<b>Biomass – The anaerobic digestion of manure, sewage and agriculture</b>
	<b>Biomass – Gasification</b>
	Wind farm- -above 50 megawatt capacity
	Wind farm -with the capacity of 50 megawatt and less
	Wind with the capacity of 1 megawatt and less ( allocated to the consumers and limited to the connection capacity)
<b>0.09</b>	<b>Solar farm above 30 megawatt capacity</b>
<b>0.11</b>	<b>Solar farm-with the capacity of 30 megawatt and less</b>
<b>0.14</b>	<b>Solar farm-with the capacity of 10 megawatt and less</b>
<b>0.20</b>	<b>Solar with the capacity of 100 kilowatt and less ( allocated to the consumers and limited to the connection capacity)</b>
<b>0.22</b>	<b>Solar With the capacity of 20 kilowatt and less ( allocated to the consumers and limited to the connection capacity)</b>
	Geothermal (including excavation and equipment)
	Waste Heat Recovery in industrial processes
	Small hydropower- Installation on the rivers and side facility of dams
	Small hydropower- (with the capacity of 10 MW and less)- Installation on the pipelines

**Article 2: Ministry of Energy is to is obliged to announce the guaranteed purchase of electricity rate from non- governmental (private) power plant types to declare such a way that their weighted average base rate is equal.**

**Electricity transmission service rates**

**Tariff Rate**

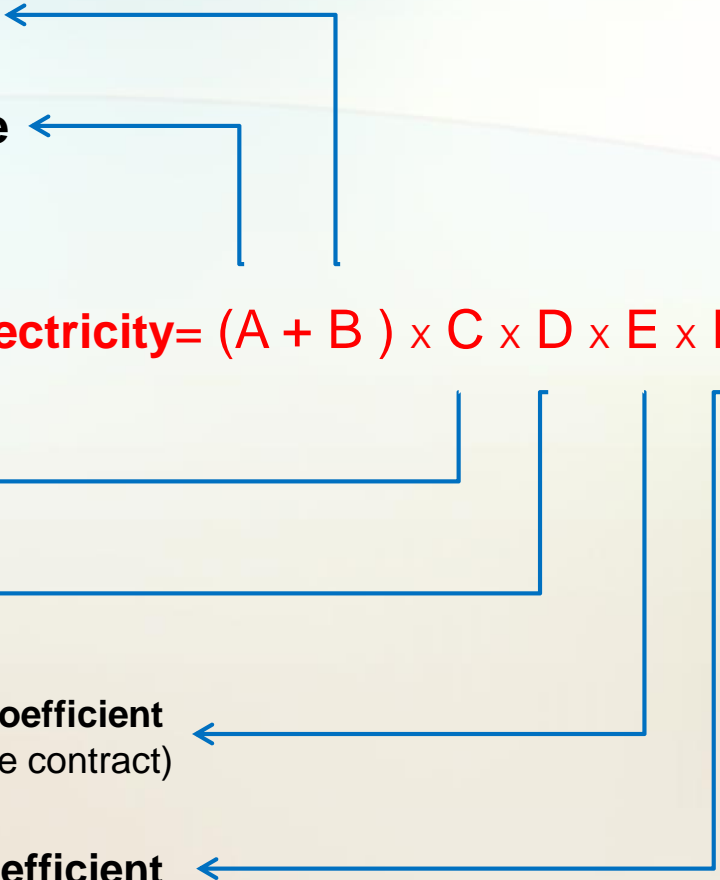
**The price per a kWh of renewable electricity= (A + B ) x C x D x E x F**

**The adjusted rate**

**Hourly readiness coefficient**

**Stepped model coefficient**  
(for 10 second year of the contract)

**Localization coefficient**



**Electricity transmission service rates**

**Tariff Rate**

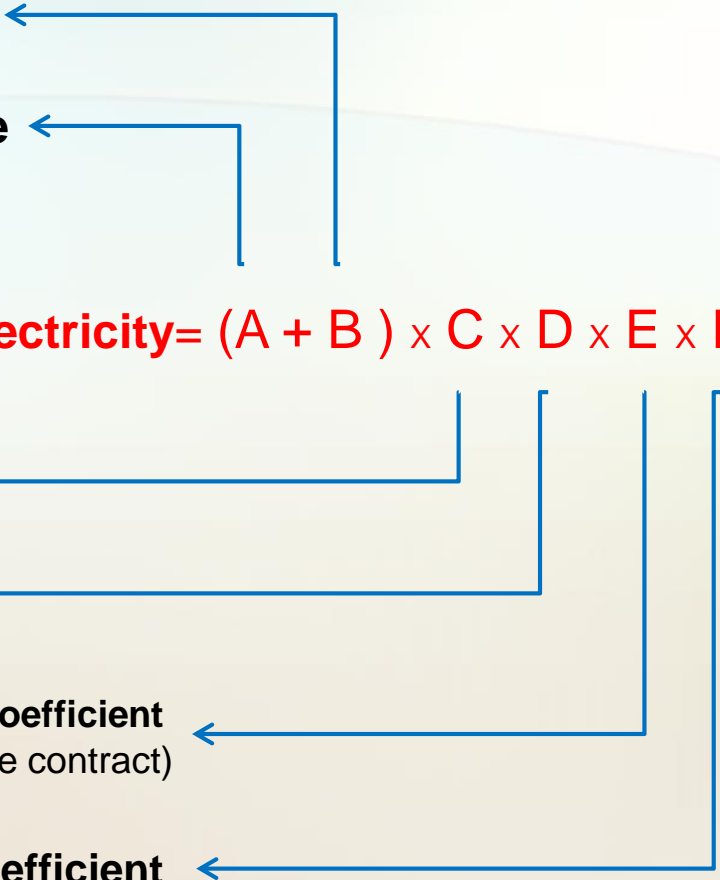
**The price per a kWh of renewable electricity= (A + B ) x C x D x E x F**

**The adjusted rate**

**Hourly readiness coefficient**

**Stepped model coefficient**  
(for 10 second year of the contract)

**Localization coefficient**



## Electricity transmission service rates

Note 3- If the electricity produced by non- governmental sector doing supplied in distribution network, transmission service rate is added to the guaranteed power purchase rate power plants

<b>Electricity transmission service rates (in 2016)</b>	<b>Impact on ROI (Return On Investment)</b>
<b>0.004 \$/Kwh</b>	<b>%0.7</b>





## C) The adjusted rate

$$\begin{aligned}
 &\text{Adjustment Coefficient of the Base Rate of the Electricity Purchase contract with power plants} \\
 &= \left( \frac{\text{Retail Sale Index at the beginning of the year of payment}}{\text{Retail Sale Index at the beginning of the year of contract conclusion}} \right)^{\alpha} \times \left( \frac{\text{Average official currency (Euro) exchange rate in the course of one year before payment}}{\text{Average official currency (Euro) exchange rate in the course of one year before contract conclusion}} \right)^{1-\alpha}
 \end{aligned}$$

☑ It is assumed that the inflation rate will be equal to the rate adjustment

Adjusted rate (in 2016)	Impact on ROI (Return On Investment)
5 %	1 %



## D) Hourly cpf

Hourly factor table					X	Hourly production power plant				
	H1	H2	...	H24			H1	H2	...	H24
1						1				
2		#				2		Kwh		
3						3				
...						...				
365						365				

The impact OF Hourly factor in billing	Impact on ROI (Return On Investment)
15% - 20%	2% - 3%



## **E) Step factor (for 10 second year of the contract)**

Power Purchase Agreements of power plants subject to this announcement are extended for a 20 year period with the specified tariffs, during years of contract, the tariffs will be adjusted in accordance with coefficient under article 3 of Economic Council Directive.

Note1: Tariffs mentioned for all power plants subject to this announcement except wind farms, will be multiplied by 0.7 after adjustment of article 3 of Economic Council Directive starting from the first day of the second 10 years till the end of the contract.



## F) Localization coefficient

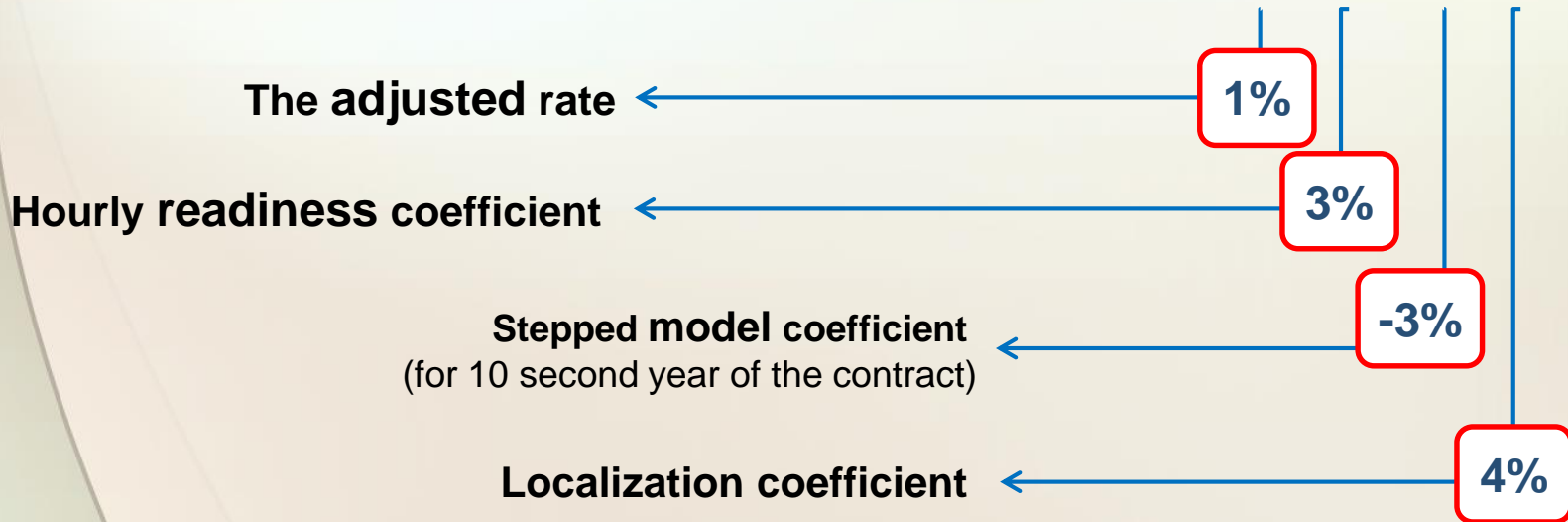
To order to encourage the development of technical know-how and support local manufacture tariff can be increased up to a maximum of 30% for power plants constructed using local know-how design and manufacturing

The impact OF Localization coefficient in billing	Impact on ROI (Return On Investment)
10% - 20%	3% - 5%





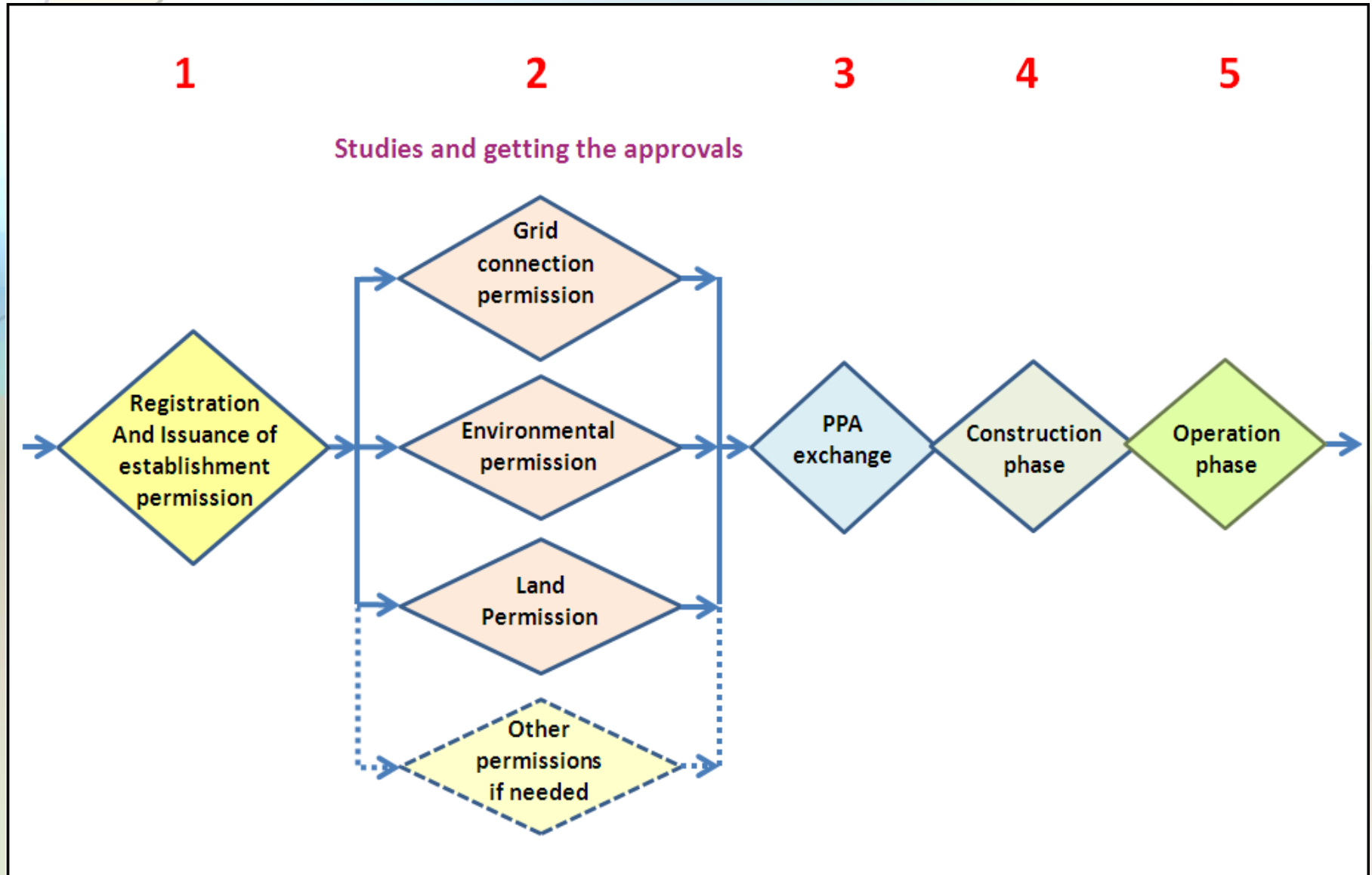
**The price per a kWh of renewable electricity= (A + B ) × C × D × E × F**



# Steps of implementing projects

1. **Registration** and acquiring **Establishment Approval** from **SUNA**
2. **Gathering other permissions** including:
  1. **Grid Connection Permission** from the grid manager,
  2. **Environmental Permission** from the Conservation of Environment Organization of Iran,
  3. **Land Use Permission** from the governmental lands authorization,
3. **Signing Power Purchase Agreement** with **SUNA**
4. **Construction of the power plant.** **SUNA** will **monitor** and generally **supervise** the activities in this step,

# Simple Flowchart of Implementing Steps





# Policy guidelines for the development of renewable energy

Recognition

Obtaining licenses

Financing

Manufacturing and construction

Operation

Construction permit

Exchange of PPA

Connecting to the grid

Establishment of renewable energy developer

Tender on condition of technology transfer

To Provide a government al guarantee

enforcement of Section 3 of Article 61 of the law modifying the pattern of energy consumption

enforcement of Article 12 of the Law on Elimination of production barriers

Increase the amount of electricity from Article 5 of the electricity industry support

Providing tax and customs incentives to import main wind turbine equipment



**Thanks For Attention**

**Mehrdad DAVARI FAR**

[davarifar@gmail.com](mailto:davarifar@gmail.com)

**+98 9123476762**