



Ministry of Industry and Trade



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Đức

DEUTSCHE ZUSAMMENARBEIT

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**ERAV**  
Electricity Regulatory  
Authority of Vietnam



# **SGREEE - AA1: Revision of Viet Nam's Smart Grid Roadmap**

## **Task 1. A Comprehensive Assessment of Smart Grid Development in Vietnam**

Thursday, March 10, 2022

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# 1. Regulatory Development for Vietnam Smart Grid Roadmap



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**11/2:** Resolution of Politburo On Orientations of the Viet Nam's National Energy Development Strategy to 2030 and outlook to 2045

Report for the result of proposed Indicator Set By EVN

Development strategy of Renewable Energy of Vietnam by 2030 with a vision to 2050

2021



2020



2019



2017



2016



2015



2012



**17/8:** EVNHANOI completed its 2021-2025 detailed smart grid development roadmap.  
**November:** Revised Power Development Plan 8

**1/10:** Approval of the terms of reference for the development of the national power development plan for the 2021 - 2030 period, outlook to 2045 (**Power Development Plan VIII**)

**18/3:** Approving revisions to the national power development plan from 2011 to 2020 with visions extended to 2030.  
**21/3:** Approving the indicator set for evaluating Vietnam's power sector development.  
**13/4:** Program to improve the efficiency of the operation of the power system

Prime Minister approved the Scheme on Development of Intelligent Power Grid in Vietnam

Timeline

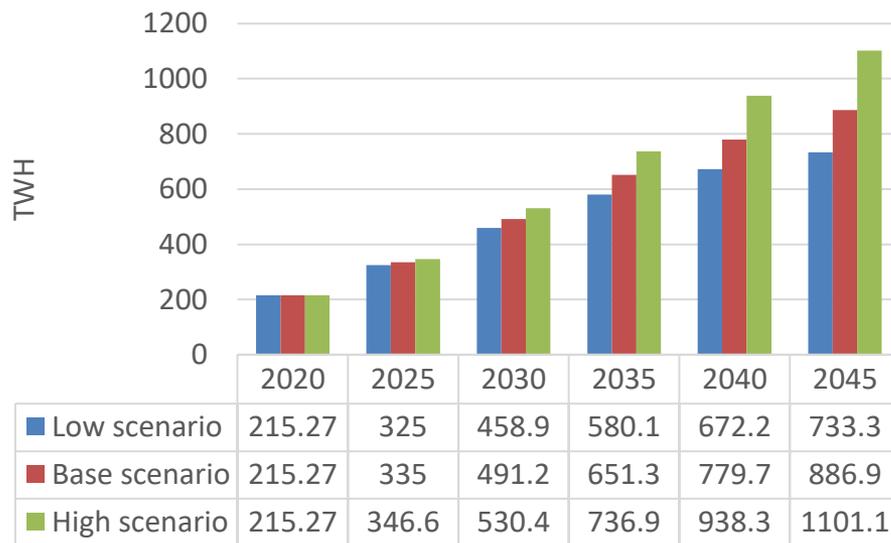


## **2. Power Development Plan VIII (Draft of November 2021)**

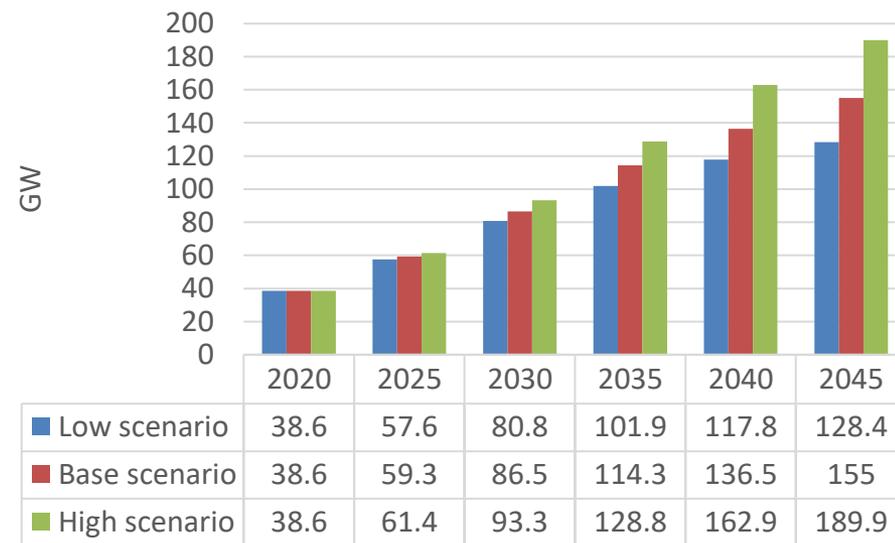
# Power Development Plan 8 (November Draft)

## National electricity demand forecasting

Forecasted commercial electricity demand

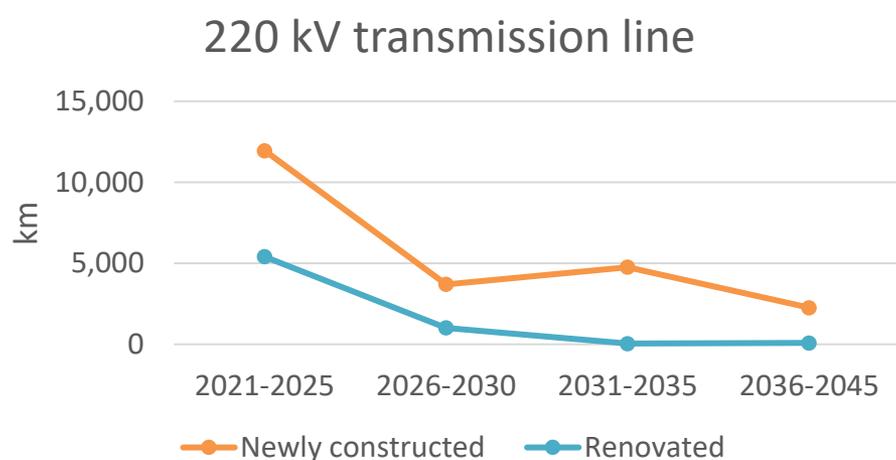
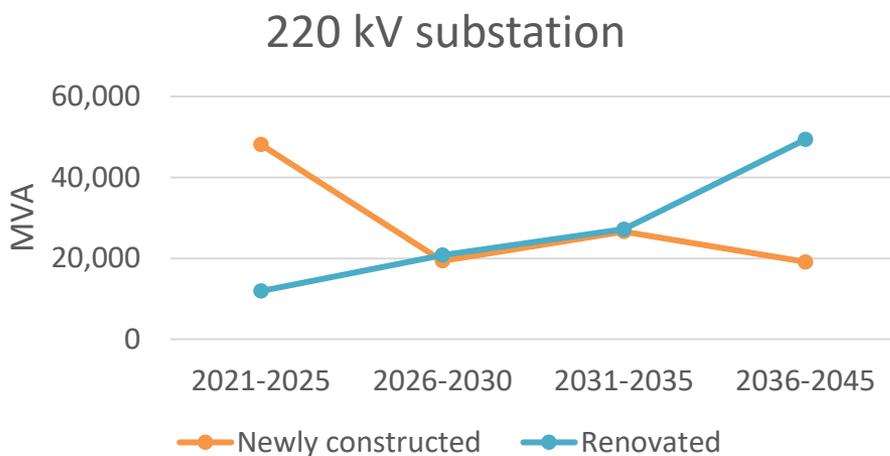
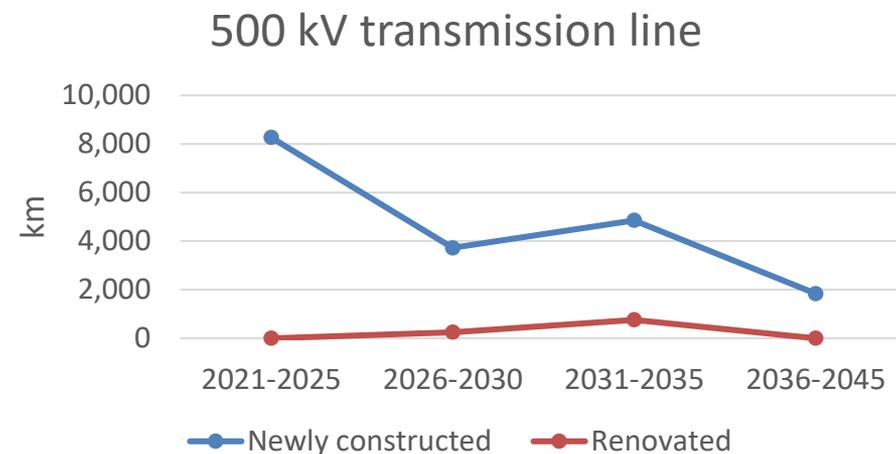
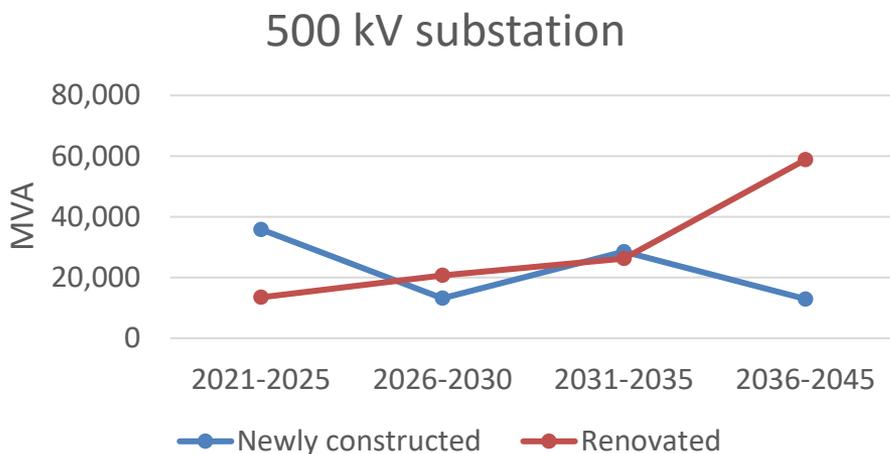


National grid's maximum capacity



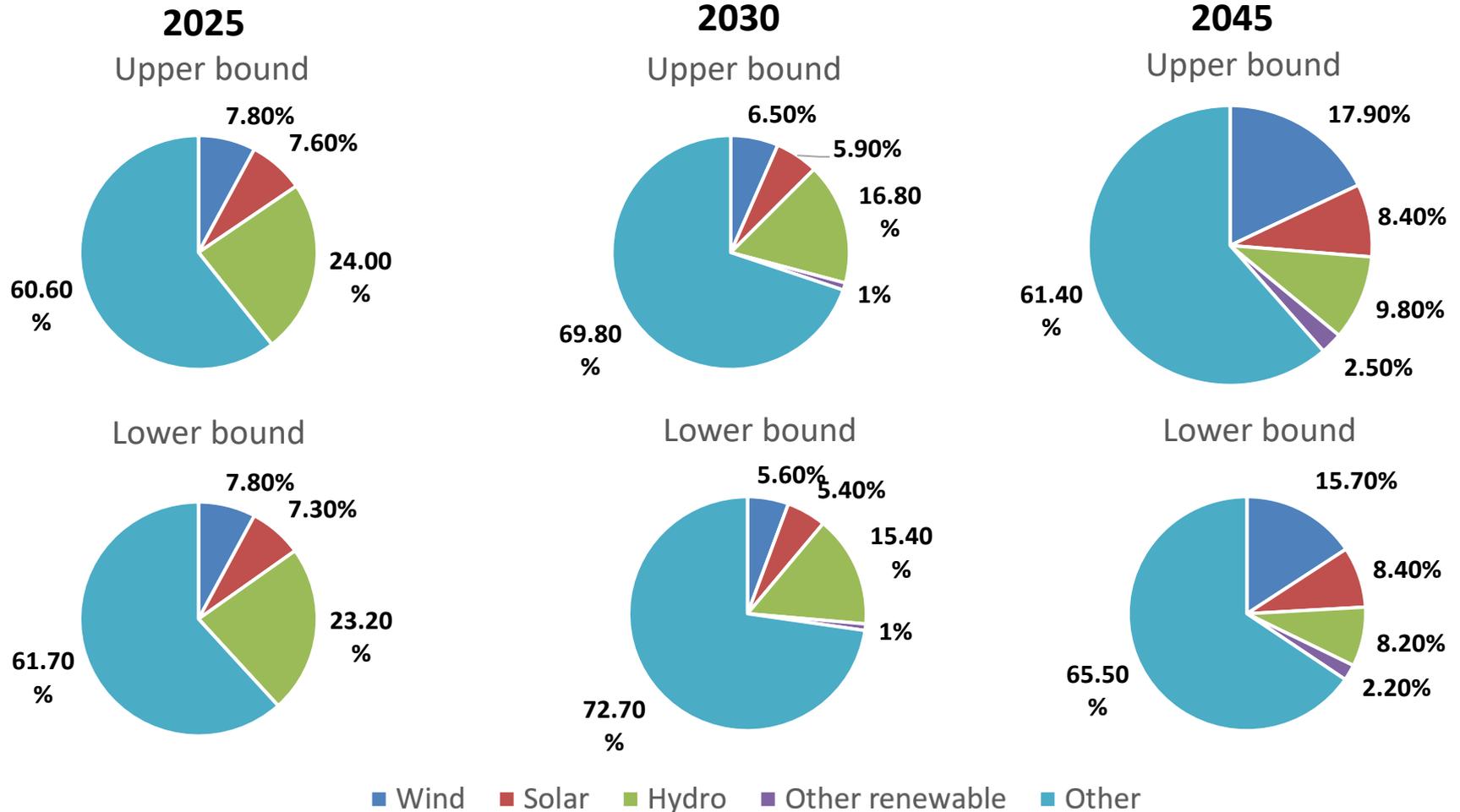
# Power Development Plan 8 (November Draft)

## Transmission system construction, by period



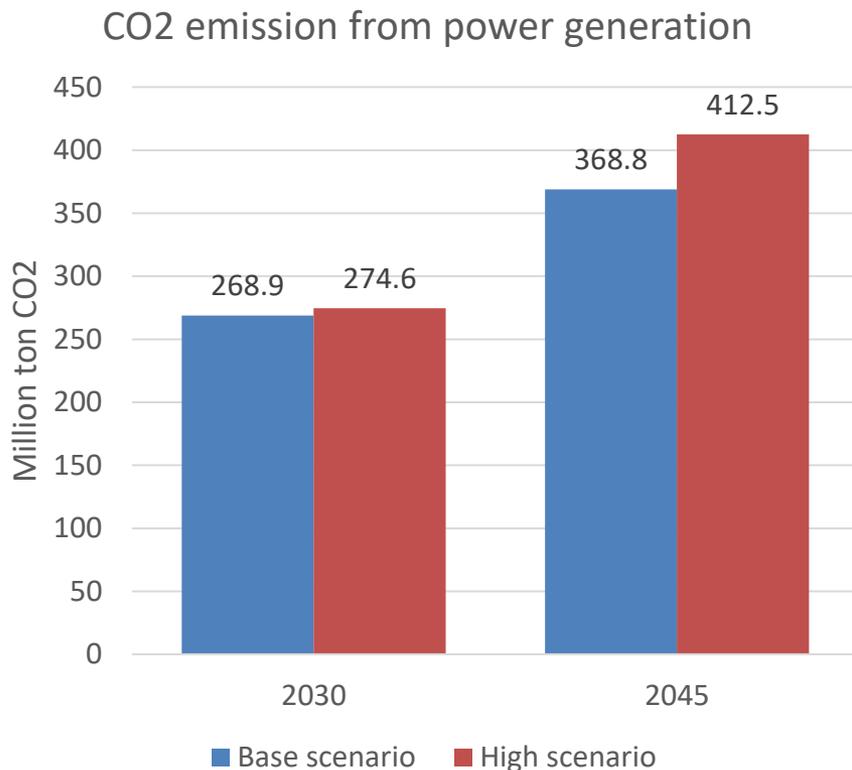
# Power Development Plan 8 (November Draft)

## Renewable energy proportion in total electricity production



# Power Development Plan 8 (November Draft)

## CO2 emission and Power dispatching



### Reformation of power dispatching organization

- ❖ 2021 - 2025: National power system dispatching center (NLDC) of EVN will become a one-member limited liability company (NSMO), wholly state-owned. Coincide with introduction of retail energy market
- ❖ 2026 - 2030: NSMO separates from EVN. The electricity market expands with derivative market, demand response, etc.
- ❖ 2031 - 2045: Vision for a multi-sector utility service.

### ***3. ANNUAL SUMMARY REPORT OF VIETNAM'S SMART GRID DEVELOPMENT***

# Annual Summary Report (2012-2016/2017)

## First phase (2012-2016) and 2017 Reports

| Categories                       | 2012-2016                                                                                                                                                                                                                                                                                                                                                                          | 2017                                                                                                                                                                                                                                                   |
|----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SCADA Connection                 | <ul style="list-style-type: none"> <li>Increase percentage of SCADA system connection in power plants and substations</li> <li>Unconnected 110 kV substations (41/703 substations)</li> <li>Percentage of stable and sufficient connection needs improvement (objective is over 80%, &gt;30MW power plant is 76%, 500/220/110kV sub is 76%, 78%, 81%, 73% respectively)</li> </ul> | <ul style="list-style-type: none"> <li>Increase percentage of SCADA system connection in power plants and substations.</li> <li>All but the percentage of stable and sufficient connection of 110kV substations (77%) exceed 80% threshold.</li> </ul> |
| Remote Data Collection           | Basic Complete (EVNNPC at 86%)                                                                                                                                                                                                                                                                                                                                                     | Complete                                                                                                                                                                                                                                               |
| Measuring Equipment Installation | Complete                                                                                                                                                                                                                                                                                                                                                                           | Complete                                                                                                                                                                                                                                               |
| Digital Meters                   | As of 12/2016, 10% increase of digital meter, 5% increase of digital meter with remote measuring capability installed nationally compared to 12/2015.                                                                                                                                                                                                                              | Digital meters without and with remote capability grew by 7% and 6% respectively, now at 35% and 26.5% of total number of meters.                                                                                                                      |
| Power Supply Reliability         | <ul style="list-style-type: none"> <li>MAIFI: 1.51 (times/customer)</li> <li>SAIDI: 1651 (minutes)</li> <li>SAIFI: 10.60 (times/customer)</li> </ul>                                                                                                                                                                                                                               | <ul style="list-style-type: none"> <li>MAIFI: 2.40 (times/customer)</li> <li>SAIDI: 1183 (minutes)</li> <li>SAIFI: 10.70 (times/customer)</li> </ul>                                                                                                   |

# Annual Summary Report (2018/2019)

## 2018 and 2019 Reports

| Categories                       | 2018                                                                                                                                                                                                                                                                                                                                                                                                  | 2019                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SCADA Connection                 | <ul style="list-style-type: none"> <li>The percentage of power plants and substations equipped with SCADA and sufficient signals remained at a high level and improved in comparison with that in 2017.</li> <li>The percentage of power plants with capacity larger than 30MW that has sufficient signals is more than 80%, while the figure of 500/220kV substations is larger than 87%.</li> </ul> | <ul style="list-style-type: none"> <li>The percentage of power plants and substations equipped with SCADA and sufficient signals remained at a high level and improved in comparison with that in 2018</li> <li>The percentage of power plants with power generation capacity of above 30MW, 500/220kV substations equipped with SCADA and sufficient signals exceeded 90%; the percentage of 100kV substations with sufficient signals reached 70%, which was substantially improved in comparison with that in 2018 (63%).</li> </ul> |
| Remote Data Collection           | Complete                                                                                                                                                                                                                                                                                                                                                                                              | Complete                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Measuring Equipment Installation | Complete                                                                                                                                                                                                                                                                                                                                                                                              | Complete                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Digital Meters                   | <p>Quantity of digital meters: <b>increasing by approximately 6%</b> over the respective statistics of December 2017.</p> <p>Quantity of digital meters which <i>applied remote metering</i> and data collection <b>increasing by approximately 9%</b> over the respective statistics of December 2017.</p>                                                                                           | <p>Quantity of digital meters: <b>increasing by approximately 11%</b> over the respective statistics of December 2018.</p> <p>Quantity of digital meters which <i>applied remote metering</i> and data collection <b>increasing by approximately 7%</b> over the respective statistics of December 2018</p>                                                                                                                                                                                                                             |
| Power Supply Reliability         | <ul style="list-style-type: none"> <li>MAIFI: 0.78 (times/customer)</li> <li>SAIDI: 724 (minutes)</li> <li>SAIFI: 4.97 (times/customer)</li> </ul>                                                                                                                                                                                                                                                    | <ul style="list-style-type: none"> <li>MAIFI: 0.89 (times/customer)</li> <li>SAIDI: 1071 (minutes)</li> <li>SAIFI: 6.57 (times/customer)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                     |

# Annual Summary Report (2020)

## 2020 Report

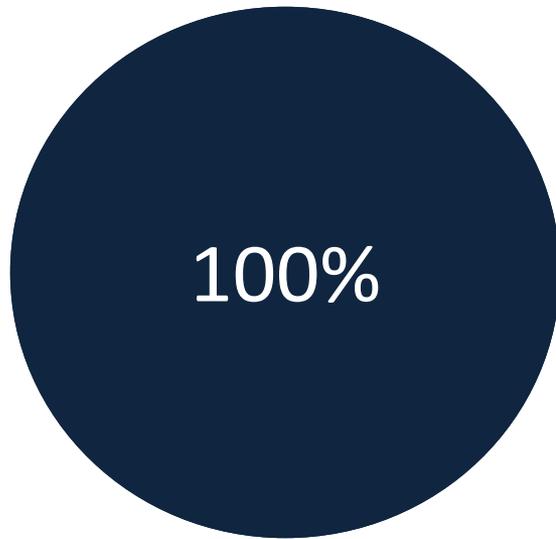
### SCADA Connection Rate

| Power Plant / Substation | Year    |          | Total Amount | Connected | Remaining connection | Connected and sufficient signals |
|--------------------------|---------|----------|--------------|-----------|----------------------|----------------------------------|
| Power Plant (> 30MW)     | 12/2019 | Quantity | 222          | 222       | 216                  | 199                              |
|                          |         | %        |              | 100%      | 97%                  | 90%                              |
|                          | 12/2020 |          | 276          | 276       | 270                  | 245                              |
|                          |         |          |              | 100%      | 98%                  | 89%                              |
| Substation 500kV         | 12/2019 | Quantity | 32           | 32        | 32                   | 29                               |
|                          |         | %        |              | 100%      | 100%                 | 91%                              |
|                          | 12/2020 |          | 36           | 36        | 36                   | 33                               |
|                          |         |          |              | 100%      | 100%                 | 92%                              |
| Substation 220kV         | 12/2019 | Quantity | 134          | 134       | 134                  | 132                              |
|                          |         | %        |              | 100%      | 100%                 | 98,5%                            |
|                          | 12/2020 |          | 140          | 140       | 138                  | 139                              |
|                          |         |          |              | 100%      | 99%                  | 99%                              |
| Substation 110kV         | 12/2019 | Quantity | 841          | 806       | 763                  | 609                              |
|                          |         | %        |              | 96%       | 91%                  | 72,4%                            |
|                          | 12/2020 |          | 869          | 844       | 825                  | 756                              |
|                          |         |          |              | 97%       | 95%                  | 87%                              |

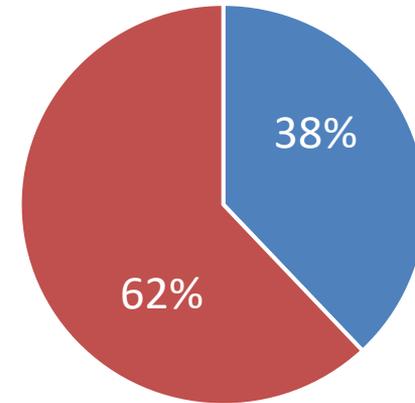
# Annual Summary Report (2020)

## 2020 Report

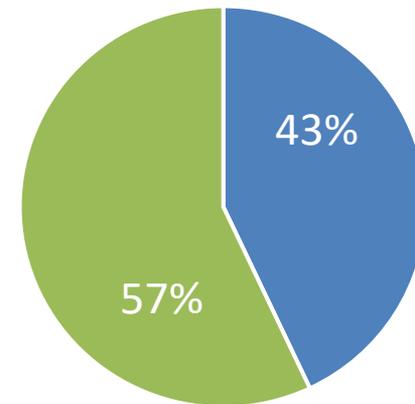
### Remote Metering



All meters at 110kV+ substations  
have remote features



■ Mechatronic Meter ■ Digital Meter



■ Others ■ Digital Meter with remote features

# Annual Summary Report (2020)

## 2020 Report

### Unmanned Substation

| Unit     | Number of Control Center in Operation | Number of Control Center in Operation / Total amount of Control Centers | Number of Unmanned Substations in Operation (220/110kV) | Total number of operating substations (220/110kV) | Unmanned Substations in Operation / Total number of operating substations (220/110kV) |
|----------|---------------------------------------|-------------------------------------------------------------------------|---------------------------------------------------------|---------------------------------------------------|---------------------------------------------------------------------------------------|
| EVNNPC   | 27                                    | 100%                                                                    | 213                                                     | 269                                               | 79%                                                                                   |
| EVNCPC   | 13                                    | 100%                                                                    | 123                                                     | 123                                               | 100%                                                                                  |
| EVNSPC   | 21                                    | 100%                                                                    | 230                                                     | 230                                               | 100%                                                                                  |
| EVNHANOI | 01                                    | 100%                                                                    | 47                                                      | 48                                                | 98%                                                                                   |
| EVNHCMC  | 01                                    | 100%                                                                    | 55                                                      | 55                                                | 100%                                                                                  |
| EVNNPT   | No Control Center                     |                                                                         | 94                                                      | 129                                               | 73%                                                                                   |

# Annual Summary Report (2020)

## 2020 Report

### SAIDI & SAIFI

| Reliability Criteria | SAIDI<br>(minutes) | SAIFI<br>(times/customer) |
|----------------------|--------------------|---------------------------|
| 2019                 | 1.071              | 6,57                      |
| Target for 2020      | 400                | 8                         |
| Result for 2020      | 356                | 3,11                      |

- ❖ The SAIDI and SAIFI indexes of the Power Corporations and the whole EVN exceeded the plan set out in Decision No. 1047/QD-BCT dated March 21, 2016, of the Minister of Industry and Trade on approving the set of criteria to assess the development level of Vietnam's electricity industry

## 4. Vietnam Smart Grid Index Assessment



# Vietnam Smart Grid Index Assessment

Monitoring & Control

Data Analytics

Cyber Security

VIETNAM  
INDEX

Supply Reliability

Customer Empowerment  
& Satisfaction

DER Integration

Green Energy

# Vietnam Smart Grid Index Assessment

## Monitoring & Control

### EVNHCMC

- ✓ All 220/110kV substations are equipped with SCADA
- ✓ Applications:
  - Fault location
  - Fault isolation
  - Automated feeder reconfiguration
  - Distribution power flow
  - Load and Volt/VAR management
  - Planned outage study
  - Short circuit calculation
- ✗ Does not have tools for minimizing grid losses and load forecasting

### EVNCPC

- ✓ MV Network is monitored by SCADA, but LV Network does not have that feature.
- ✓ Applications:
  - Grid Topology Management, Power flow calculation
  - short circuit calculation
  - Random error analysis
  - power flow optimization
  - optimization of capacitors allocation
  - open-loop optimization
  - Protection settings management
  - Load estimation and load forecasting
- ✗ Does not have any tools for load shedding and managing the voltage

### EVNSPC

- ✓ MV Network is monitored by SCADA, but LV Network does not have that feature.
- ✗ EVNSPC does not have tools for state estimator, load flow, minimizing grid losses and load forecasting.

### EVN HNPC

- ✓ Uses a SCADA system to monitor the MV network, but it is not used to monitor the LV network. EVNHNPC integrated Volt-VAR control, Load Shedding Fault Management and System Restoration to their SCADA system

# Vietnam Smart Grid Index Assessment

## Data Analytics

*Table: Digital Meter Roll-out per regions*

| Region      | Digital Meter Roll-out [%] |
|-------------|----------------------------|
| Ho Chi Minh | 82%                        |
| Central     | 92%                        |
| Southern    | 41%                        |
| Ha Noi      | 100%                       |

- ❖ The smart meters installed in Viet Nam can measure active and reactive power consumed or produced by the prosumer. The customer can monitor his/her energy consumption with 30 minutes steps via a mobile app or webpage. **The digital meters installed can measure the power factor but can't measure harmonic distortion.**
- ❖ Unfortunately, the data collected by smart meters **are not used for network planning and maintenance and asset renewal but is used for load forecasting.** The current digital meters installed **don't offer demand response or load control service.** Moreover, it **neither detects outages nor non-technical losses.**

# Vietnam Smart Grid Index Assessment

## Supply Reliability

| Unit     | Year            | MAIFI<br>(times) | SAIDI<br>(times) | SAIFI<br>(times) |
|----------|-----------------|------------------|------------------|------------------|
| EVNNPC   | 2019            | 1,08             | 2495             | 14,3             |
|          | Plan for 2020   | 2                | 511              | 9                |
|          | Result for 2020 | 0,46             | 498              | 4,68             |
| EVNCPC   | 2019            | 1,2              | 297              | 2,69             |
|          | Plan for 2020   | 2,15             | 402              | 8,73             |
|          | Result for 2020 | 1,17             | 362              | 2,33             |
| EVNSPC   | 2019            | 0,79             | 275              | 2,3              |
|          | Plan for 2020   | 2                | 306              | 5,27             |
|          | Result for 2020 | 1,28             | 287              | 2,73             |
| EVNHANOI | 2019            | 0,44             | 205              | 1,45             |
|          | Plan for 2020   | 2                | 254              | 6,12             |
|          | Result for 2020 | 0,26             | 173,5            | 1,3              |
| EVNHCMC  | 2019            | 0,37             | 58,46            | 0,77             |
|          | Plan for 2020   | 2                | 174              | 5                |
|          | Result for 2020 | 0.35             | 44,2             | 0.59             |
| EVN      | 2019            | 0,89             | 1071             | 6,57             |
|          | Plan for 2020   | 2                | 400              | 8                |
|          | Result for 2020 | 0.77             | 356              | 3,11             |

# Vietnam Smart Grid Index Assessment

## Supply Reliability

- ❖ All the DSOs in Vietnam monitor the SAIDI and SAIFI indexes in their network according to **Circular 39/2015/TT-BCT**. It has been noticed from the SAIDI and SAIFI reports that it improves year after another except for EVNNPC in which SAIDI and SAIFI values increased in 2019.
- ❖ All the DSOs in Vietnam monitor the voltage deviation in the network. It has been noted from the survey that whenever a voltage deviation occurs in the network, even if it is for a couple of minutes, the DSO calculate the whole hour as a voltage out of range, which could wrong sign. **Therefore, it is recommended to calculate the voltage deviation beyond the limit with minutes not with hours.**

# Vietnam Smart Grid Index Assessment

## DER Integration

Regarding  
Renewable Energy  
Integration

- ❖ Regulation currently defines the integration of renewable energy but not yet consider the RE Ancillary Services.

Regarding Energy  
Flexibility

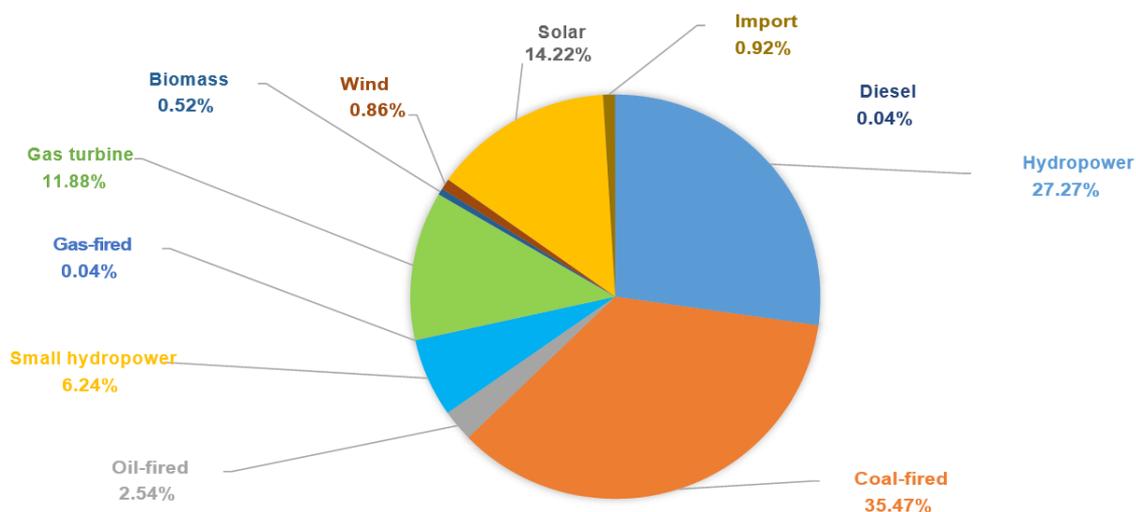
- ❖ The energy flexibility is still under development in Vietnam and there is no clear regulation defining it

It is recommended to accelerate the issue of new regulations defining the operation of batteries and power-to-gas technology to support the electric energy system with a high percentage of renewable energy integration

# Vietnam Smart Grid Index Assessment

## Green Energy

| National         |                         |             |
|------------------|-------------------------|-------------|
| Fuel source      | Installed capacity (MW) | Share (%)   |
| Hydropower       | 16,972                  | 27.27%      |
| Coal             | 22,077                  | 35.47%      |
| Oil              | 1,579                   | 2.54%       |
| Small Hydropower | 3,887                   | 6.24%       |
| Gas-fired        | 24                      | 0.04%       |
| Gas turbine      | 7,398                   | 11.88%      |
| Biomass          | 325                     | 0.52%       |
| Wind             | 538                     | 0.86%       |
| Solar            | 8,852                   | 14.22%      |
| Import           | 572                     | 0.92%       |
| Diesel           | 24                      | 0.04%       |
| <b>Total</b>     | <b>62,248</b>           | <b>100%</b> |

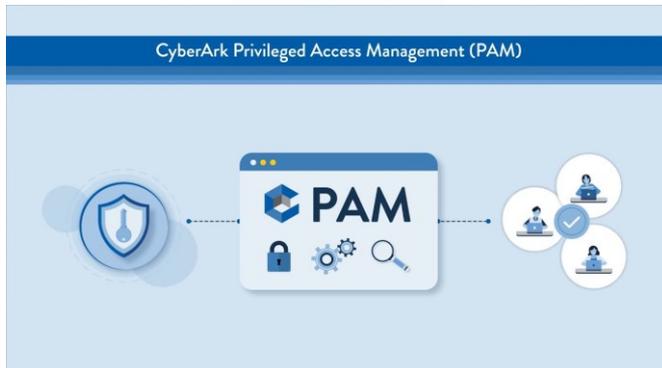


*Power generation mix in Viet Nam*

- ❖ It is recommended to continue the promotion of electric mobility and develop regulations to support smart charging and vehicle-to-grid technology.

# Vietnam Smart Grid Index Assessment

## Cyber Security



- ❖ **VPN and PAM are used to access remote hardware and devices**

### *Important Notes:*

- The software used are updated every quarter or whenever it is recommended by the manufacture.
- Decision No. 99/QD-EVN regulators data security.
- Annual training and audits are organized on annual basis.
- All units of EVN (except EVNEPTC) have registered and achieved cybersecurity certificate according to ISO 27001.

# Vietnam Smart Grid Index Assessment

## Customer Empowerment & Satisfaction

- ❖ Energy consumption can be monitored by customers with remote meters
- ❖ Large customers could join demand response campaign voluntary without receiving any incentives. It is recommended in the future to organise a demand response market to customers who will participate in demand response.
- ❖ The utilities organise annual surveys to get feedback from customers. The survey results show very good feedback from the customers.

**Thank you!**