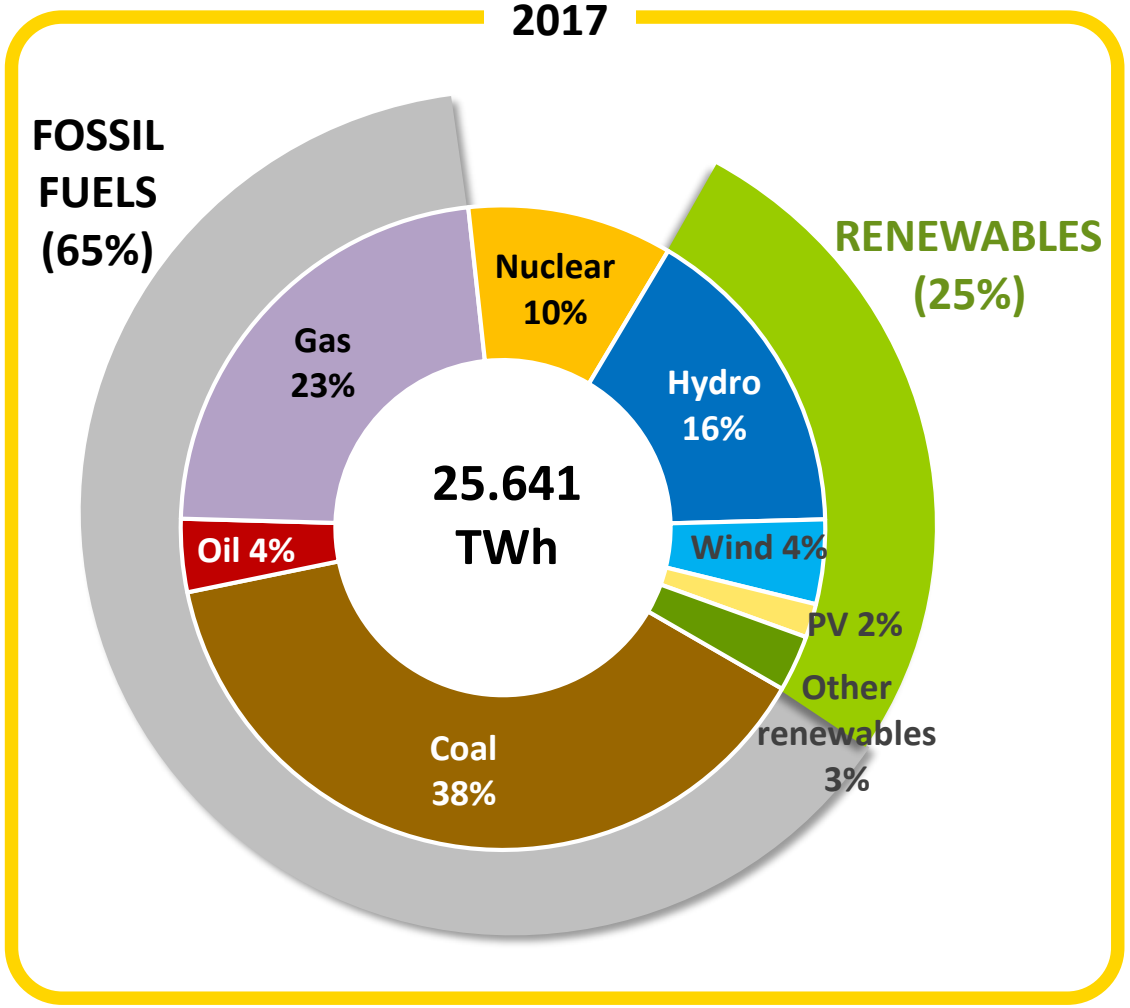
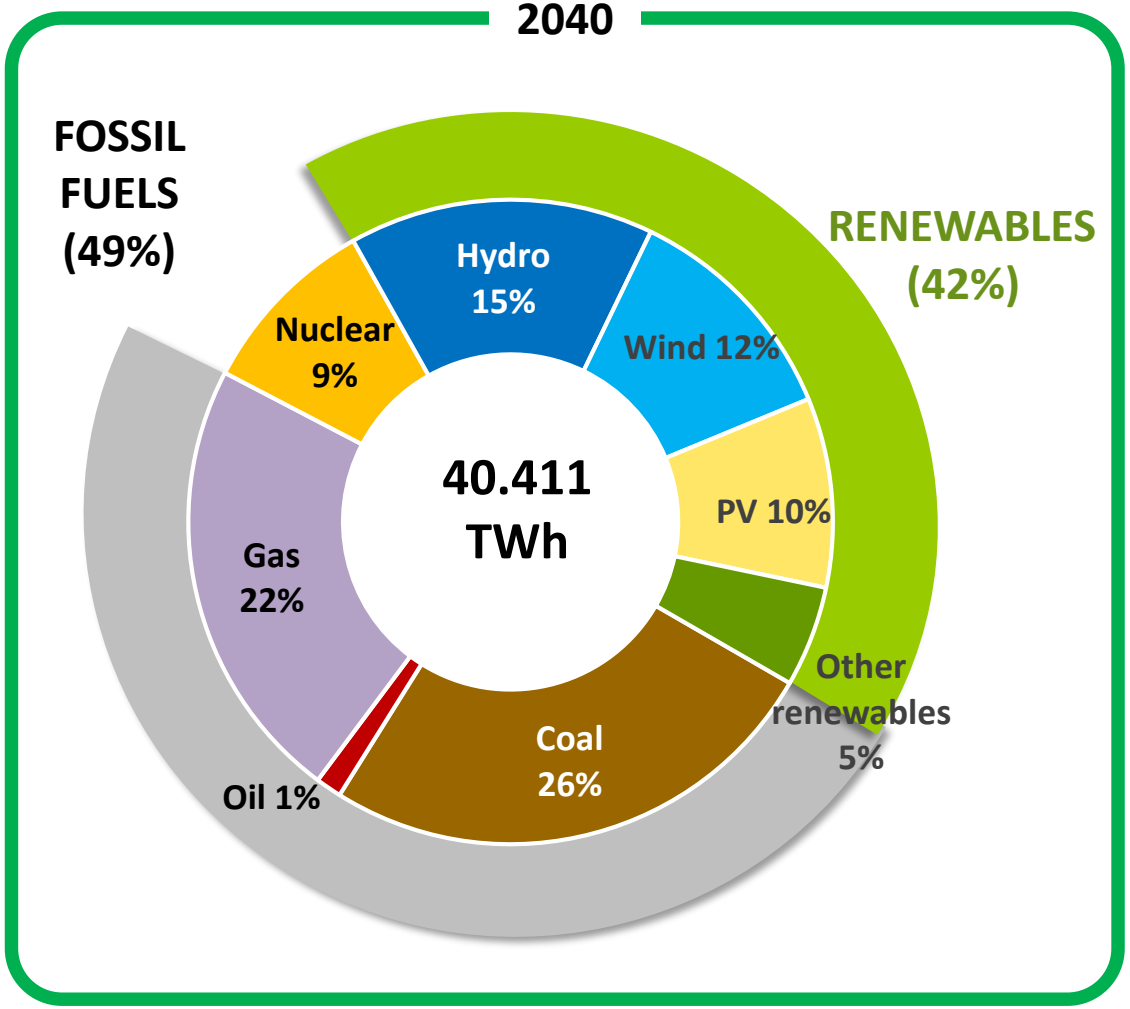
Wind energy in Kazakhstan

Eni experience with “Badamsha wind project”

Donato Azzarone
VP Eni Energy Solutions
MENA and Central Asia

Electricity generation mix : scenario to 2040 and the role of renewables

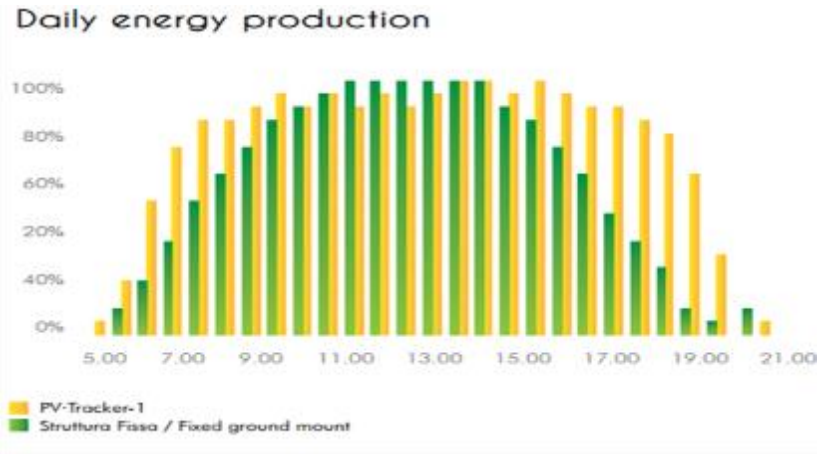




Source: IEA, «World Energy Outlook 2018, NPS»

Solar PV : huge cost reduction

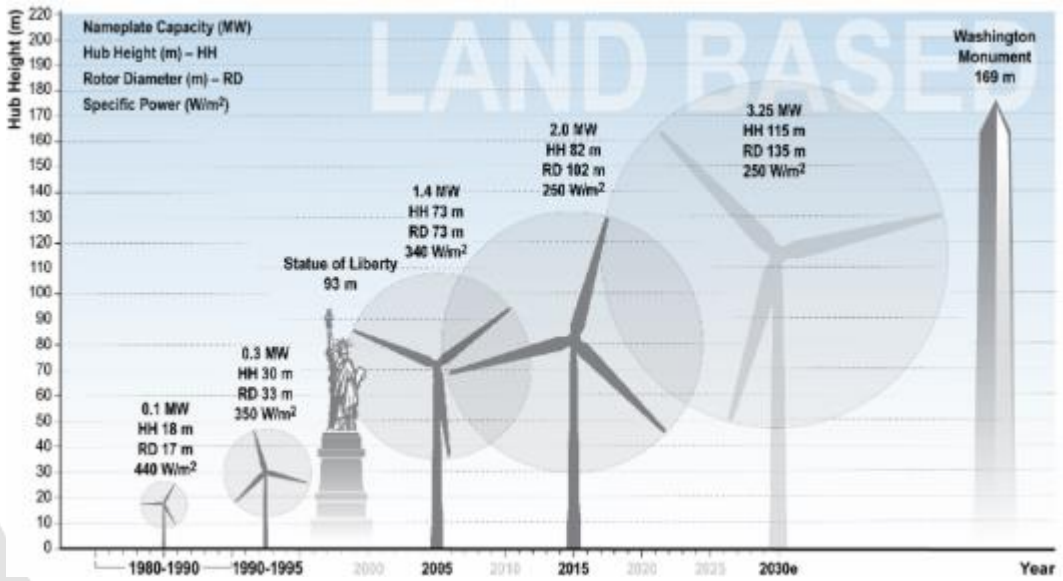
- **Intermittent but fairly predictable power source** due to the daily and seasonal variability of the natural resource (sunlight).



- **Capacity Factor up to 30%** (up to 2.600 equivalent operating hours)
- **Electricity cost of utility-scale solar PV fell 73%** between 2010 and 2017, making it in **some cases cheaper than fossil fuel generation** (up to 23 USD/MWh)
- **Capital intensive power generation technology**, while the **marginal cost of the energy produced is nearly zero** (no fuel required and low operation and maintenance cost)

Wind : toward gigantism

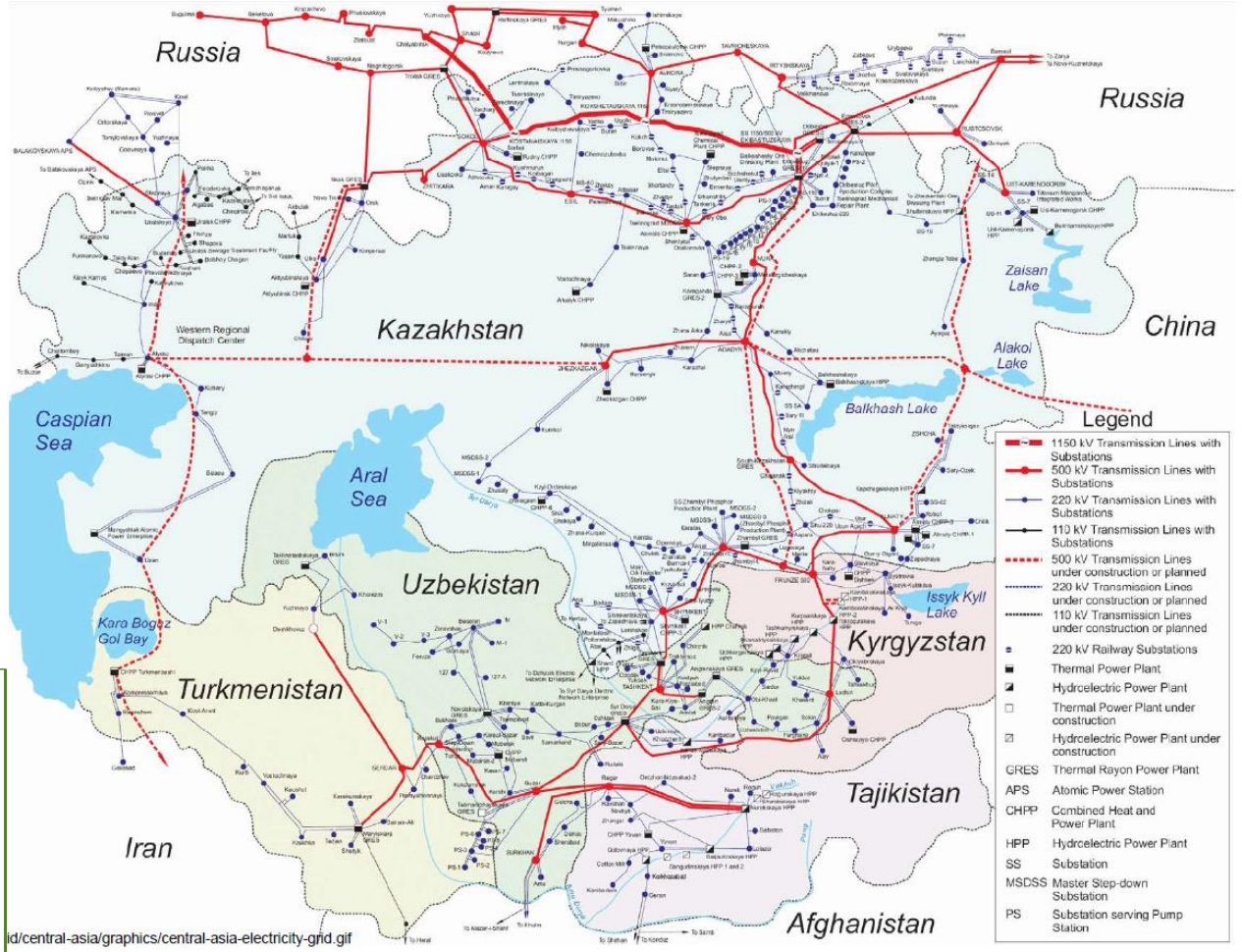
- Wind turbines **convert wind kinetic energy into power**
- **Capacity factor up to 60%** (up to 5.000 equivalent operating hours)
- **Electricity cost** of utility-scale wind farm is **in the fossil fuel range** in many areas of the world
- **Limited land footprint** compared to solar technologies
- **Sharp increase in the size** of single turbine installed and wind parks



Renewables role into the Central Asian Power System

UZBEKISTAN		
2015		
Total electricity output (TEO)	GWh	57280
Renewable electricity output	GWh	11830
Renewable electricity share of TEO	%	20,7%
2017		
Installed Renewable Capacity	MW	1844
Hydro	MW	1839
Wind	MW	1
Solar	MW	4

TURKMENISTAN		
2015		
Total electricity output (TEO)	GWh	22534
Renewable electricity output	GWh	0
Renewable electricity share of TEO	%	0,0%
2017		
Installed Renewable Capacity	MW	0
Hydro	MW	0
Wind	MW	0
Solar	MW	0



KAZAKHSTAN		
2015		
Total electricity output (TEO)	GWh	106468
Renewable electricity output	GWh	9448
Renewable electricity share of TEO	%	8,9%
2017		
Installed Renewable Capacity	MW	2897
Hydro	MW	2726
Wind	MW	112
Solar	MW	59

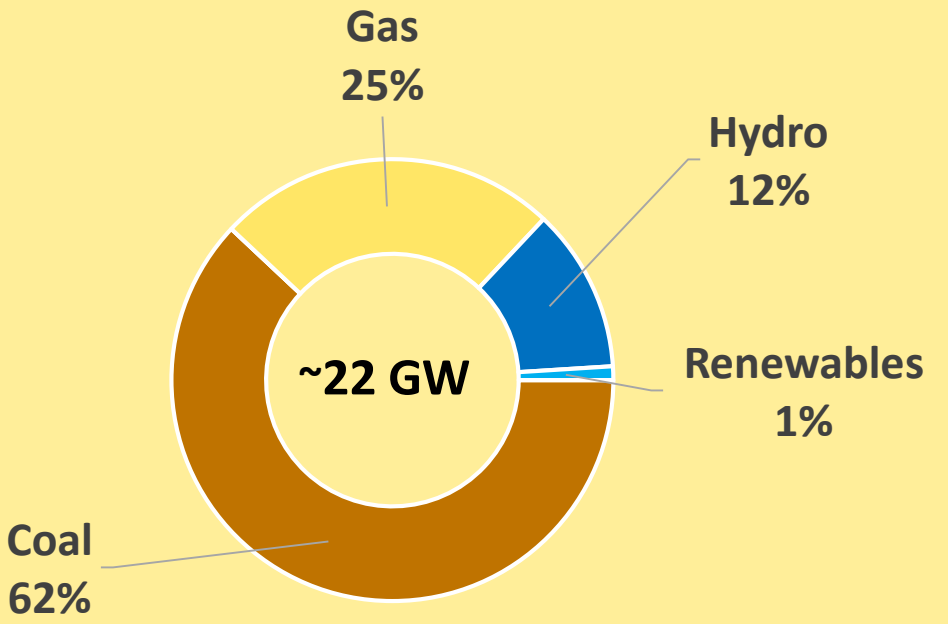
KYRGYZSTAN		
2015		
Total electricity output (TEO)	GWh	13030
Renewable electricity output	GWh	11100
Renewable electricity share of TEO	%	85,2%
2017		
Installed Renewable Capacity	MW	3677
Hydro	MW	3677
Wind	MW	0
Solar	MW	0

TAJIKISTAN		
2015		
Total electricity output (TEO)	GWh	17162
Renewable electricity output	GWh	16900
Renewable electricity share of TEO	%	98,5%
2017		
Installed Renewable Capacity	MW	5325
Hydro	MW	5325
Wind	MW	0
Solar	MW	0

Current negligible role of non-hydro renewables

Kazakhstan : current situation and renewables target

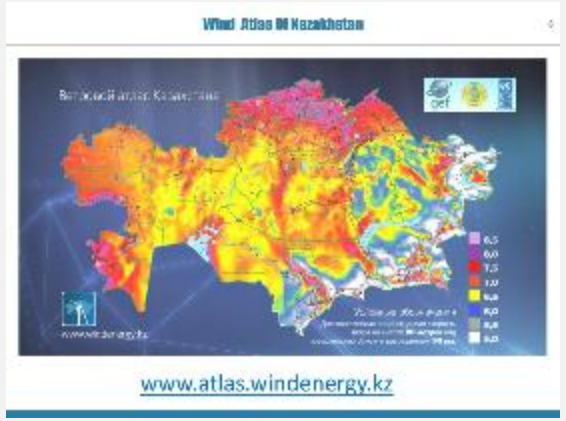
Electricity Installed Power 2017-2018



Source: personal elaboration

120 TWh generated electricity in 2017

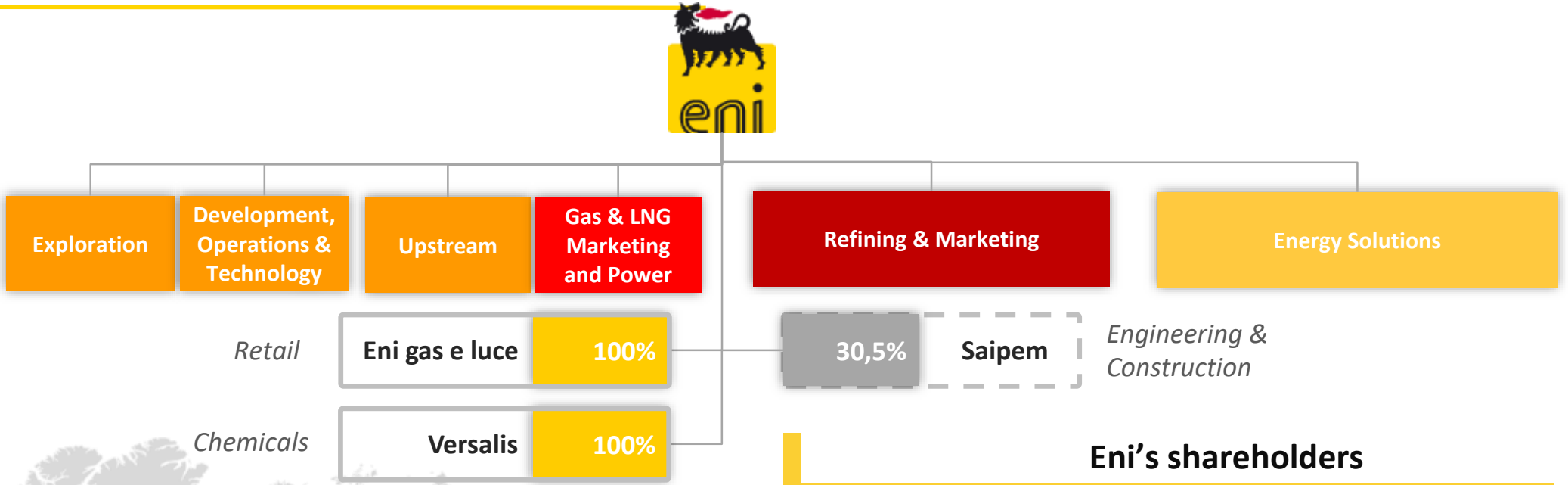
Renewable potential



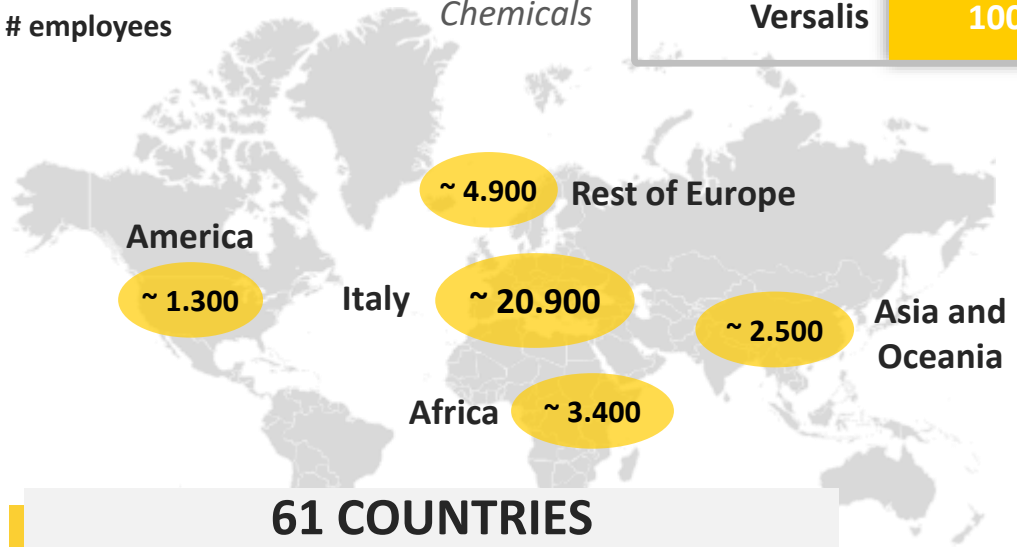
Renewable target

50% of total electricity production from renewables by 2050

Eni at a glance

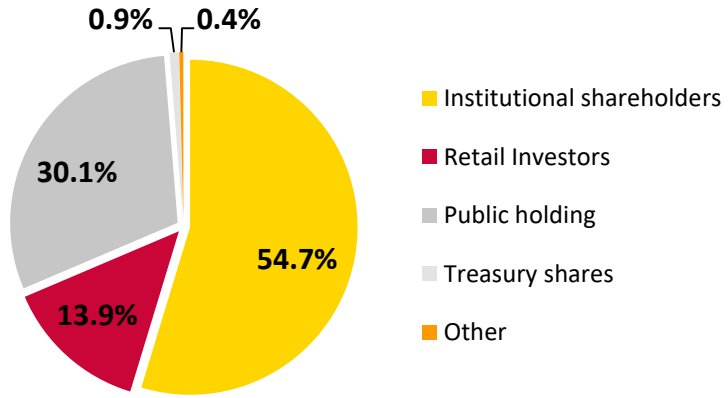


= # employees



61 COUNTRIES
~ 33.000 EMPLOYEES*

Eni's shareholders

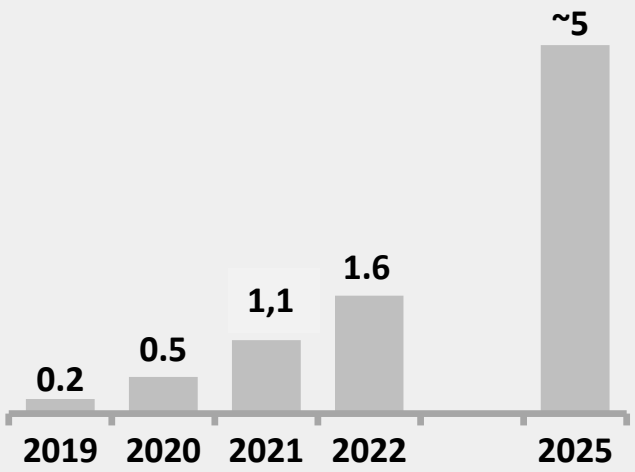


Market capitalization: around € 50 bln

** 2017 data including only consolidated companies.*

Eni renewable industrial plan

CAPACITY | GWp

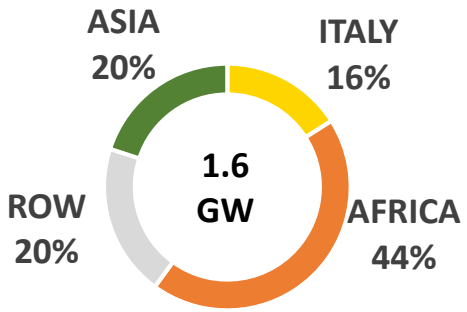


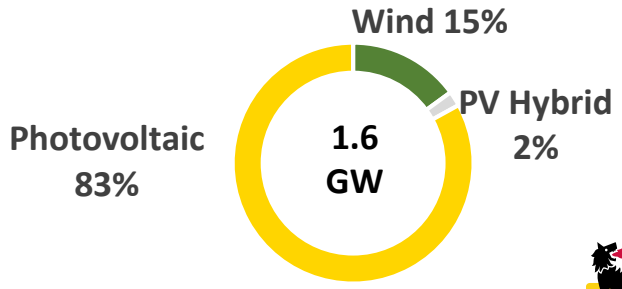
4YP CAPEX| € bln

HIGHLIGHTS

- Distinctive model based on **synergy** with other Eni businesses
- Over **60 Brownfield** and **Greenfield** projects in the plan
- **Leading edge technologies** and proprietary **R&D** Deployment

INSTALLED CAPACITY @2022





Eni in Kazakhstan

Upstream presence

Karachaganak (1997)
KPO *– Karachaganak Petroleum Operating Company BV*
Eni (op.) 29.25%, Shell 29.25% (op.), KazMunayGas 10%, Chevron 18%, Lukoil 13.5%

Kashagan (1997)
NCOC *– North Caspian Operating Company NV*
Eni 16.81%, KazMunayGas 16.81%, ExxonMobil 16.81%, Shell 16.81%, Total 16.81%, CNPC 8.33%, Inpex 7.56%

Isatay (2017)
Isatay Operating Company: Eni 50%, KazManuyGas 50%
Exploration phase

Quick overview

Caspian Pipeline Consortium (CPC)
Eni 2%

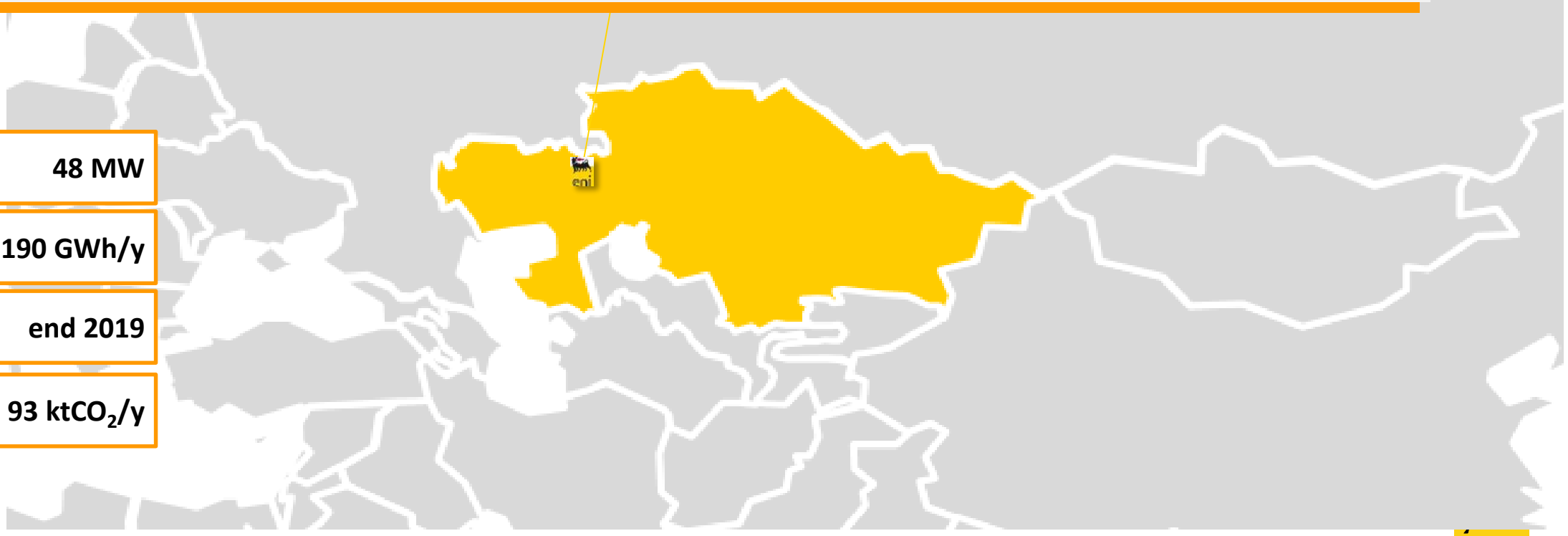
Kashagan e Karachaganak
Production 143 kboe/d in 2018

Eni and General Electric (2017)
Agreement on promoting energy-generation from renewable sources (wind and solar)

Eni personnel in Kazakhstan: 358
(130 at HQ in Astana; 60 at NCOC in Atyrau; 168 at KPO in Aksai/Urask

Eni renewables in Kazakhstan : Badamsha wind project

- The project originates from an agreement, signed in June 2017 by Eni, General Electric (GE) and the Ministry of Energy of the Republic of Kazakhstan for the development of renewables projects in the country.
- The sale of the electricity produced is regulated by a 15 years Power Purchase Agreement with Financial Settlement Center as Single Buyer.
- The tariff is linked to Kazakh inflation.
- The initiative represents the first project of Eni in the business of onshore wind plants.



48 MW

190 GWh/y

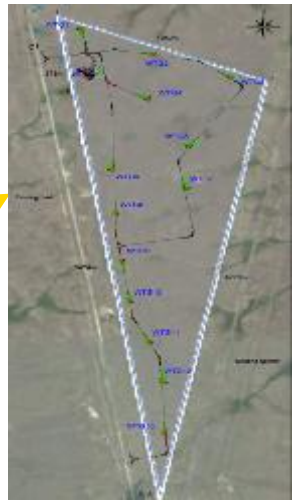
end 2019

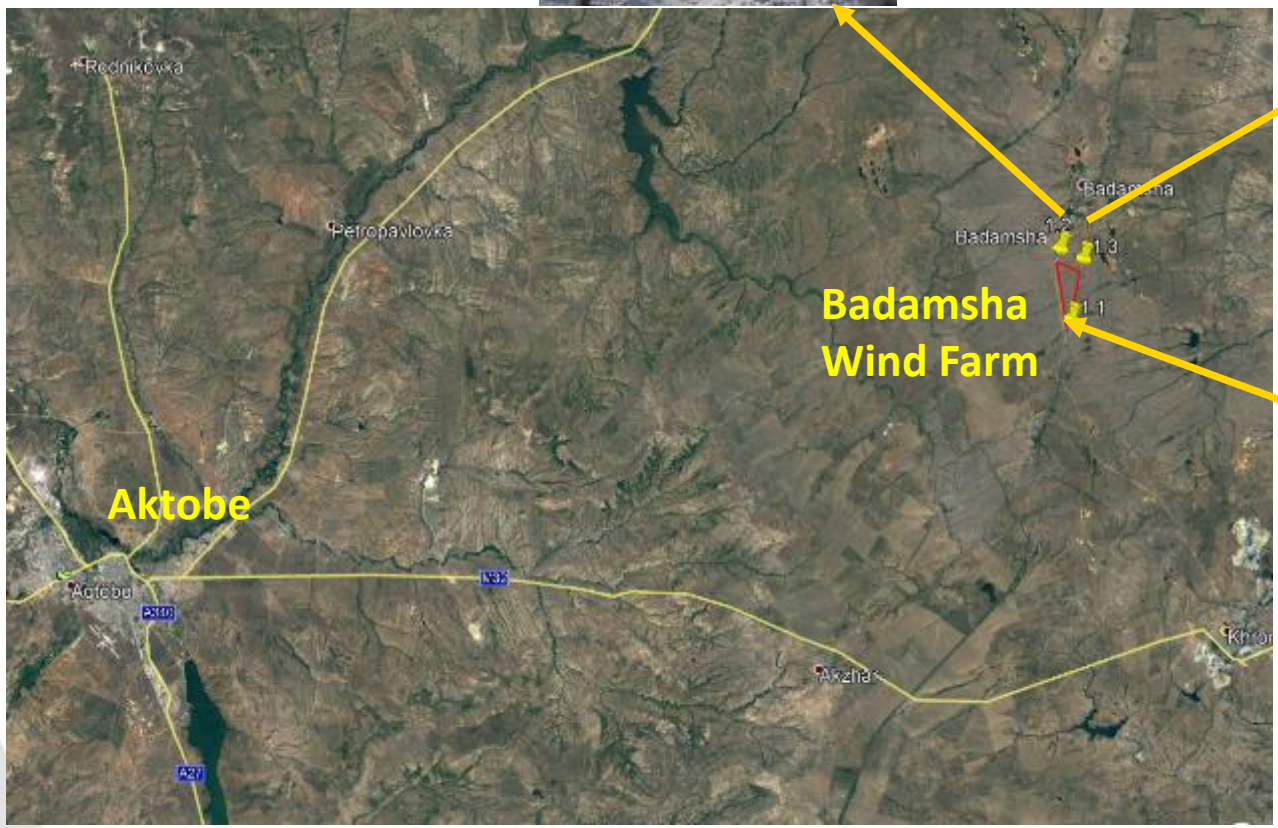
93 $ktCO_2/y$

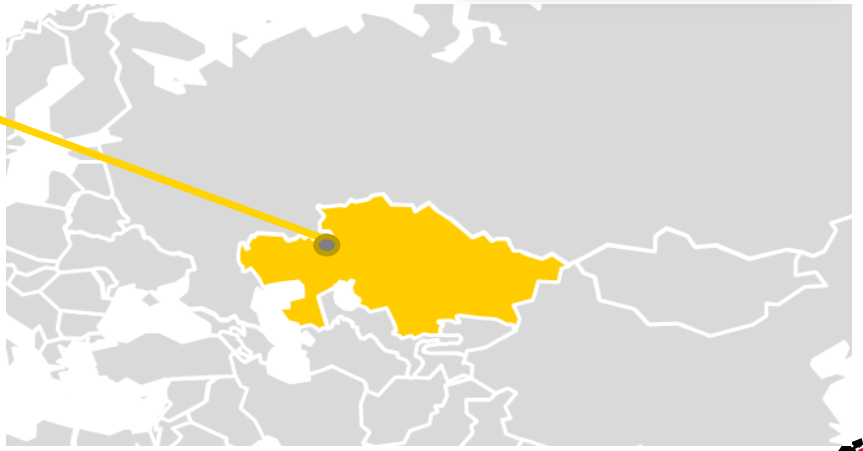
Badamsha wind project - project selection and location

Kimpersay Substation

Wind Farm layout



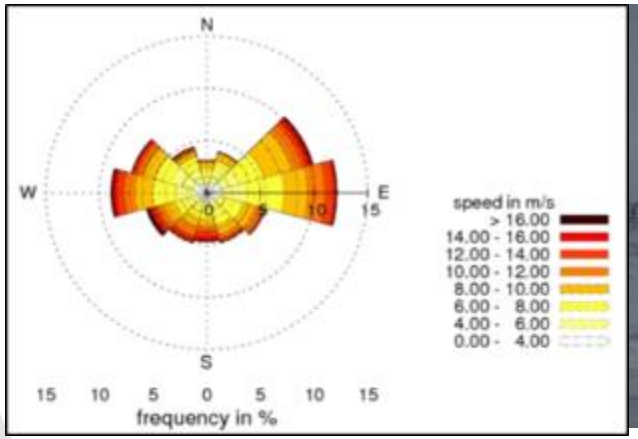


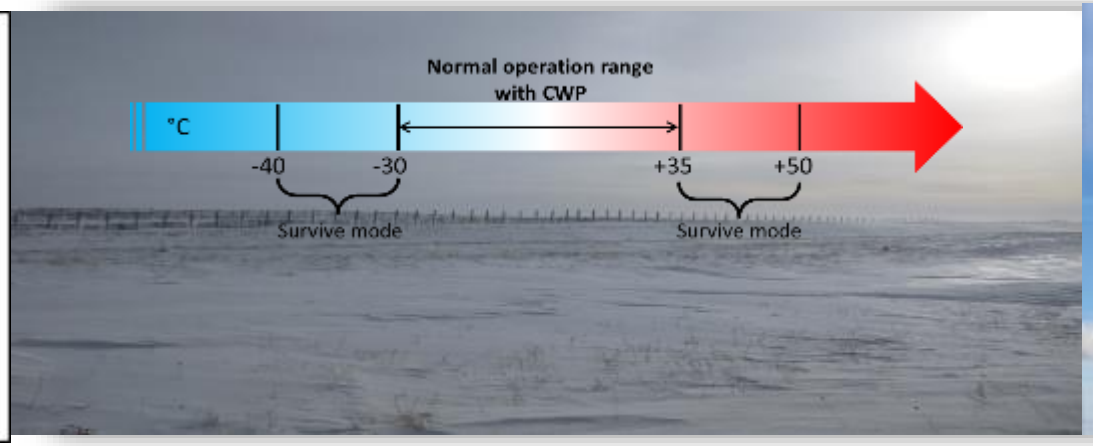


Badamsha wind project - high wind potential in harsh and remote environment

wind	
Average wind speed @ 85 m	>8.0 m/s
Temperature (annual average)	+2,8°C
Average Energy	> 190 GWh/y
Capacity factor	45 %

technology	
WTG GE 3.8 – 130 HH 85m	13
Rotor diameter	130 m
Number of blades:	3
Hub height:	85 m





Badamsha wind project : logistics and construction challenges

logistics

Logistics assessment

Roads modifications

Transportation challenges

construction

Electrical connection

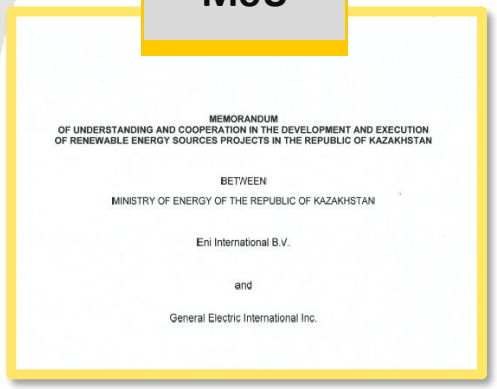
Foundations concrete

Lifting operations

Badamsha as flagship wind project for Eni in Kazakhstan

Short time to market exploiting all the existing synergies in the Country

MoU



MEMORANDUM
OF UNDERSTANDING AND COOPERATION IN THE DEVELOPMENT AND EXECUTION
OF RENEWABLE ENERGY SOURCES PROJECTS IN THE REPUBLIC OF KAZAKHSTAN

BETWEEN
MINISTRY OF ENERGY OF THE REPUBLIC OF KAZAKHSTAN

Eni International B.V.

and

General Electric International Inc.

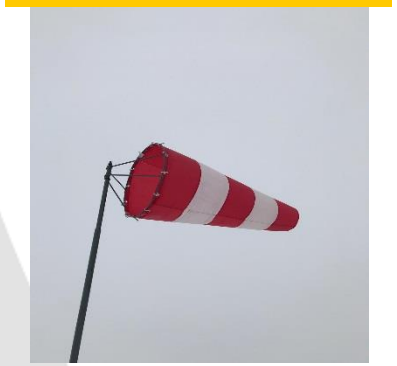
18 months

inauguration

12 months

planned start up

impressive wind resource



complex projects management

local development

Drawings from Badamsha school