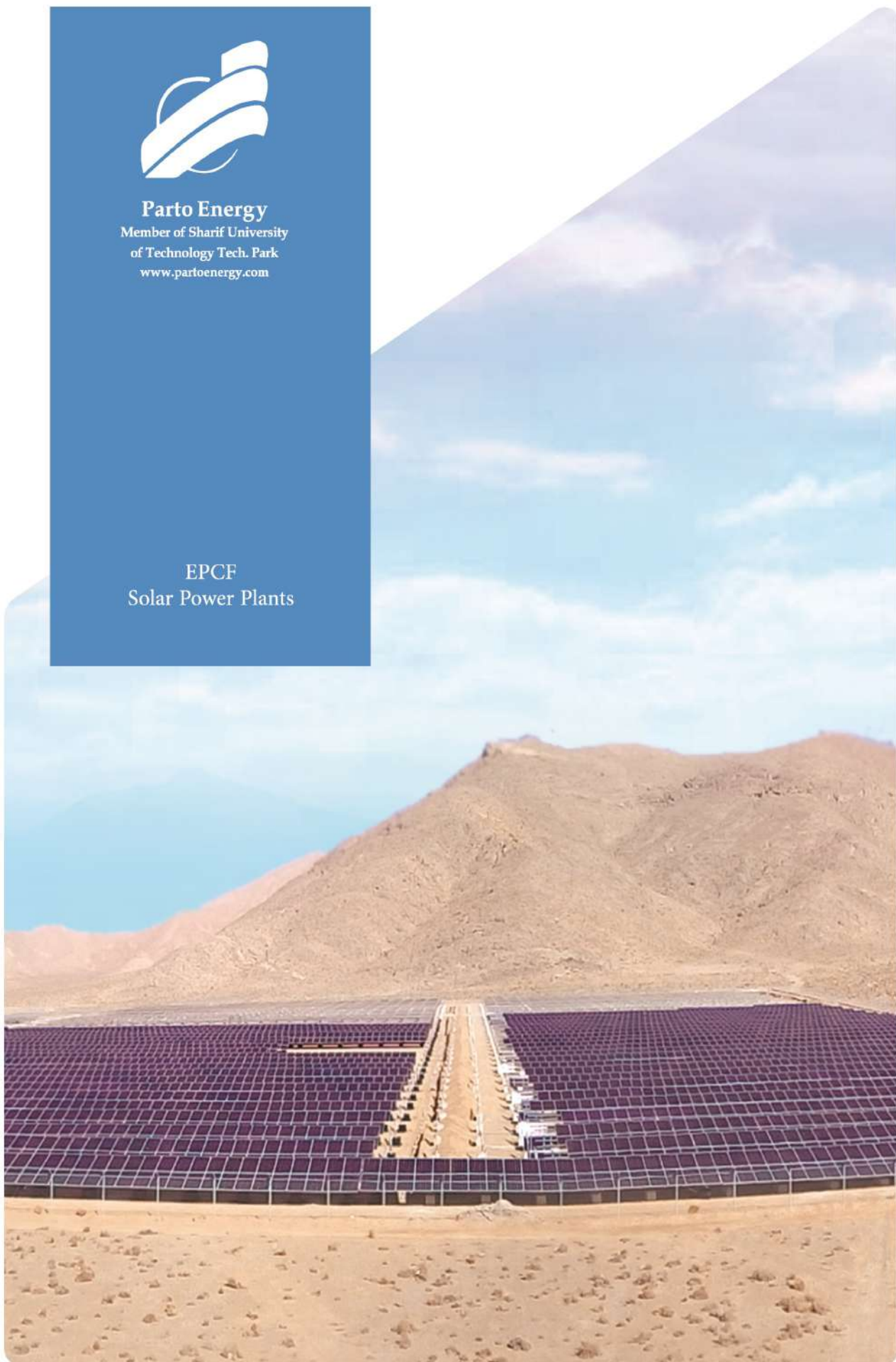




Parto Energy

Member of Sharif University
of Technology Tech. Park
www.partoenergy.com

EPCF
Solar Power Plants



In The Name of God

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Introduction, Solar Energy

Main advantages of the construction of solar power plants

Economic and financial advantages of solar power plants



Main advantages of the construction of solar power plants

Economic benefits

- 20years Power Purchase Agreement (PPA)
- Being in line with the Paris agreement and emitting 8 percent of greenhouse effects
- Guaranteed investment in the renewable energy sector
- Help to improve knowledge-based activities
- Localization of science and executive operation of solar power plants construction
- The entrepreneurial approach to invest in small-size enterprises working on renewable energy
- Having specified share of participation in the economic projects for the development of small and medium-sized power plants
- Moving toward sustainable development based on Iran's local programs

Technical benefits of solar energy as a clean resource

- No environmental pollution
- No noise pollution
- Fast EPC
- Long life-cycle
- Easy and cheap O&M
- Reducing CO₂ emission
- Lowering social costs regarding the environmental pollution
- Sustainable development in renewable energy
- Reduce energy lost in the electricity network

Government economic policies and constitution

- Endeavor to meet the Resistive Economy policies articles no. 1, 2, 3, 13, 20, 22
- Distributed power generation
- Help to improve civil defense
- Fulfillment of the article no. 44 of the Iran constitution regarding the participation of the private sector in the economic activities

Financial benefits

- Internal Rate of Return (IRR) of at least 20%
- Guaranteed payment for buying the electricity by Iran government for 20 years

Economic advantages of solar power plants in Iran

- The 20 years power purchase agreement (PPA)
- Tariffs higher than most countries
- Considering late fees
- Considering the adjustment rate based on Currency changes

Financial estimation

- The solar photovoltaic power plants tariffs were determined by the minister of energy on May 8, 2016, as described in the following table.
- The power purchase agreement (PPA) is for a 20year period based on following table.

NO.	Type	Plant capacity	Tariff (RIs per kWh)
Connect to Substation			
1	Solar Farm	10MW to 30 MW	4000
2		100kW to 10 MW	4900
Subscriber Split			
3	Power Plant	20kW to 100 kW	7000
4		20kW and less	8000

- The power purchase tariffs will adjust by the following adjustment rate for the first decade and for the rest ten years the adjustment rate will be set at 0.7.

$$\text{Adjustment rate} = \left[\frac{\text{Retail Index at the beginning of the payment year}}{\text{Retail Index at the beginning of the agreement year}} \right]^{\alpha} \times \left[\frac{\text{Average of the official value of currency (euro) at one year period before the payment year}}{\text{Average of the official value of currency (euro) before the agreement}} \right]^{1-\alpha}$$

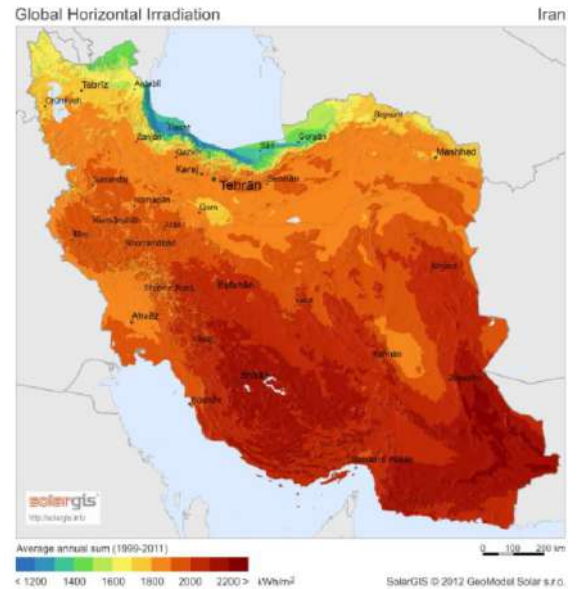
- In this equation, the α value is considered at 0.3. It depends on the usage of foreign goods (in foreign currency) or local goods (in Rial) in the production process.
- The average inflation rate for Rial and foreign currency is considered 15 and 12 percent respectively in a 20year period.
- According to the numbers given above, the adjustment rate will be equal to 1.1289.
- 1 percent reduction of annual energy production for PV modules, according to standards, and the operation and maintenance cost has been considered in above Calculations.

Iran and solar power plants

Locating solar power plant, Assessment of Iran solar radiation

Assumptions and equipment

Locating the solar power plant and assessment of Iran solar radiation



Examples of Solar Radiation and Energy Production assessments for a 1 kW Solar Power Plant in one Year

No	City	Radiation	Efficiency %	1kW production in a year
		Net of radiation in one year	Based on climate condition	kWh/kW
1	Shiraz	2474	78	1930
2	Zahedan	2478	77.8	1928
3	Brojen	2379	79.7	1897
4	Kerman	2376	78.6	1866
5	Esfahan	2373	78.4	1862
6	Birjand	2368	78.2	1853
7	Yazd	2300	78.2	1798
8	Semnan	2253	79.8	1797
9	Khoram Abad	2282	77.7	1774
10	Tehran	2233	79.3	1772
11	Arak	2217	79.2	1755
12	Hamedan	2168	79.2	1716
13	Zanjan	2121	80.8	1715
14	Qazvin	2163	79.1	1712
15	Abhar	2130	80.2	1709
16	Tabriz	2109	80.5	1698
17	Qom	2127	78.3	1665
18	Mashhad	2107	78.7	1659
19	Ahwaz	2179	74.7	1628

- One of the most important factors of solar power plants development is choosing the right location based on the climate condition.

Factors of Climate Condition assessment:

- ♦ Solar radiation intensity
 - ♦ Sunny hours (during the day)
 - ♦ Ambient temperature
 - ♦ Wind velocity
- Regarding the importance of the climate condition data, the data collected by satellites from a valid European company has matched to results of Iran Meteorological Organization 20-year data.
 - Also we guarantee mentioned data in Economic plan in normal conditions.
 - The solar radiation intensity map of Iran is illustrated above.



Power plant assumptions

1	Capacity	20kW	100kW	1MW	2MW	4MW	10MW
2	Required land	400m ²	2000m ²	2Hectares	4Hectares	8Hectares	20Hectares
3	Executive period/ Operation period	8-2months/ 20 years operation					
4	Process	Engineering, Procurement, Civil Construction, Mounting system, PV module, cabling, inverter, grid connection					

Power plant equipment

No	Description	Made in	Brand
1	72cells PV module	China & Korea	Top 10 brands
2		Iran	-
3	Central Inverter	Germany	SMA
4	String Inverter	Germany/China	Top 10 brands/SMA
5	Mounting System	Iran	Parto Energy
6	L.V. electrical panel	Iran	Parto Energy
7	Transformer, M.V. electrical	Europe	Top 10 brands
8	panel	Iran	Iran Transfo, Aria Transfo
9	Cable	Iran	Hedayat electric, Tak, Sepehr Al-borz, Abhar Simca, Metal

Solutions and engineering services

Attar Group

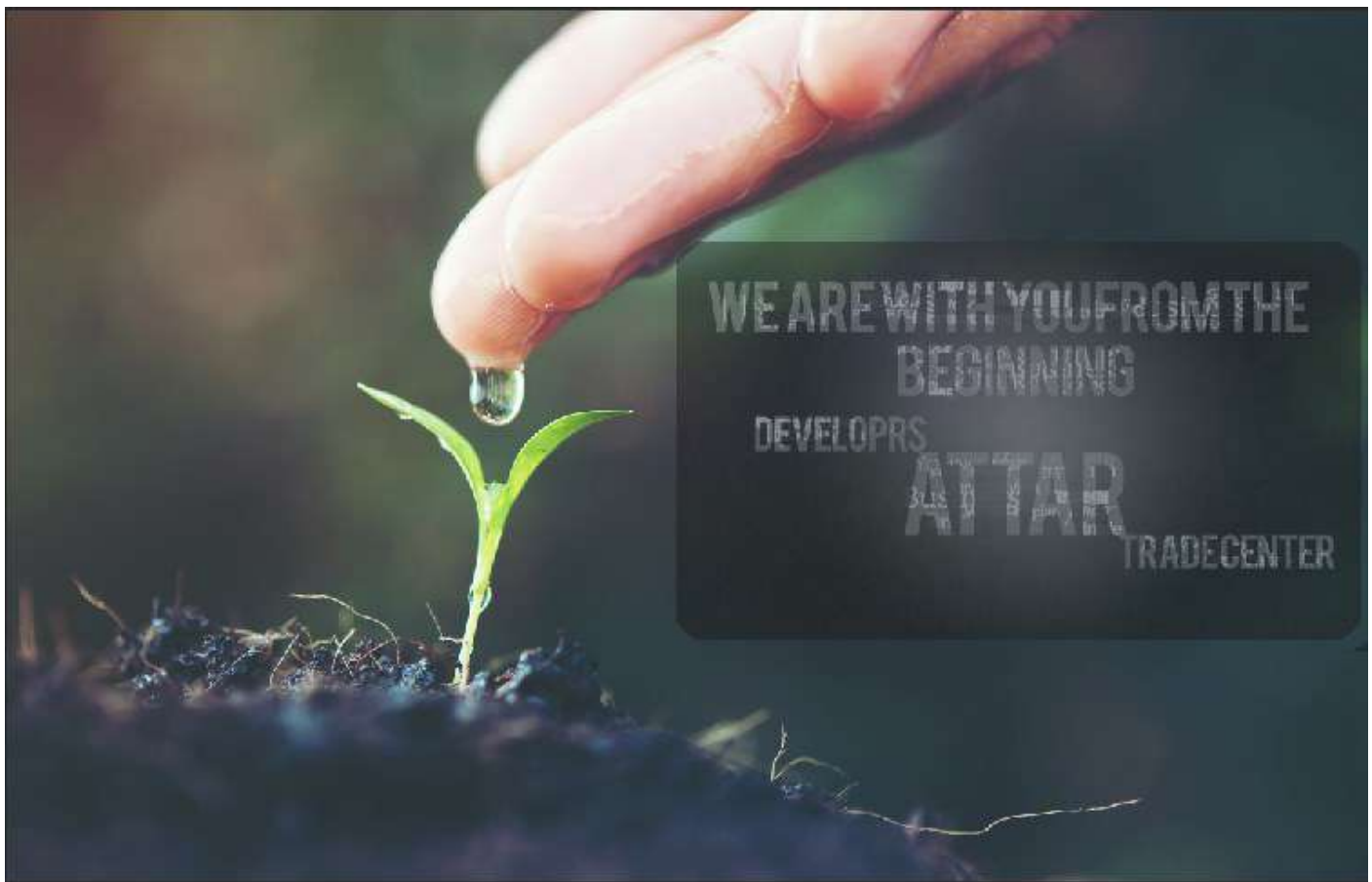
Parto Energy

Our Team

Parto Energy's solutions

Business plan of solar power plants in Iran





" Attar investment group " has originated from "Young Scholars Club" since 1999. The main goal of this group is to provide alternative attraction and suitable job solution in order to prevent the immigration of elites. Connecting to the industrial, scientific and research centers and establishing knowledge-based companies to resolve their demand, has played a key role to achieve this goal.

Some of companies that Attar investment group founders have established:

- Fanap group
- Hasin group
- Basir Partdazesh Qeshm company

Key people of above-mentioned companies, collecting useful experiences, decided to establish a new company in supporting knowledge-based entrepreneurship so they have established Developers Attar Trade Center in 2013. This company is active in many countries (Iran, France, Netherlands, Russia, United Arabia Emirates, Oman and China).

Attar investment group is active in the following fields:

- ICT
- Energy and Nanotechnology
- Biotechnology and Treatment
- Agriculture and Food Industry
- Establishing knowledge-based business club (BOX)

Attar investment group main activities:

- Investing in the companies and providing assistance to their progress by owning company share
- Signing the memorandum of understanding with related organizations to develop knowledge-based activities and support knowledge-based companies
- Encourage and support elites to do knowledge-based activities
- Organizing teams to focus on the ideas that have the potential of creating knowledge-based companies



- Professional management and financial team familiar with the market, supported by Attar group
- Professional engineering team consist of Sharif University of Technology graduates familiar with up to date knowledge because of continuous communication with the university
- Engineering and Construction of a 10 MW solar farm utilizing Iranian knowledge and experts for the first time
- Having the previous experience of the technical team in establishing 3.2 MW of distributed power plants during 2012 and 2013
- Constructing more than 310 kW of solar power plants in the first 3 month of the company establishment
- The technical team:
 - Masters of quality control, industrial engineering, and MBA
 - Ph.D. and masters of electrical engineering, process control, and energy engineering
 - Ph.D. and masters of mechanical engineering, structural and civil engineering
- Attending solar power plants construction workshops (in addition to university education) licenses by Germany and French institutes.
- Member of the Sharif University Science and Technology Park
- Member of the standard committee of engineering and establishing of solar power plants in Renewable Energy and Energy Efficiency Organization (SATBA)
- Use the PMO method in project management
- Organizational Culture based on optimization in the financial, timing, human resource, and energy production sections, with the motto of high quantity, and high quality activity
- Cooperation with the governmental and private organizations and industries such as:
 - Governmental: Hekmat Insurance, Bank Hekmat Iranian, Central Bank of Iran, Boushehr Abfa
 - Private Sector: Savin Carpet, Abhar Razi Textile, Dineh Iran Industry
 - Cooperation with: Astan Qods Razavi, Imam Khomeini relief foundation, Mostazafan foundation, Bank Pasargad, Omran-e-Fars, Esfahan-Abfa
- Important solar farms of Parto Energy are including:
 - 10 MW solar power plants in Abadeh, Kohmareh, and Shahreza,
 - 7MW solar power plant in abhar, 1MW solar power plant in eqlid, 300 kW solar power plant Jarghooye

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Parto Energy's solutions

Engineering (EPCF)

- Engineering design (site plan)
- Feasibility study of solar power plant construction
- Engineering design of mounting system and foundation
- Electrical engineering design including AC, DC & grid sectors
- Calculation of power plant energy generation
- Economical evaluation of power plant

Procurement (EPCF)

- Manufacturing of the solar mounting systems, with fully automatic machines and local design
 - Solar Farm: fixed, single axis tracker & dual axis tracker with pile, screw or concrete foundation
 - Rooftop (flat and gable roof) and commercial: fixed with fixed or block foundation, solar carport
- Procurement of PV modules and inverter
 - PV modules: top brands from China, South Korea & Iran
 - Inverter: Germany , China
 - Procurement & construction of electrical panels, switches & electrical cables



Parto Energy's solutions

Construction (EPCF)

- Installation of solar mounting structures
- Foundation executive including pile, screw or concrete types
- Installation of solar modules
- Installation of inverters, electrical panels & grid
- Installation and set up the power plant in the DC phase
- Installation and set up the power plant in the AC phase
- Construction and start up the solar power plant
- Operation and maintenance
- Supervision and advising for the whole EPC process

Financing (EPCF)

- Based on the owner investment, power plant site radiation, contract condition, equipment and financial status of the project:
 - Participation in the construction of solar power plant up to 50%
 - Financing the solar power plant up to 60% with specific terms



Solar Farms mounting System

Solar Rooftop Mounting System



Construction of solar power plants comparison

Net radiation of 1850 kWh/kW

No.	Index	Unit	20 kW	100 kW	10 MW
1	Cost of 1 kW	USD	825	785	695
3	Total investment cost	USD	16,500	78,500	6,950,000
4	Internal Rate of Return (IRR)	%	26.4	24.6	20.3
5	NPV with adjustment rate of 0.2	USD	24,500	107,500	7,520,000
6	Payback Period	Month	53	56	67
7	Average of monthly revenue in first year	USD	308.10930	1,347.97810	94,358.46940
8	First year revenue	USD	3,697.31150	16,175.73760	1,132,301.63280
9	Maximum land required	Hectare	0.04	2.0	20
10	Panel 72cell, 330 W	Number	60	300	30300
11	Inverter	Number	1# 20 kW	String Based on design	String Based on design
12	Mounting System type	-	Rooftop, carport, ground, flat and gable roof		gable roof or ground
13	10 meters ground mounting system	Number	3	15	1515
14	Gird connection	Type	local	Industrial	Post
15	Tariff per kWh	USD	0.08	0.07	0.049
16	Construction period	Month	2	2	7
17	Life cycle	Year	20		
18	Land type	-	Residential, office or commercial	Industrial or commercial	Private, natural resource
19	Type of branch for grid connection	-	3 phase 32 A	3 phase 170 A	20 kV post

1 USD is calculated according to the announced amount in December 2018 which is equal to 100,000 Rials.

Activities and Projects

Solar farms

Commercial and residential solar power plants

Parto Energy up to now





Solar farms/ 8 solar farms with the capacity of 49.3 MW

- 4 constructed solar farms: 21.3 MW
- 2 under construction solar farms: 17 MW
- 2 solar farms in the engineering process: 11 MW

10 MW solar farm at Abadeh, Fars province/ autumn 2017 and winter 2018

- First Iranian engineered and constructed solar farm
- Solar mounting system: Parto Energy / PV module: Taban / Inverter: China

10 MW solar farm at Kohmareh, Fars province/ begun at summer 2018

- Solar mounting system: Parto Energy/ PV module: China/ Inverter: string inverter/ engineering and construction: Parto Energy

Engineering of 10 MW solar farm at Nir, Yazd province/ summer 2018

- Owner: Kishsolar / Investor: partnership of Iran and Germany private sector

10 MW solar farm at Shahreza, Esfahan province/ engineering process

- Solar mounting system: Parto Energy/ PV module: 72 cells/ Inverter: string/ engineering and construction: Parto Energy

1 MW solar farm at Yazd province/ engineering process

- Solar Mounting system: Parto Energy/ PV module: 72 cells/ Inverter: string/ engineering and construction: Parto Energy

1 MW solar farm at Eqlid, Fars province/ spring 2018

- Solar mounting system: Parto Energy / engineering and construction: Parto Energy

300 KW solar farm at Esfahan province/ spring 2018

- Solar mounting system: Parto Energy / engineering: Parto Energy

Engineering, mounting system and construction of 7 MW solar farm at Abhar, Zanjan province/ summer and autumn 2018

- Solar mounting system: Parto Energy/ PV module: 72 cells/ Inverter: string/ engineering and construction: Parto Energy





10 MW solar power plant at Abadeh



10 MW solar power plant at Abadeh



7 MW solar power plant at Abhar

300 kW solar power plant at Jarghooye



7MW solar farm at Abhar



10MW solar power plant at Kohmare



Commercial solar power plants (private industries) /10 power plants/capacity 505kW

- 10 solar power plant in 7 provinces of Iran for 10 private owner
- 4 projects with the capacity of 225kW in 2016 and 3 projects with the capacity of 135kW in 2017 and 3 projects with the capacity of 135kW in 2018

Residential and Commercial (governmental)/ 17 power plants/capacity of 150 kW

- 17 solar power plants in 6 provinces and 9 difference owners
- Engineer and executor of the first solar power plant for Central Bank of the Islamic Republic of Iran
- 80 kW solar power plants (13 projects) in 2018 and 70 kW solar power plants (4 projects) in 2017

120 kW solar power plant, PV module manufacturing in Shiraz

- Solar mounting system: Parto energy/ PV module: China/ Inverter: China

110 kW solar power plant, Razi Textile Co. in Abhar, Zanjan

- Solar mounting system: Parto energy / PV module: China / Inverter: Germany

80 kW solar power plant, Dineh Iran industrial complex, Qazvin

- Solar mounting system: Parto energy / PV module: China / Inverter: Germany

100 kW solar power plant, Amout Rafsanjan Co. in Rafsanjan

- Solar mounting system: Parto energy/ engineering: Parto Energy

5 kW solar power plant, Savin Carpet

- Solar mounting system: Parto energy / PV module: China / Inverter: China

20 kW solar power plant, Dr. Sina farm at Yazd

- Solar mounting system: Parto energy/ PV module: China/ Inverter: China

15 kW solar power plant, Golhaye Boroujen hall, Boroujen

- Solar mounting system: Parto energy/ PV module: China/ Inverter: China

15 kW solar power plant, Pars Boroujen Cultivation and Industry, Boroujen

- Solar mounting system: Parto energy / PV module: China / Inverter: China

20 kW solar power plant, Hekmat Saba insurance

- Solar mounting system: Parto energy/ PV module: China / Inverter: Germany

20 kW solar power plant, Pishva Varamin

- Solar mounting system: Parto energy / PV module: s-Korea / Inverter: Germany

30 kW solar power plant, Central Bank of Islamic Republic of Iran

- Solar mounting system: Parto energy / PV module: China/ Inverter: China

30 kW solar power plant, Bushehr water and wastewater treatment

- Solar mounting system: Parto energy / PV module: China / Inverter: Germany

9 solar power plants with the capacity of 5 kW, state welfare organization of Bardaskan

- Solar mounting system: Parto energy / PV module: s-Korea / Inverter: China

5 kW solar power plant, Tafresh

- Solar mounting system: Parto energy / PV module: s-Korea / Inverter: China

5 kW solar power plant, Ashrafi Esfahani, Tehran

- Solar mounting system: Parto energy / PV module: China / Inverter: Germany

5 kW solar power plant, Yazd

- Solar mounting system: Parto energy / PV module: s-Korea / Inverter: Germany

5 kW solar power plans, Borujen 3

- Solar mounting system: Parto energy / PV module: s-Korea / Inverter: Germany

5 kW solar power plant, Sharif university of Technology town

- Solar mounting system: Parto energy / PV module: China / Inverter: Germany

20 kW solar power plant, Mahdi abad, Qazvin Province

- Solar mounting :Parto energy/PV module:s-Korea /Inverter:Germany

80 kW solar power plant of Dineh industrial complex



110 kW solar power plant of Razi Textile Co. in Abhar



30 kW Solar power plant of Abfa at Bushehr province



5 kW Solar power plant in Tafresh



110 kW solar power plant of Razi Textile Co. in Abhar



120 kW Solar power plant in Shiraz



15 kW Solar power plant of Golaha hall at Broujen



15 kW Solar power plant of Golaha hall at Broujen



20 kW Solar power plant in Yazd



Hekmat Saba insurance solar power plant



Savin Carpet solar power plant



Savin Carpet solar power plant



Hekmat Saba insurance solar power plant



first solar power plant for Central Bank of the Islamic Republic of Iran



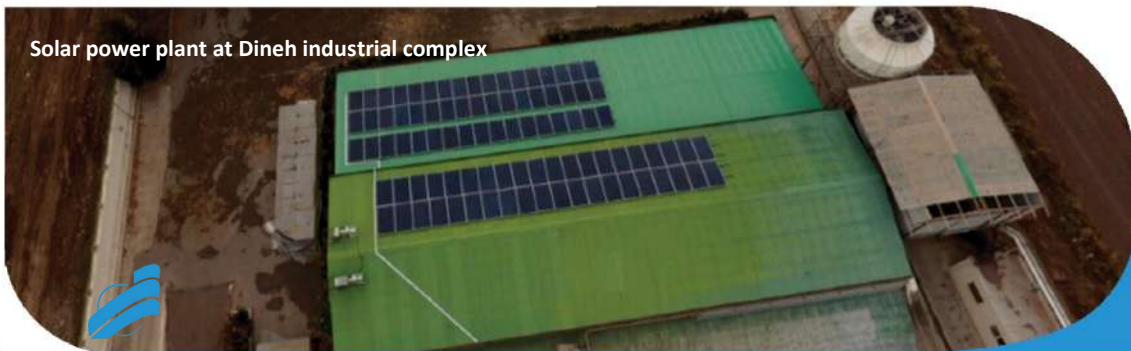
5kW Solar power plant at Bardaskan



20kW Solar power plant at Varamin



Solar power plant at Dineh industrial complex



100kW Solar power plant at Rafsanjan





Membership at the standard committee of SATBA



Workshop of fundamentals of solar energy



Participating at the establishment of a solar module manufacturing company

Parto Energy

Past to Present

Established at January 9, 2017
January to March 2017

No.	Title	Description
1	Establishment	Employing a professional technical team of Sharif University of Technology graduates, having the experience of more than 3.2 MW solar power plants in Iran, supporting by the Attar Investment Group that is a VC group for development of knowledge-based technologies and market with the experience of establishing large companies such as Fanap, Hasin, Basir, etc.
2	First Projects	Establishment of 4 solar power plants with the total capacity of 255 kw in Tehran, Shiraz and Abhar cities.

March 2017 to March 2018

No.	Title	Description
1	Solar Farm	EPC of the first 10 MW solar power plant in the country using Iranian specialists in the Abadeh city.
2	Other projects	Establishment of 7 solar power plants with total capacity of 205 kW in the cities of Abarkouh, Borujen, Tafresh, Qazvin and Tehran.
3	Honors	The first and the only approved company in automatic solar mounting system manufacturing by SATBA.
		EPC of the first Solar Power Plant of the Central Bank of the Islamic Republic of Iran.
		Member of the Sharif University of Technology's Tech. Park at the first year of establishment as a developed Company.
		Member of standard committee of SATBA (Renewable Energy and Energy Efficiency Organization).
		Approved economic performance by Iran's Economic organization.
4	International communications	More than 30MW solar farm engineering design, investigation of more than 3500 MW opportunities for solar power plants investment, energy consulting of lots of huge organizations.
		complete import supply chain of solar power plant materials including inverter and panel from the best brands of China and Europe.

Parto Energy

Past to Present

March 2018 to present

No.	Title	Description
1	Solar farm	EPC of 4 solar farms with a capacity of 21.3 MW in Kohmara, Nair, Eqhlid and Jarqavieh
		Preparation and design process of 2 solar farms with the capacity of 17 MW in Kohmareh and Abhar and 2 solar farms in the engineering process with the capacity of 11 MW
2	Other projects	Establishment of 20 solar power plants with total capacity of 235 KW in Tehran, Borujen, Yazd, Bardskan and Rafsanjan.
3	Honors	Member of the energy standard committee of institute of standards and industrial research of Iran.
4	International communications	The first company has a contract for EPC of the 10 MW solar farm with a German Owner and financier.
		Announced by Iran ministry of foreign affairs as a chosen company in the field of exporting engineering services in solar power plant section
		EPC and solar mounting system approval of international organizations like VDE and TUV NORD.
5	Human Resources	Full-time: 24 employees of top graduated students of Sharif University of Technology (15 employees), Tehran University (3 employees), Amirkabir University of Technology (1 employee), Iran University of Science and Technology (1 employee), Technical University of Munich (1 employee), And the other Iran's public universities (4 people).
		Part-time and Consultants: 22 experts from related fields and graduates of the best universities of the country, like Sharif University of Technology (8 employees).



Sharif Science & Technology Park



Parto Energy
Member of Sharif University
of Technology Tech. Park



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