

CLIMATE CHANGE AND RENEWABLE ENERGY

1. Climate Changes

Climate change is a phenomenon caused by global warming, which means that the Earth's temperature rises due to an increase in greenhouse gases.

Greenhouse gases such as carbon dioxide (CO₂), methane (CH₄), and nitrogen dioxide (N₂O) are emitted in large quantities due to human activities in addition to natural processes.

The main causes include the use of fossil fuels, industrial processes, and waste disposal.

Climate change has a variety of impacts.

Important examples include extreme weather events (heat waves, heavy rainfall, droughts, etc.), rising sea levels, melting ice, and ecosystem changes.

This poses a threat to humans and ecosystems and can cause numerous environmental and social problems.

Energy transition is necessary to respond to the climate change crisis.

Therefore, in fact, in order to achieve the 1.5 degree target of the Paris Agreement, greenhouse gas emissions in the energy sector must be reduced, and for this, energy conversion is essential.

As a method of energy conversion to reduce fossil fuels, increasing the proportion of renewable energy, improving energy efficiency, and reducing energy demand are required.

It is necessary to analyze the causes and effects of greenhouse gas emissions, predict future changes through climate modeling, and prepare countermeasures.

The development and use of sustainable energy solutions in various aspects, such as the use of renewable energy, advancement of energy storage technology, and improvement of energy efficiency, will play a significant role in protecting the environment and ensuring energy stability.

Observed climate change in Switzerland

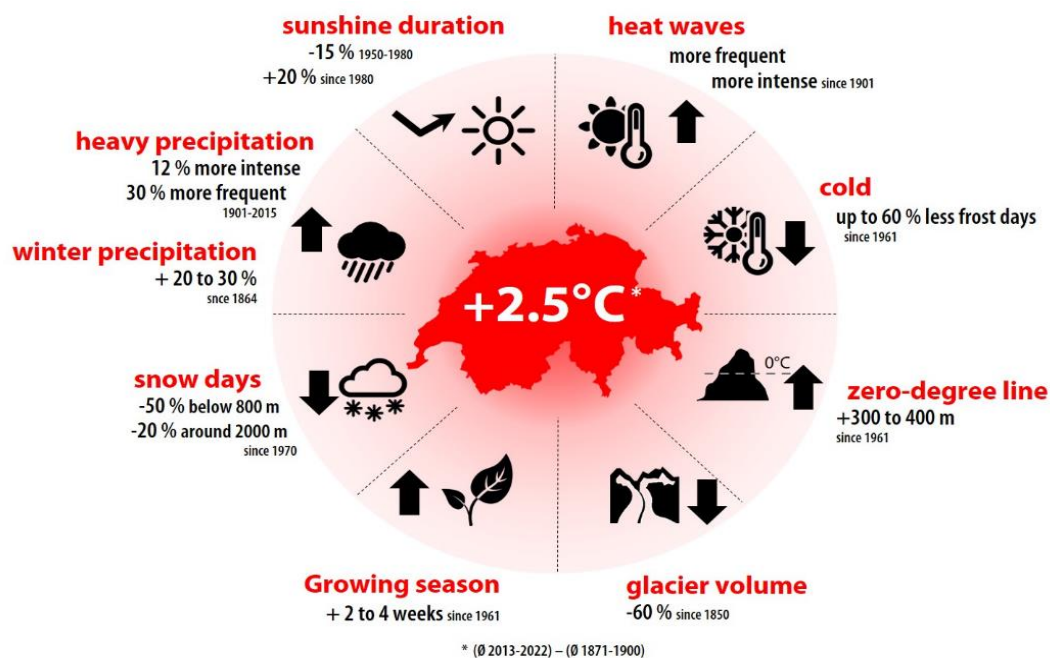
All regions in Switzerland are considerably warmer than they used to be.

The near-surface air temperature has risen over the last 150 years by about 2.5 °C a considerably greater increase than the worldwide average.

Nine out of the ten warmest years since records began have been in the 21st century.

Heavy precipitation events have also become more intense and more frequent

To see Graphic



2. Vietnam's 8th National Power Development Plan

Prime Minister decision
No. 262/QĐ-TTg (1st April 2024)

APPROVING PLANS FOR IMPLEMENTATION OF ELECTRICITY DEVELOPMENT PLANNINGS NATIONAL PERIOD 2021 - 2030, VISION TO 2050

<https://thuvienphapluat.vn/van-ban/Tai-nguyen-Moi-truong/Quy-dinh-262-QĐ-TTg-2024-Ke-hoach-thuc-hien-Quy-hoach-phat-trien-dien-luc-quoc-gia-2021-2030-604638.aspx>

Renewable Energy (2023 – 2030)

Unit : MW

Item	offshore wind	onshore winds	Water power	biomass	garbage	Roof Top	Solar Farm	Total
Capacity	6,000	17,894	4,462	766	1,112	2,600	4,160	36,228

Solar Farm : self-production, self-consumption

In order to maintain a balance between solar power and wind power, solar power was reduced and wind power was increased

3. Vietnam Renewable Energy Policy

Currently : EVN directly purchases renewable energy (PPA)
Future : Legislation being prepared to enable direct sales of renewable energy to large consumers (DPPA) by MOIT

DPPA (Direct Power Purchase Agreement) Policy

The MOIT has just sent a draft to the Ministry of Justice to appraise the Decree on DPPA mechanism, Date 9 April 2024.

<https://www.vietnam.vn/en/bo-cong-thuong-lay-y-kien-doi-voi-du-thao-nghi-dinh-cua-chinh-phu-ve-co-che-dppa/>

The draft Decree on the DPPA mechanism focuses on 2 policies:

- (1) sale of electricity between power generators and large customers via private transmission lines;
- (2) sale of electricity between generators and major customers via the national grid.

MOIT prefer to option 1

Renewable energy generators that own wind or solar power plants will be able to sell electricity directly to large electricity customers through their own lines or through the national grid.

4. Solar Power and Wind Power technology development

Solar panel efficiency

Year 2016 : 17.8%

Year 2022 : 24%

Year 2030 : Expected 30%

Solar power plant installation area

Year 2019 : 1MW = 1.2 ha

Year 2022 : 1MW = 0.8ha – 1.0ha

Installation area is expected to continue to decrease due to technological advancements

Solar panels

Currently : Panel with Frame

Future : Flexible Panel



Panel with Frame

NIPPON SOLAR
Ultra-thin and lightweight module
F "FLEXIBLE" SERIES
MWT Flexible Single Crystal PERC Module
365-385W
CELL CONVERSION EFFICIENCY
21.0%

PRODUCT FEATURES

- High efficiency
- Light and thin design
- Lead-free environmental protection
- Super flexibility
- Customizable
- Consistent performance

UTILIZATION IN VARIOUS SCENES

- Reinforcement Savings
- Life Hobby
- Disaster prevention Emergency

Management system certification

- ISO 9001:2015 / Quality management system
- ISO 14001:2015 / Environmental management system
- ISO 45001:2018 / Occupational health and safety management system

12 YEARS WARRANTY
25 YEARS WARRANTY
LLOYDS

www.nippon-solar.co.jp info@nippon-solar.co.jp

Flexible Panel

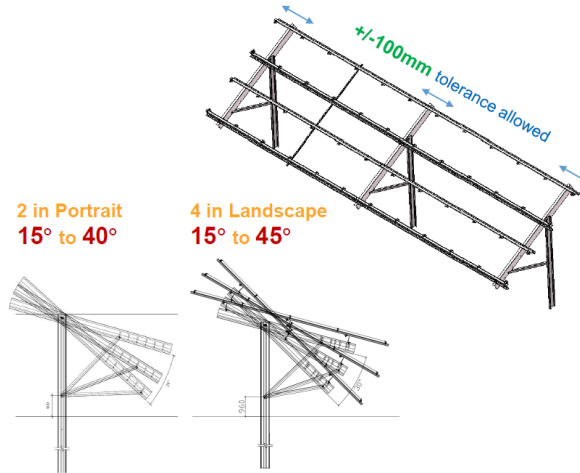
Tracking System to the Sun



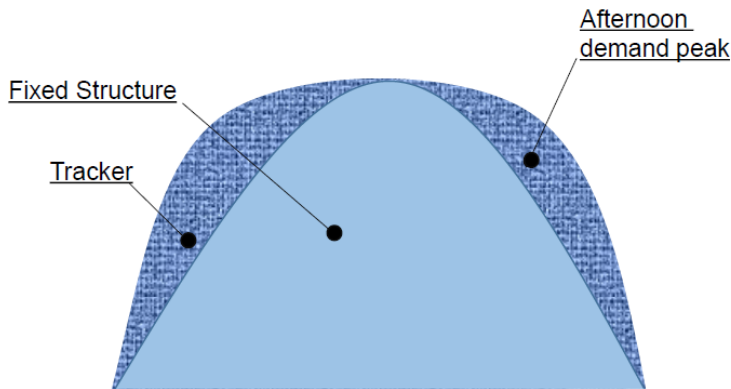
Standardized Design

To be the leading solution provider and manufacturer of tracking and racking systems worldwide

- 1** | **Standard Module Orientation**
Standardized module 2X high portrait & 4X high landscape designs
- 2** | **Adjustable Configuration**
Base structure used for both landscape and portrait configurations
- 3** | **Easy Scalability**
Fewer parts count, designed for fast installation
- 4** | **Adaptable to Building Codes**
Built to ASCE 7-10 Code (adaptable to various building codes, i.e. JIS, ASCE, IS, Euro)



- Tracker provide wind protection software control & safe structures
- A broader generation curves, more user friendly to grid.



Item	Option-1	Option-2	Data
Mounting Structures	50MWp Fixed Structures	40MWp Tracker+10MWp Fixed Structures	Increase by
Investment (USD)	38,900,000.00	40,981,202.00	5.35%
Generation (Kwh) * PPA Price (USD/Kwh)	80,150,000.00	89,990,000.00	12.28%

Solar panels move follow the sun in degree 15 - 40

Increase Invstmnt of Structure : 5.35%

Increase Generation : 12.28%

EPC price Of Solar Power Pl ant

Year 2019 : 0.8 million\$ - 1million\$/MW

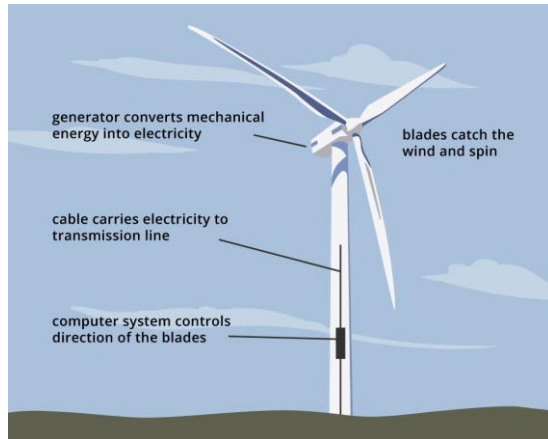
Year 2022 : 0.4 million\$ - 0.6 million\$/MW

Wind Power

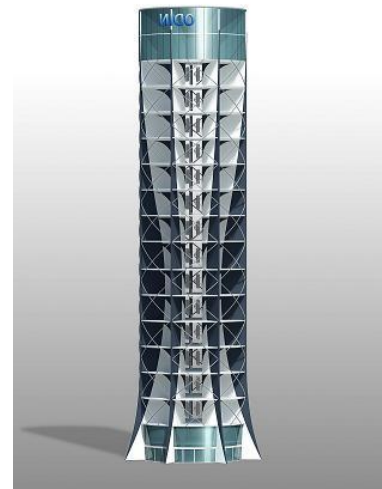
The efficiency of actual wind power is about 45-50%.

Required Wind speed is average 10m/s - 13m/s

Technological Advancements In Wind Power



Tower Type



Vertical Type



Without Blade



Both direction rotation

Tower type wind power

- a lot of noise
- Poor access to the customers
- Not easy to find suitable location
- No power generation in strong winds
- Maintenance is not ease

Vertical axis wind power

- Even weak wind (3.5m/sec) or strong wind (25m/sec) is available
- Can be installed in residential areas due to low noise and vibrations.
- Each floor is independent so repairs are easy.
- The lower floor can be used as a plant factory, coffee shop, etc.
- The electricity production is more than 4 times
- The area is more than 80 times efficient

5. Outlook of Vietnam Renewable Energy

Vietnam's electricity demand is expected to grow by an average of 10% per year until 2030.

The introduction of renewable energy is inevitable to meet the increasing demand for electricity and achieve Net Zero by 2050.

The Vietnamese government proposed a goal of achieving 50% renewable energy by 2050 in PDP 8.

To reach net-zero emissions by 2050, Vietnam would have to pivot the bulk of its power generation capacity to wind and solar, installing about 150 GW of wind capacity and about 70 GW of solar capacity.

Now, Vietnam has no choice but to focus on this because it has to pay a carbon tax if it does not meet the renewable energy ratio when exporting to the European Union (EU).

Accordingly, the next five years are believed to be the best time to invest renewable energy projects in Vietnam.

To achieve this,

It is expected that an investment worth \$135 billion will be needed by 2030.

Investments ranging from \$400 billion to \$500 billion are needed between 2031 and 2050.

For Reference

The average solar power generation in Vietnam is about 5 kWh/m².

The average wind speed is 6 meters/sec (MOIT, 2015).

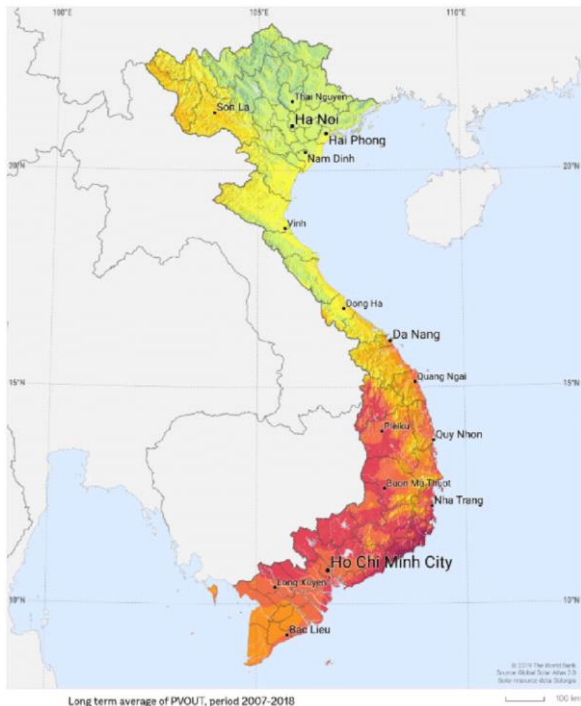
The coastline available for offshore wind power reaches 3,400 km.

Vietnam's renewable energy development potential is expected

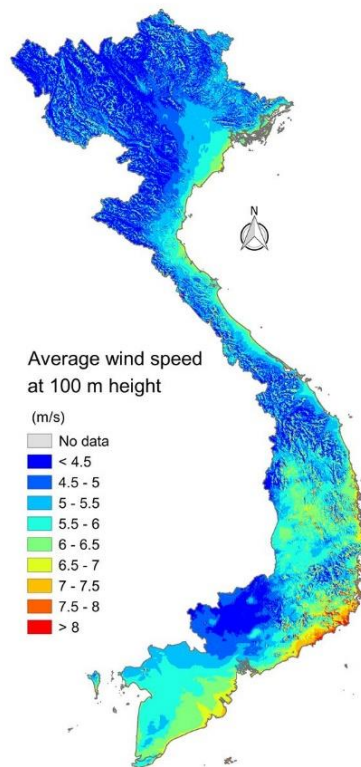
offshore wind power is over 450GW,

onshore wind power is over 210GW

solar power generation is over 200 - 300GW



Solar Map



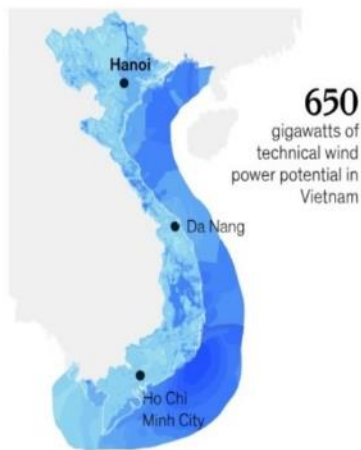
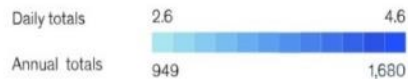
Wind Map

Vietnam has natural endowments with high potential for wind and solar power.

Mean wind speed at 100m, meters per second



Long-term average of photovoltaic power output,¹ 2007-18, kWh/kW peak



Note: The boundaries and names shown on maps do not imply official endorsement or acceptance by McKinsey & Company.
¹Specific yield of photovoltaic power output.
 Source: Global Solar Atlas 2.0; Global Wind Atlas; Institute for Sustainable Futures; Vietnam energy outlook report 2019, Electricity and Renewable Energy Authority and Danish Energy Agency, 2019

Potential wind and Solar Power

<https://dattech.com.vn/wp-content/uploads/2021/11/Map-of-Solar-Resource-and-Potential->

[in-Vietnam-REPORT-FOR-PUBLISHING.pdf](#)

https://energypedia.info/wiki/Wind_Energy_Country_Analysis_Vietnam

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In particular, the proportion of coal was 28% in 2017, which is almost similar to the proportion of renewable energy (27%), and the proportion of renewable energy is expected to increase further before 2030.