



LEBANESE REPUBLIC
MINISTRY OF ENERGY
AND WATER



LEBANESE CENTER FOR ENERGY CONSERVATION
المركز اللبناني لحفظ الطاقة

efficient resources, sustainable achievements

THE GROWING RENEWABLE ENERGY IN LEBANON & *the potential for energy storage*

By Joseph Al Assad, PhD.

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Associate Professor at Holy Spirit University
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& Rani Al Achkar,

LCEC Director of Engineering & Planning



ATA INSIGHTS WEBINAR

May 30, 2019



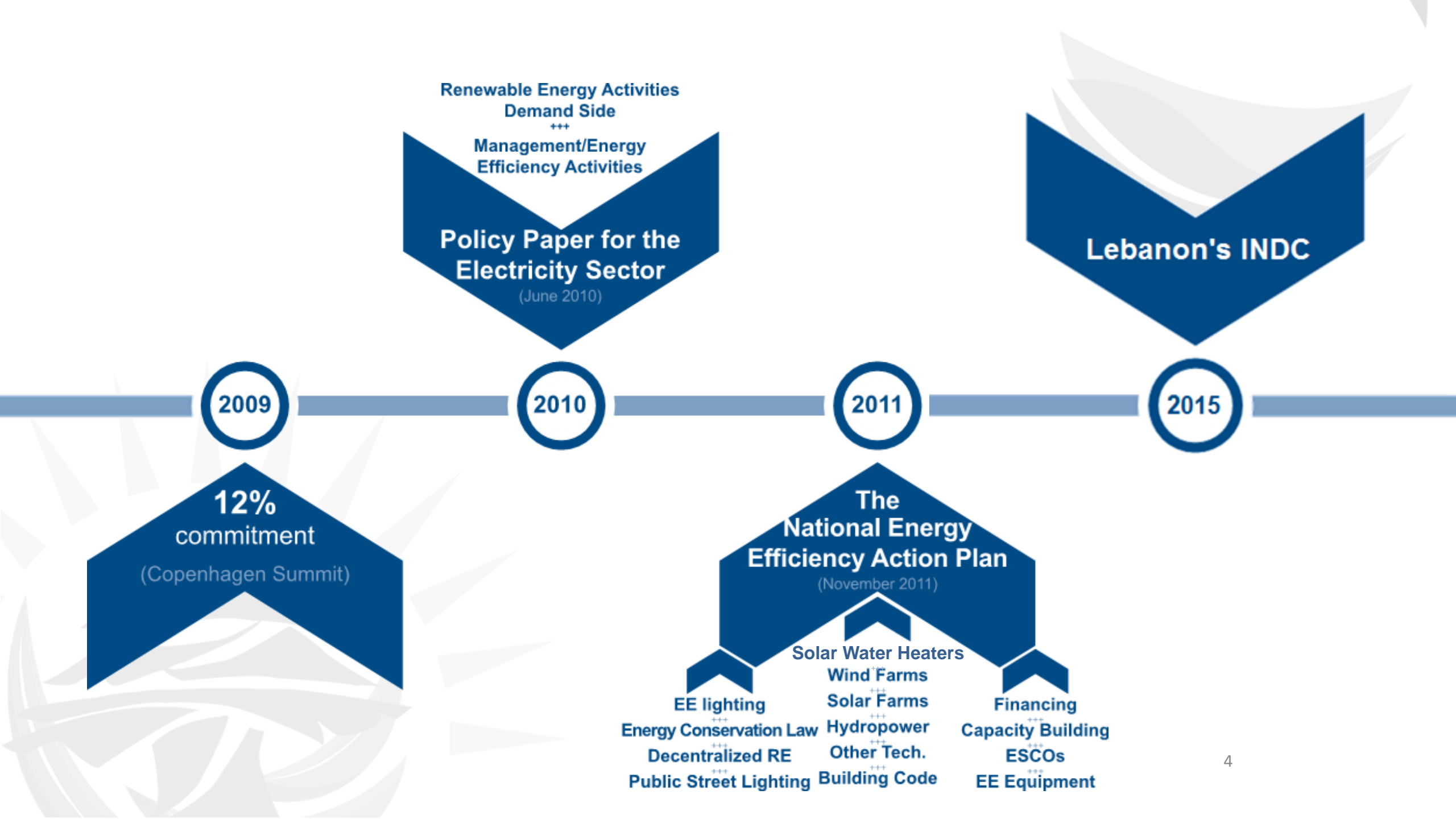
- **1. A decade of Political Commitment!**
- **2. The wheels are turning!**
- **3. Updating The Conventional Generation Fleet**
- **4. The Need For Storage?**
- **5. The Potential For Storage?**





1. A decade of political commitment!





2009

12% commitment

(Copenhagen Summit)

2010

Renewable Energy Activities
Demand Side
+++
Management/Energy
Efficiency Activities

Policy Paper for the Electricity Sector

(June 2010)

2011

The National Energy Efficiency Action Plan

(November 2011)

- EE lighting
- Solar Water Heaters
- Financing
- Energy Conservation Law
- Wind Farms
- Capacity Building
- Decentralized RE
- Solar Farms
- ESCOs
- Public Street Lighting
- Hydropower
- EE Equipment
- Other Tech.
- Building Code

2015

Lebanon's INDC

The National Renewable Energy Action Plan

2016

The National Energy Efficiency Action Plan

2018

30% Commitment
PM Saad Hariri

MEW Updated Policy Paper for the Electricity Sector

2019

IRENA Renewable Energy Outlook

REmap + Renewable Readiness Assessment
+++



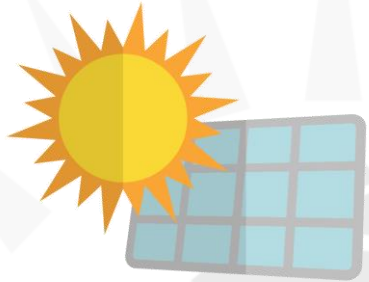
2. The wheels are turning!



3 Power Purchase Agreements (PPAs) signed
Installed Capacity 226 MW in Total
Expected Commercial Operation Date (COD): Feb 2021



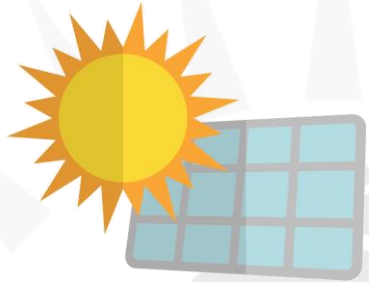
28 proposals shortlisted & under evaluation, 12 PPAs to be signed end of 2019
Installed Capacity 180 MWp in total (10-15 MWp each)
Expected Commercial Operation Date (COD): Q1 2021



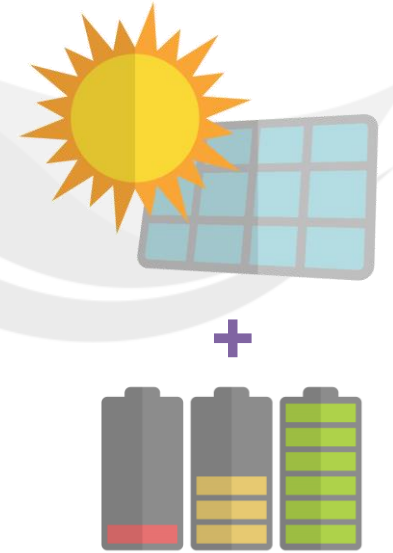
Call for Expressions of Interest (EOIs): 42 EOIs received
Request for Proposals (RFP) is under finalization
4 proposals to be selected
Installed Capacity 200 – 400 MW



Round 2 to be launched end of 2019
24 proposals to be selected
Installed Capacity 360 MWp in total (10-15 MW each)



Call for Expressions of Interest (EOIs): 75 EOIs received
Request for Proposals (RFP) is under preparation
6 proposals to be selected
Total Installed Capacity 300 MWp – 210MW/210MWh

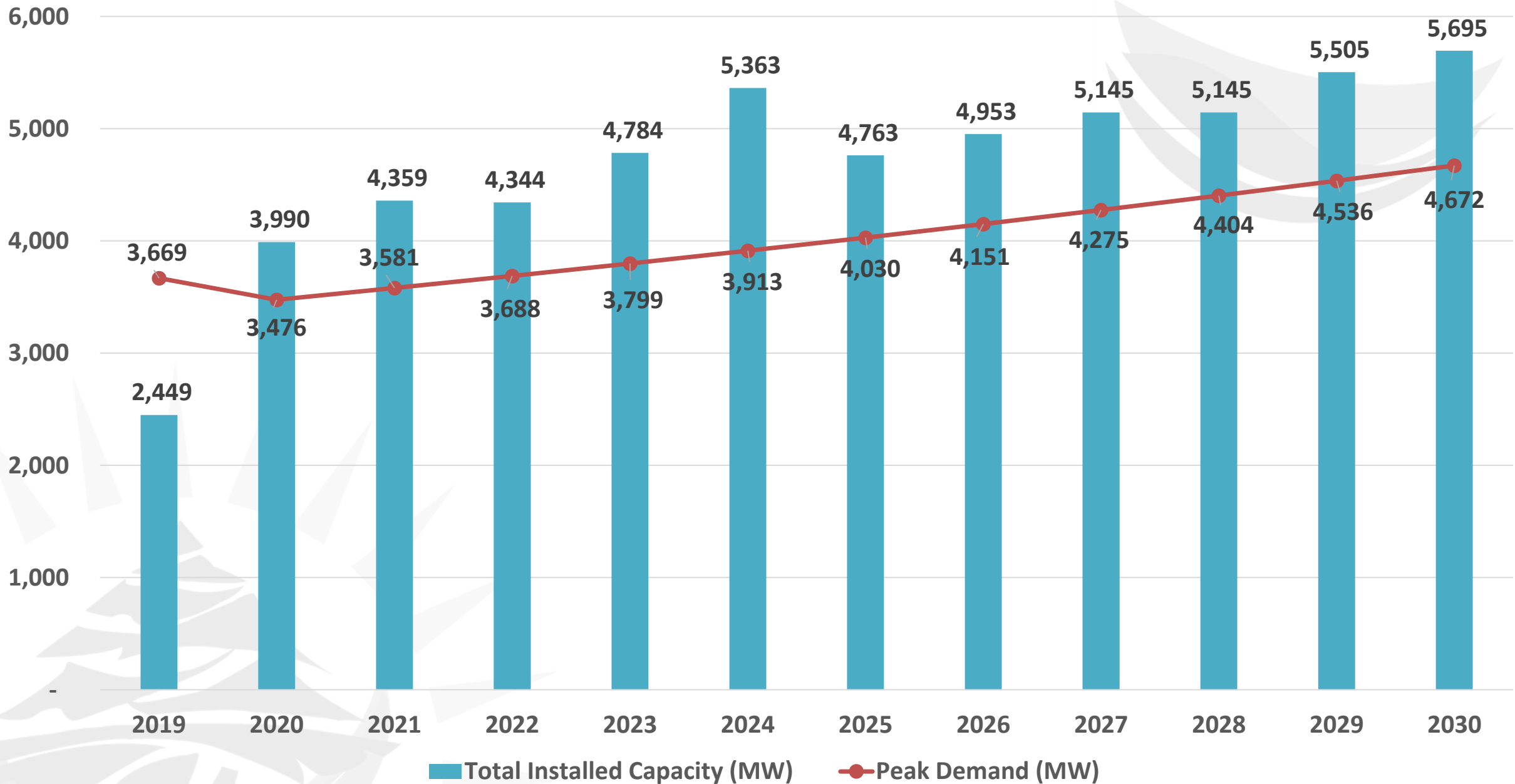


Call for Expressions of Interest (EOIs): 25 EOIs received



3. Updating The Conventional Generation Fleet

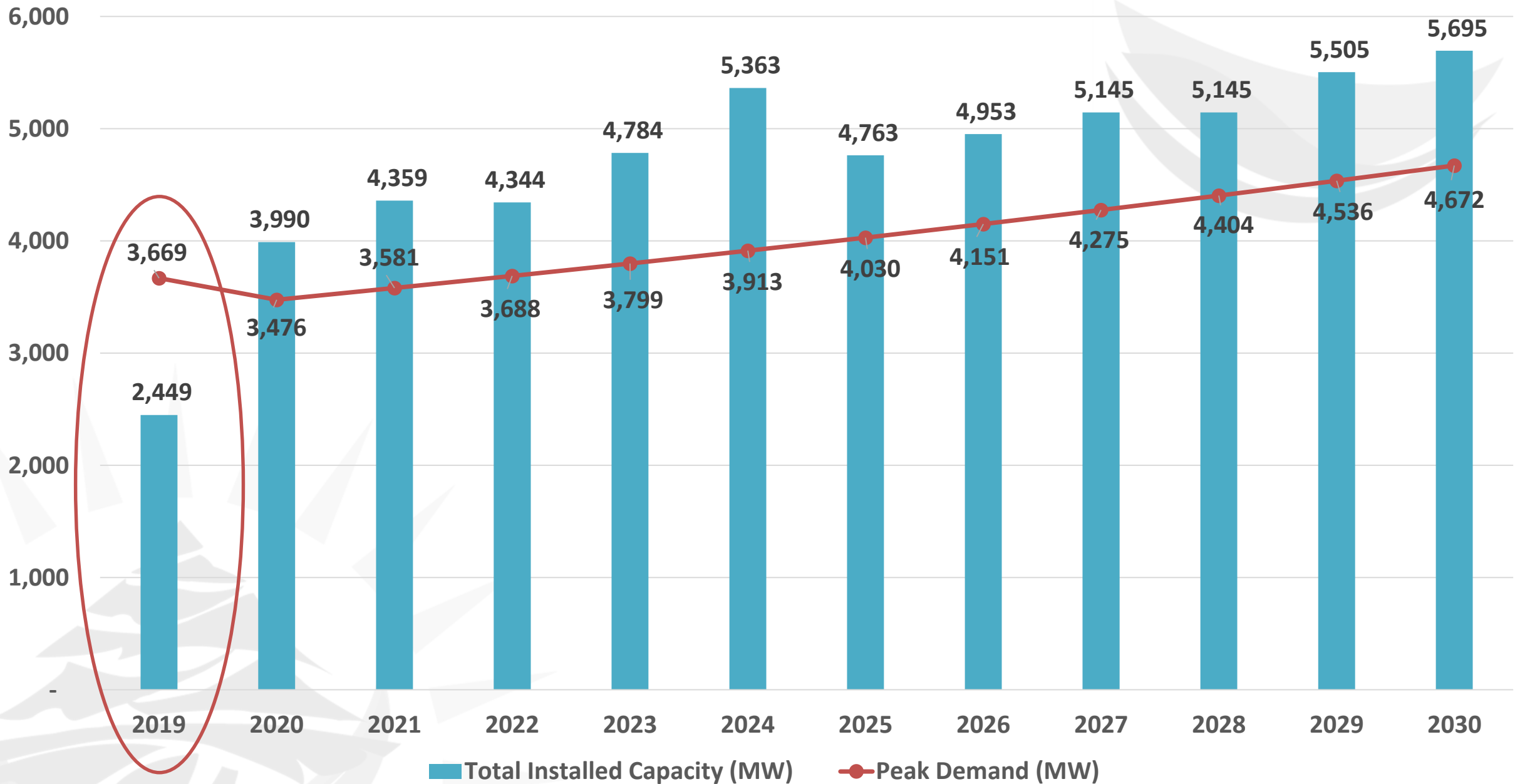




■ Total Installed Capacity (MW)

● Peak Demand (MW)

Source: Updated Policy Paper for the Electricity Sector – Ministry of Energy and Water – March 2019

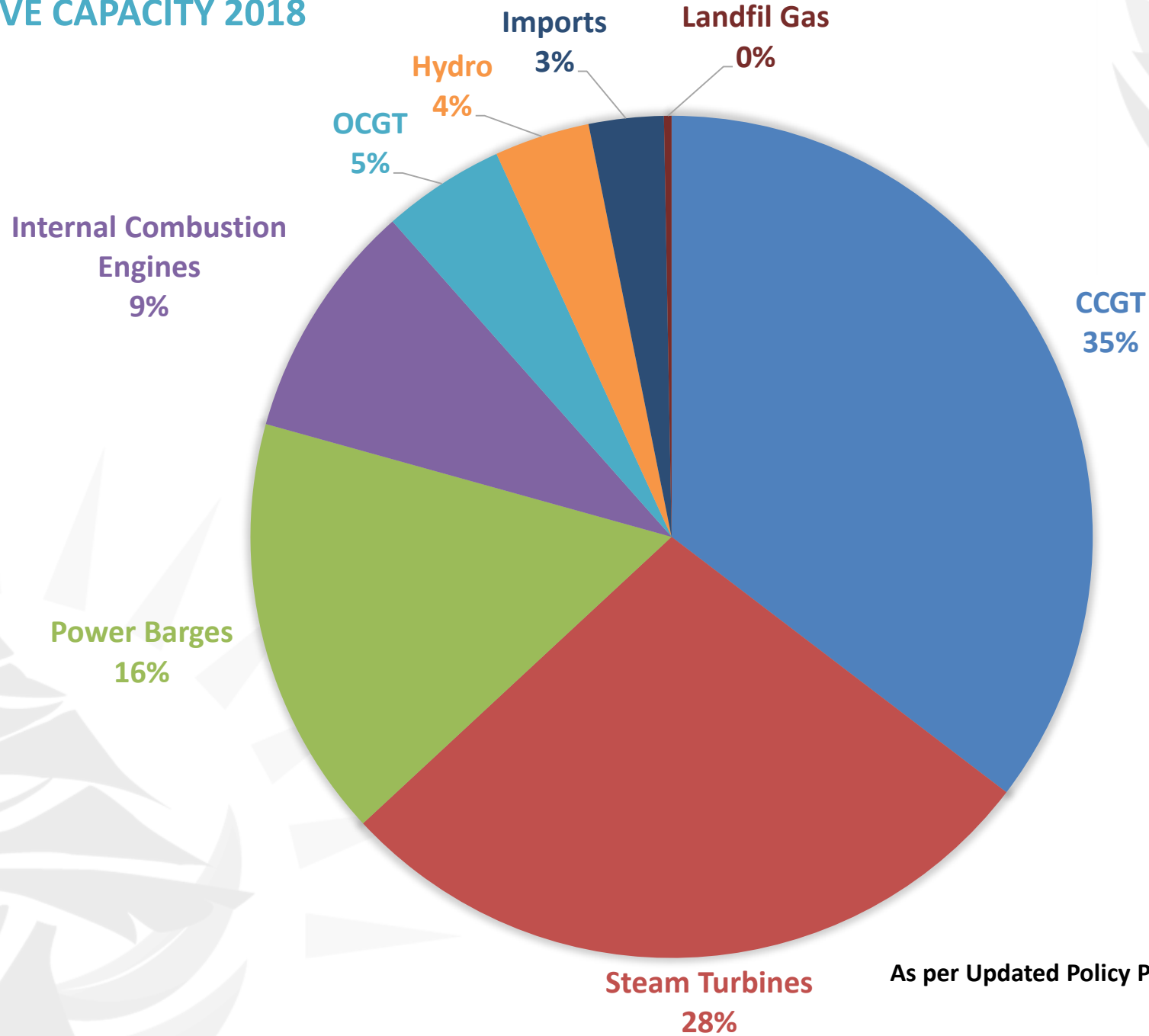


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● Peak Demand (MW)

Source: Updated Policy Paper for the Electricity Sector – Ministry of Energy and Water – March 2019

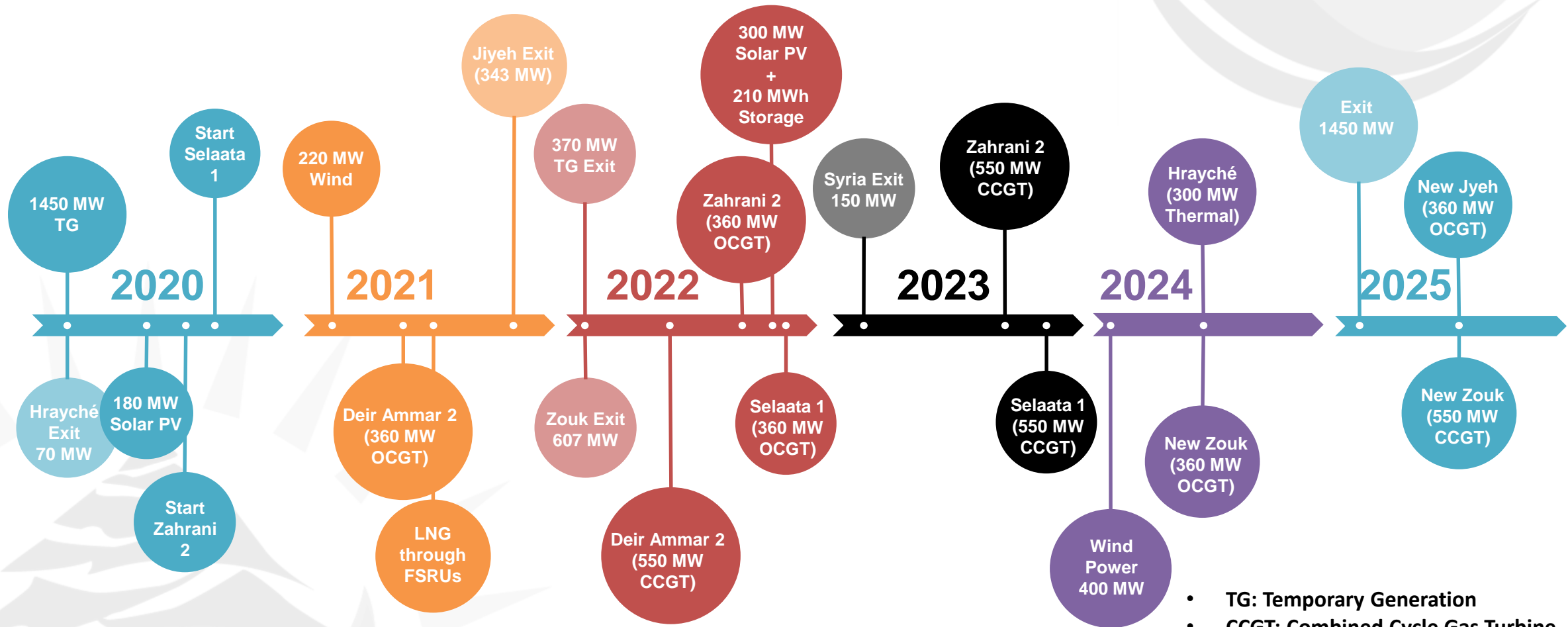
EFFECTIVE CAPACITY 2018



As per Updated Policy Paper for the Electricity Sector – Ministry of Energy and Water – March 2019

Unit Name	Unit type	Effective Capacity 2018 (MW)	Cost of Production (USD/MWh)
Zouk 1	Steam Turbines	440	\$14.75
Jieh 1	Steam Turbines	180	\$19.39
Zouk 2	Internal Combustion Engines	157	\$10.83
Jieh 2	Internal Combustion Engines	63	\$11.19
Zahrani	CCGT	420	\$13.62
Deir Ammar	CCGT	430	\$14.96
Baalbeck	OCGT	57	\$20.26
Tyr	OCGT	56	\$21.44
Richmaya-Safa	Hydro	3	\$3.66
Naameh	Landfil Gas	7	\$1.00
Power Barge Zouk	Power Barges	195	\$13.95
Power Barge Jieh	Power Barges	195	\$14.03
Litani	Hydro	47	\$3.97
Nahr Ibrahim	Hydro	17	\$2.65
Bared	Hydro	6	\$2.65
Kadisha	Hydro	15	\$2.65
Hrayche	Steam Turbines	46	\$20.13
Import from Syria	Imports	69	\$15.35

Source: Updated Policy Paper for the Electricity Sector – Ministry of Energy and Water – March 2019

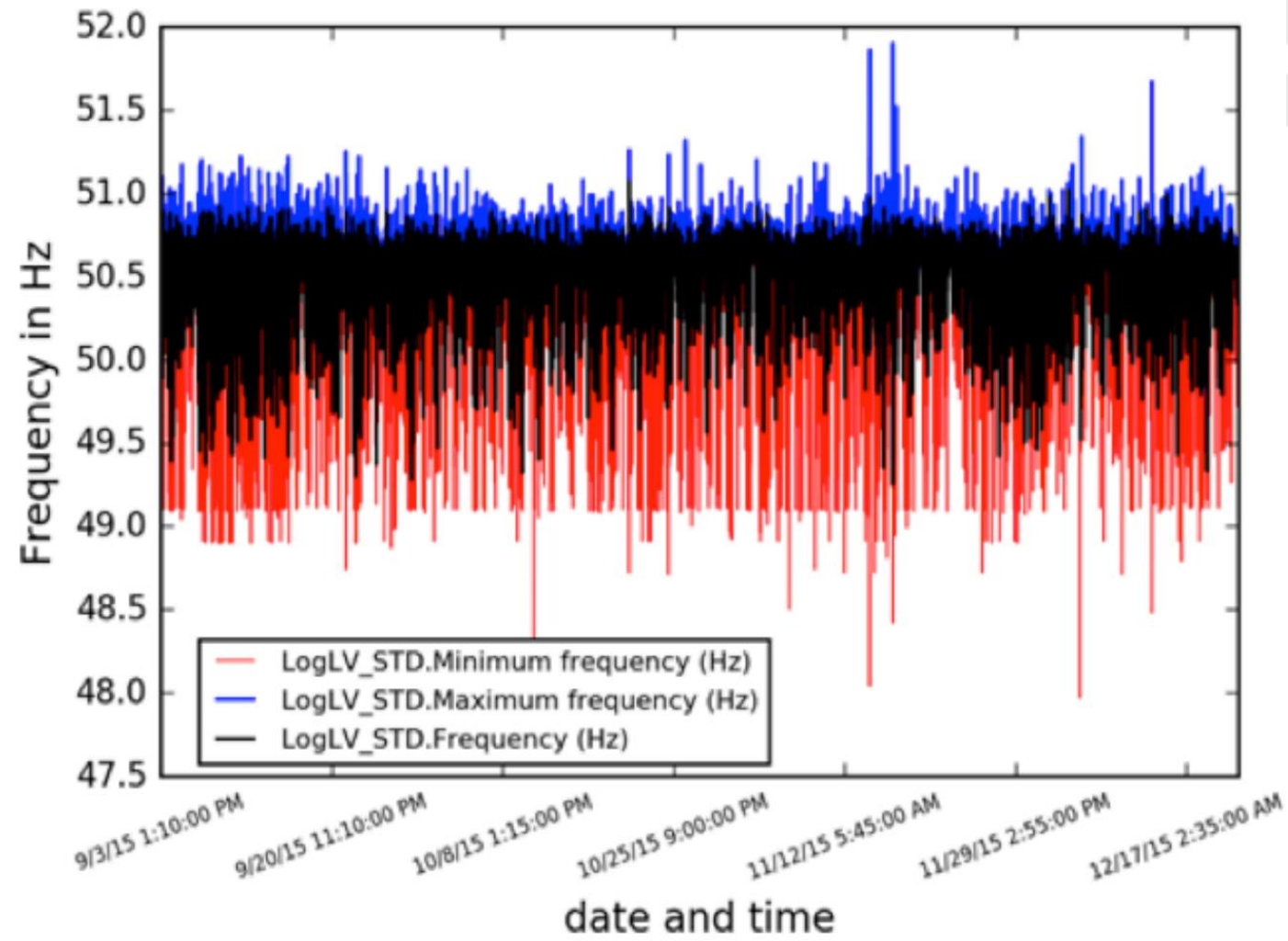


- **TG:** Temporary Generation
- **CCGT:** Combined Cycle Gas Turbine
- **OCGT:** Open Cycle Gas Turbine

Source: Updated Policy Paper for the Electricity Sector – Ministry of Energy and Water – March 2019



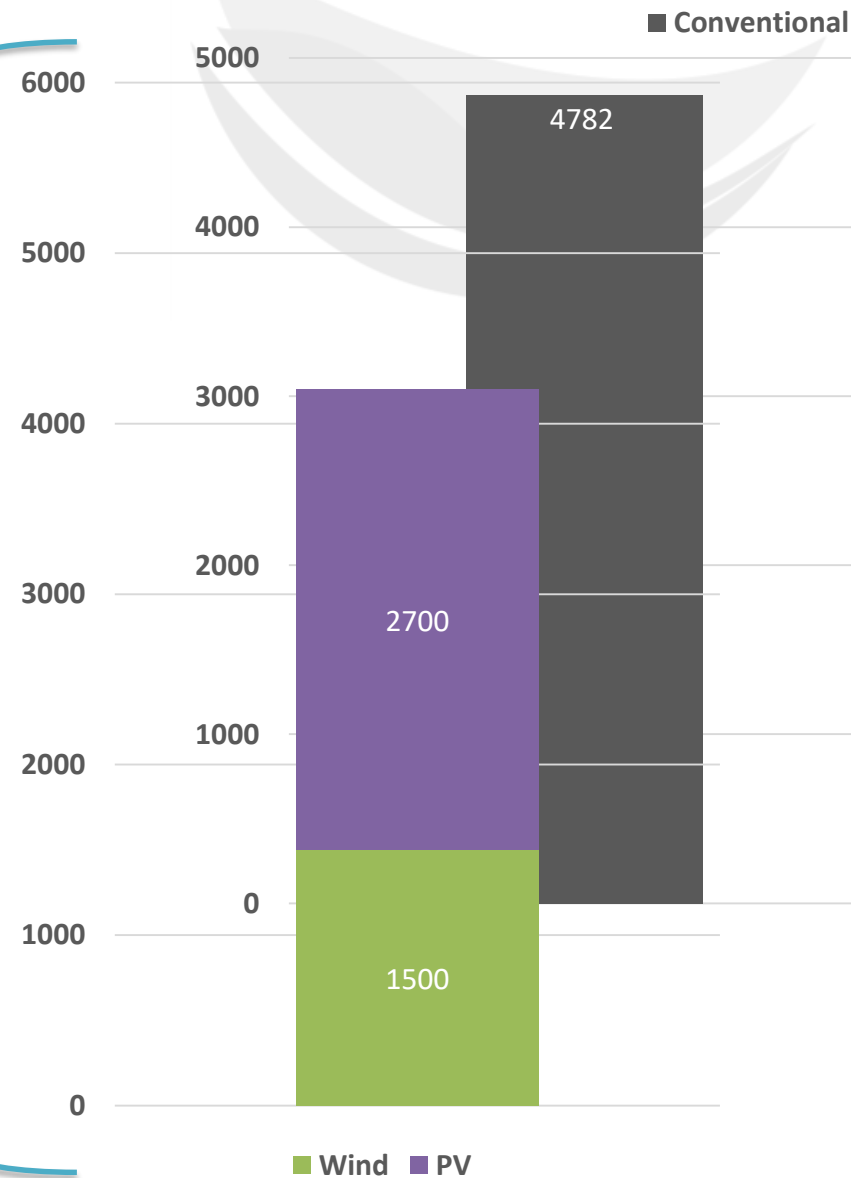
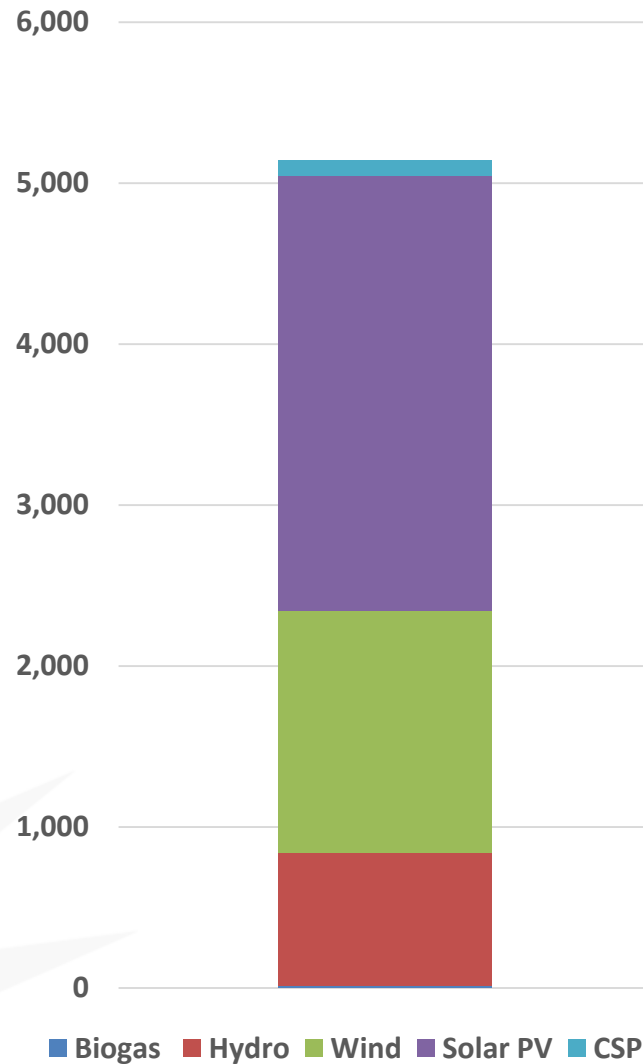
4. The Need For Storage?



Wind energy grid interconnection code for Lebanon, UNDP-CEDRO, Beirut, 2017.

30%

RE share in the Electricity Demand by 2030

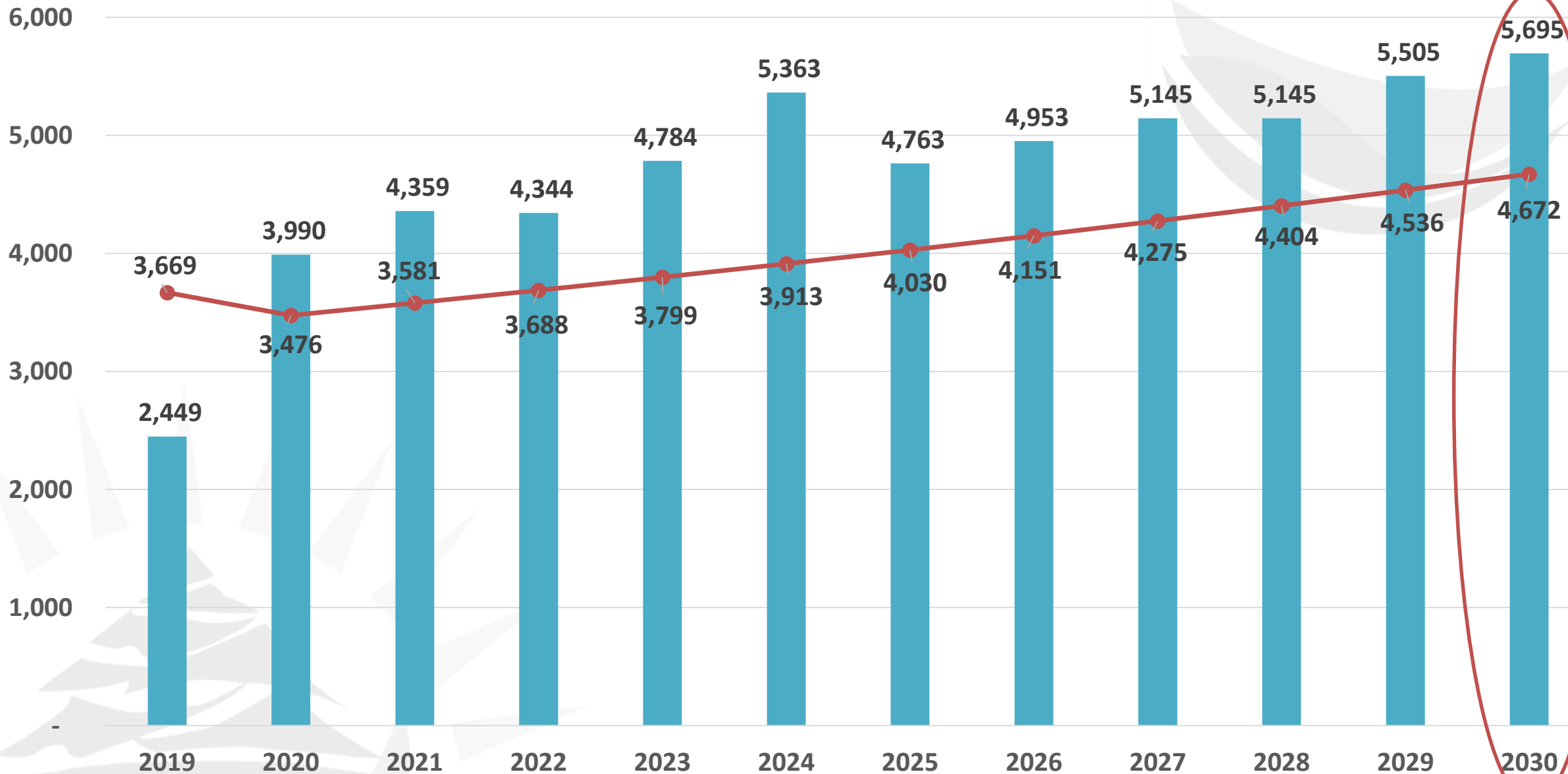


As per the IRENA Renewable Energy Outlook - Draft REmap Chapter – presented in the IRENA Validation Workshop, Beirut on 8 May 2019



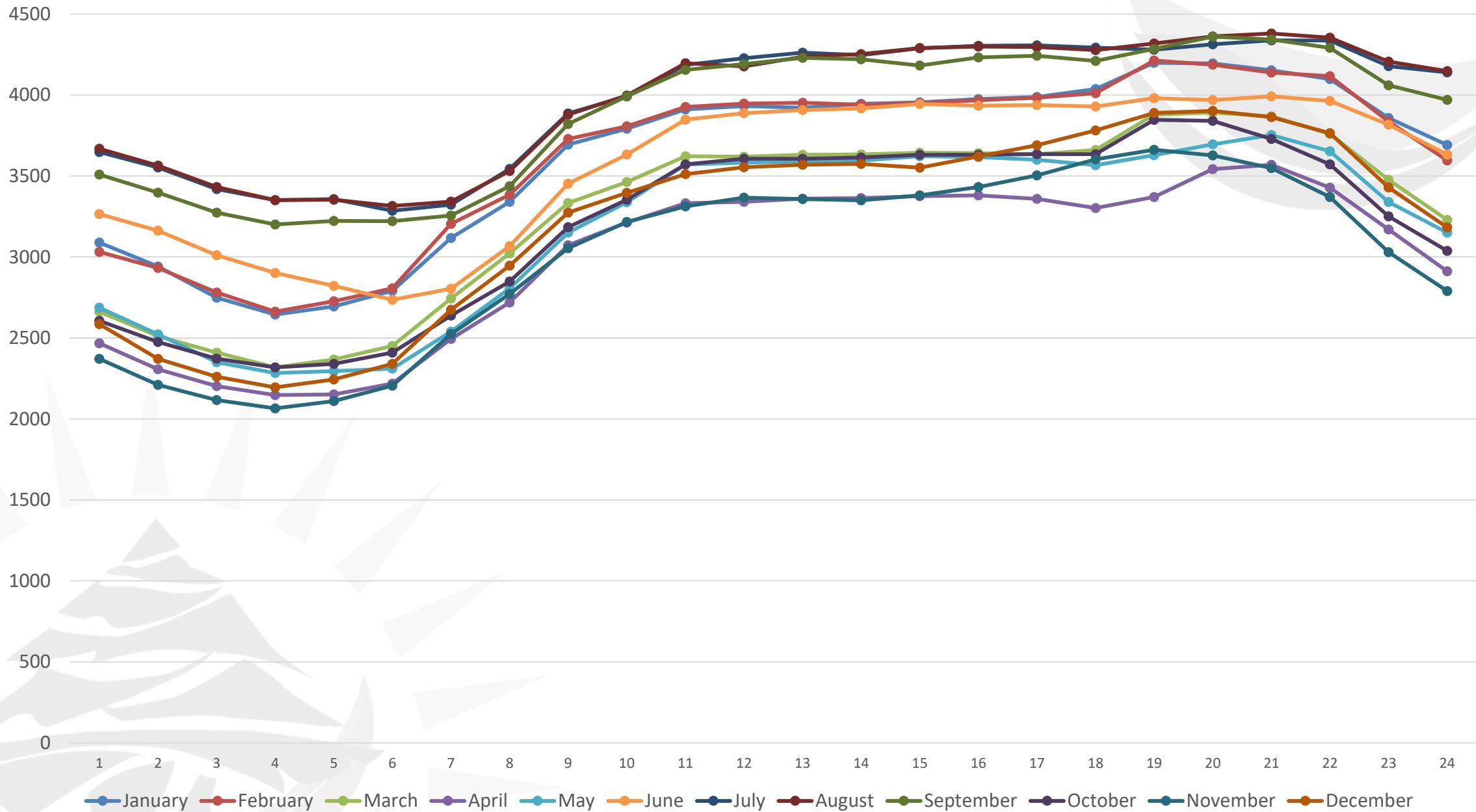
5. The Potential For Storage?

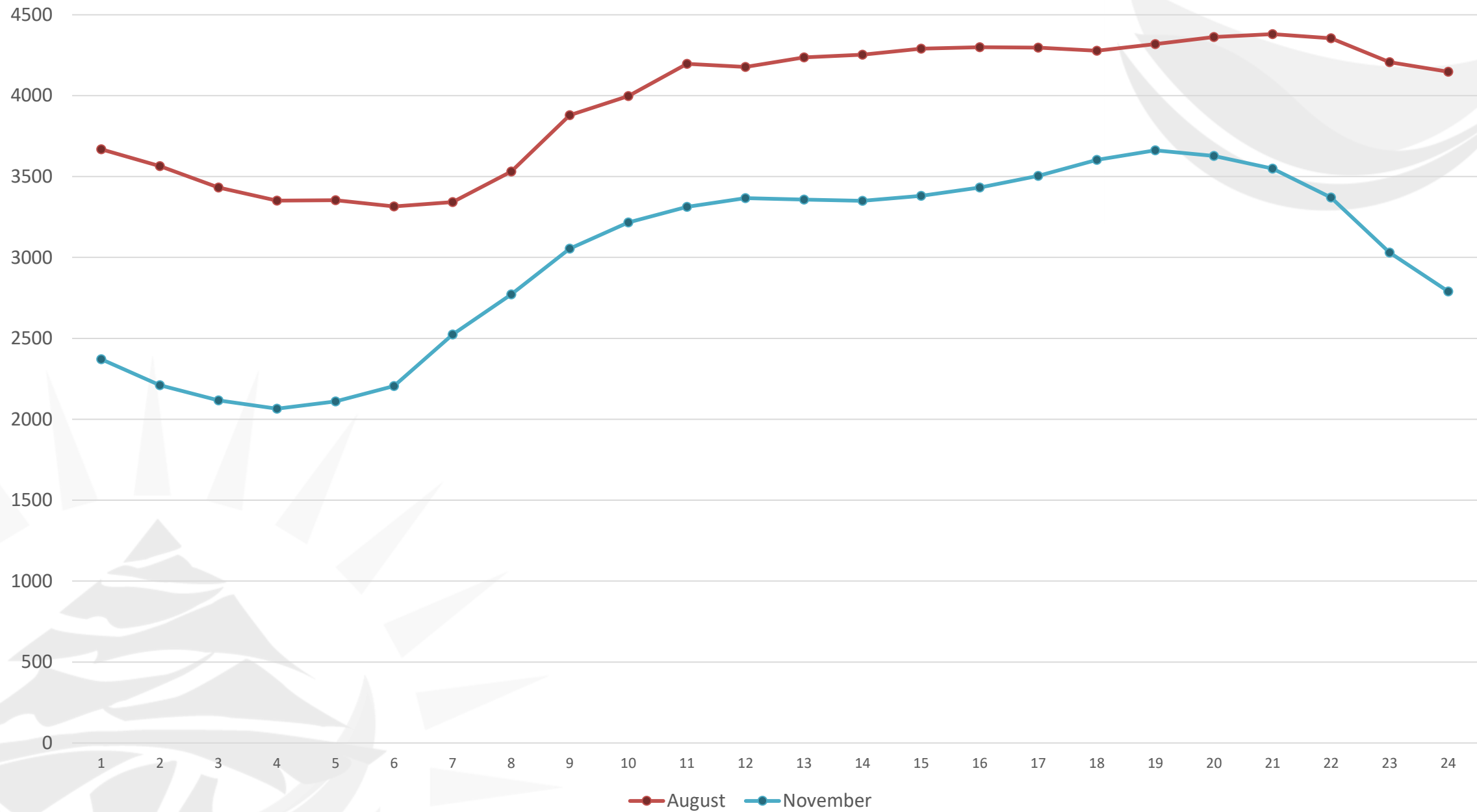


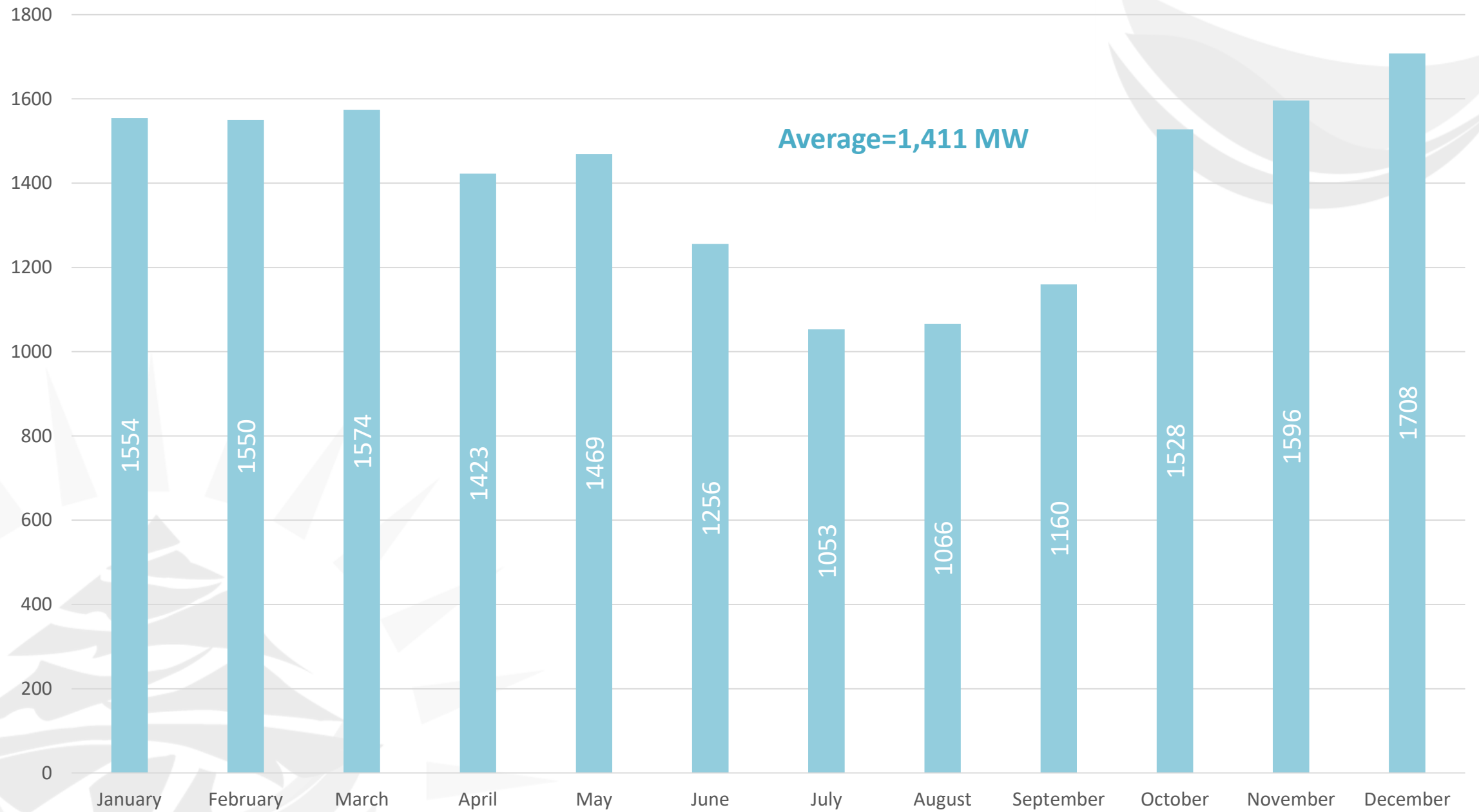


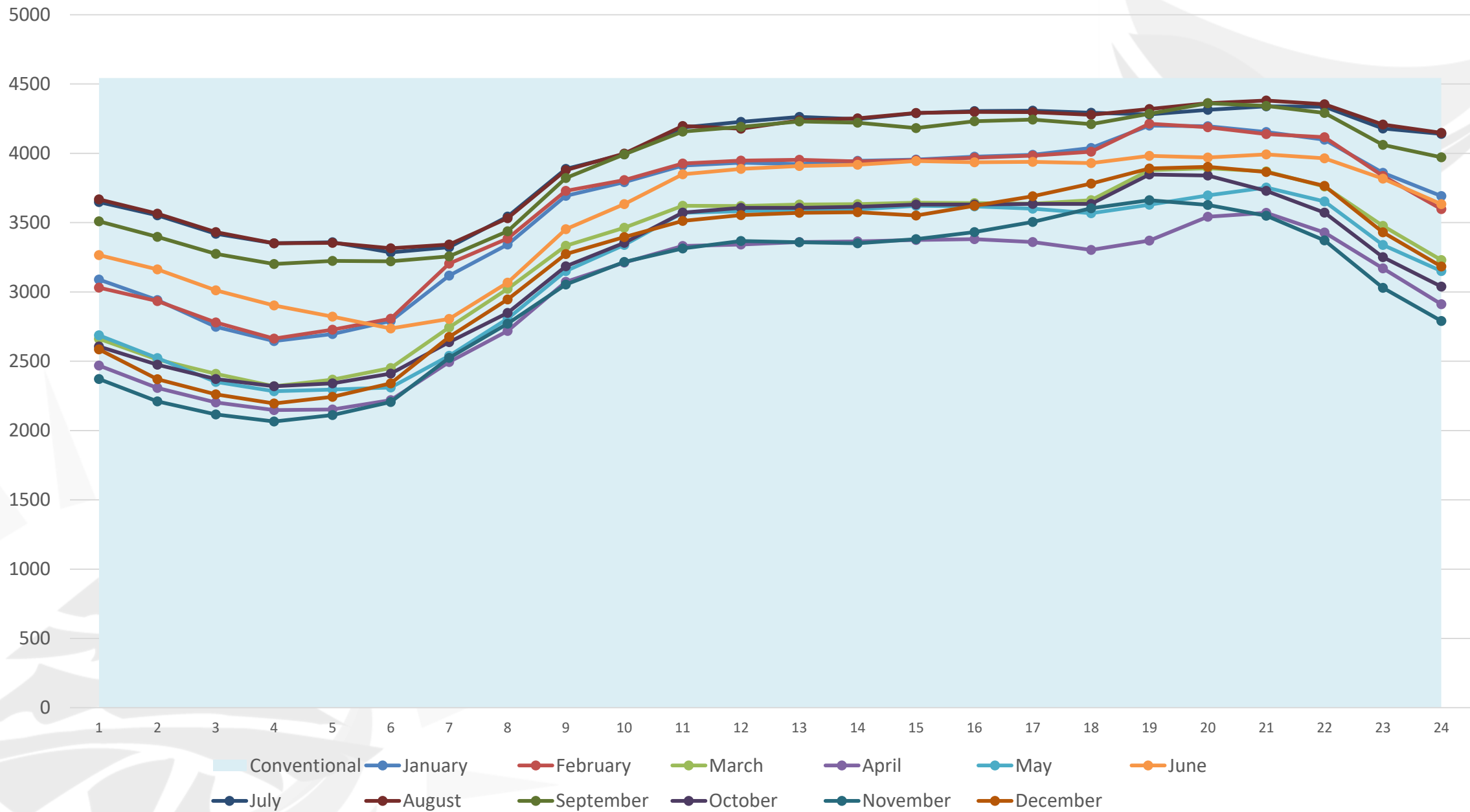
■ Total Installed Capacity (MW)
 ● Peak Demand (MW)

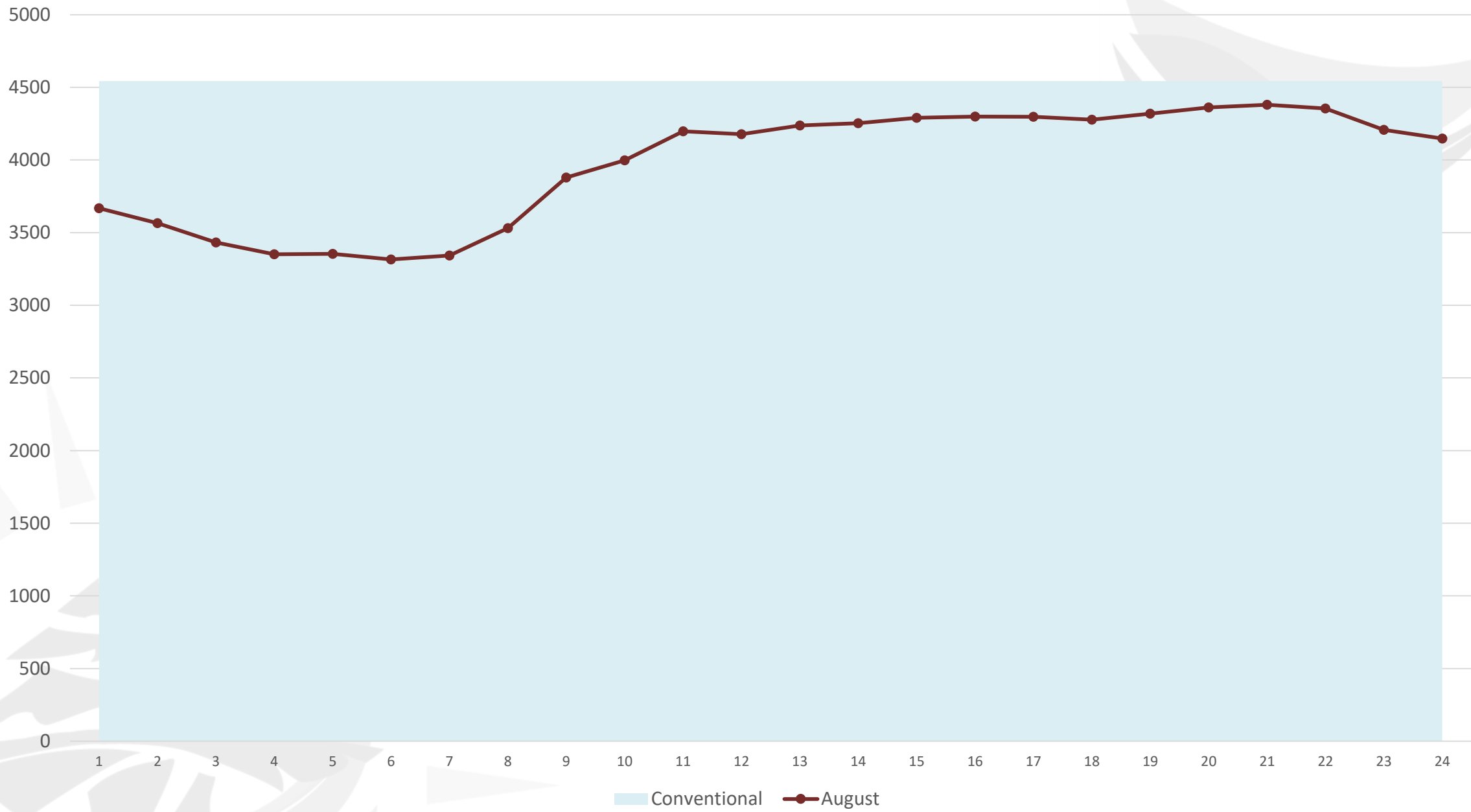
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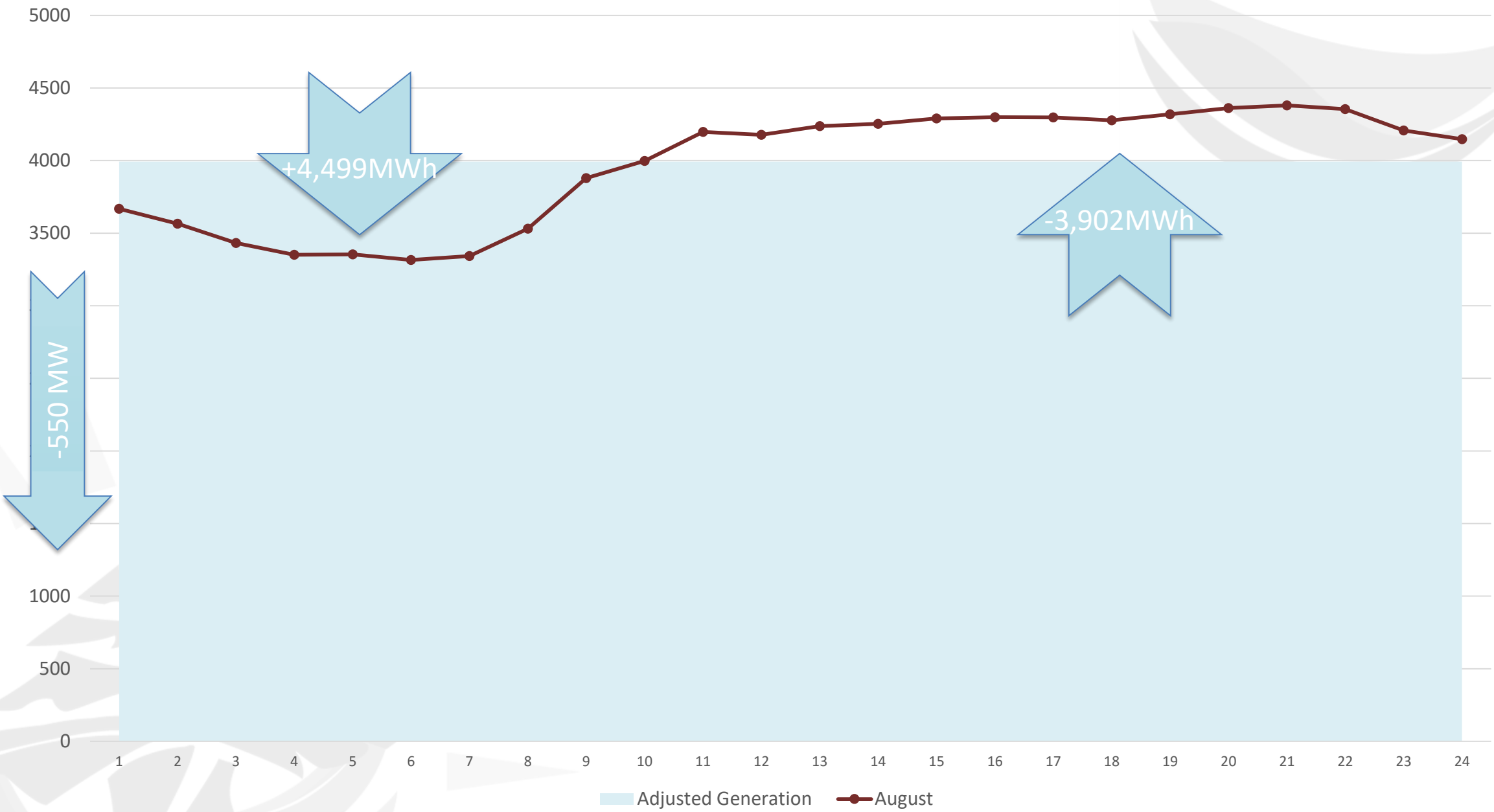






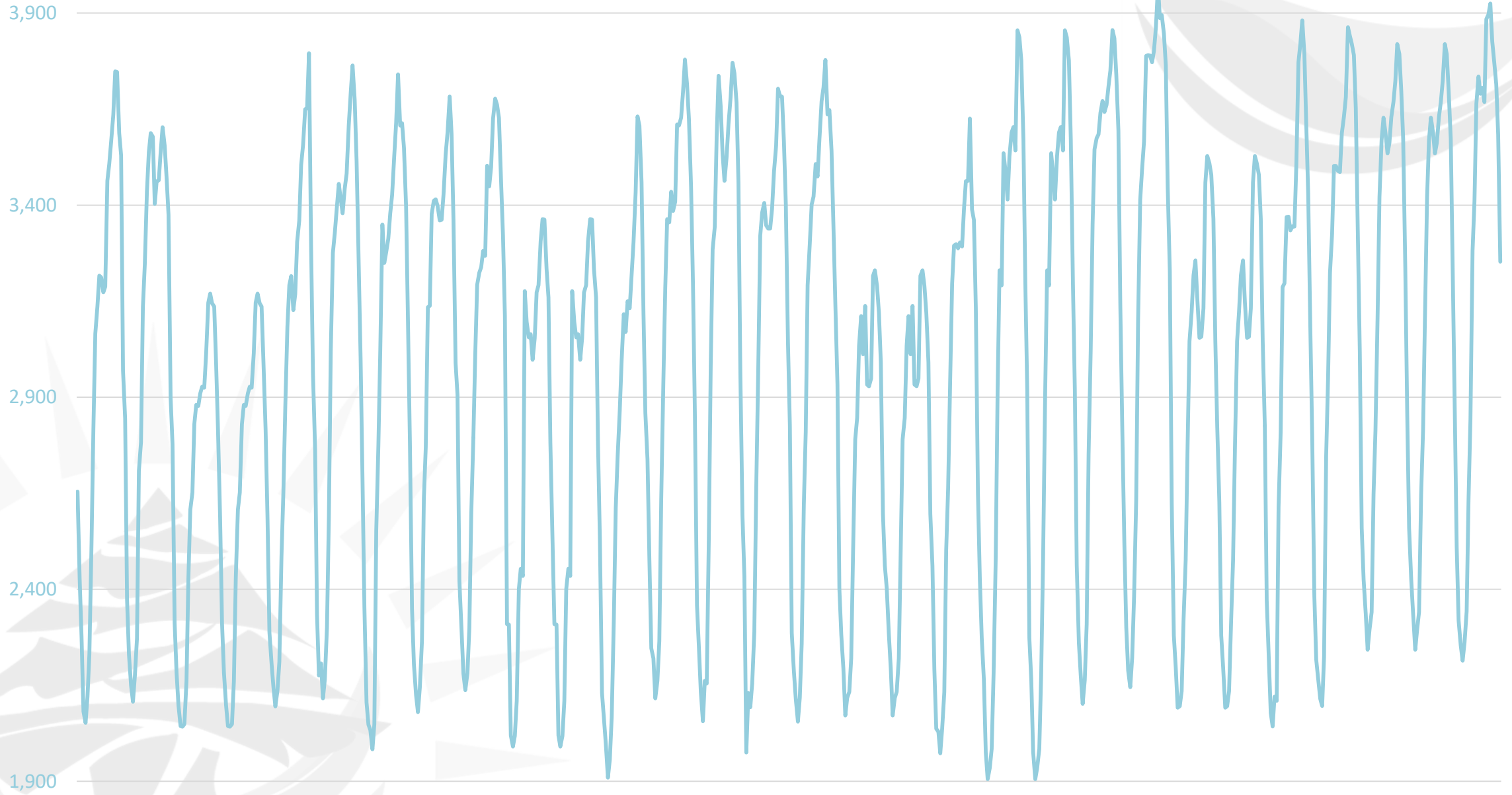




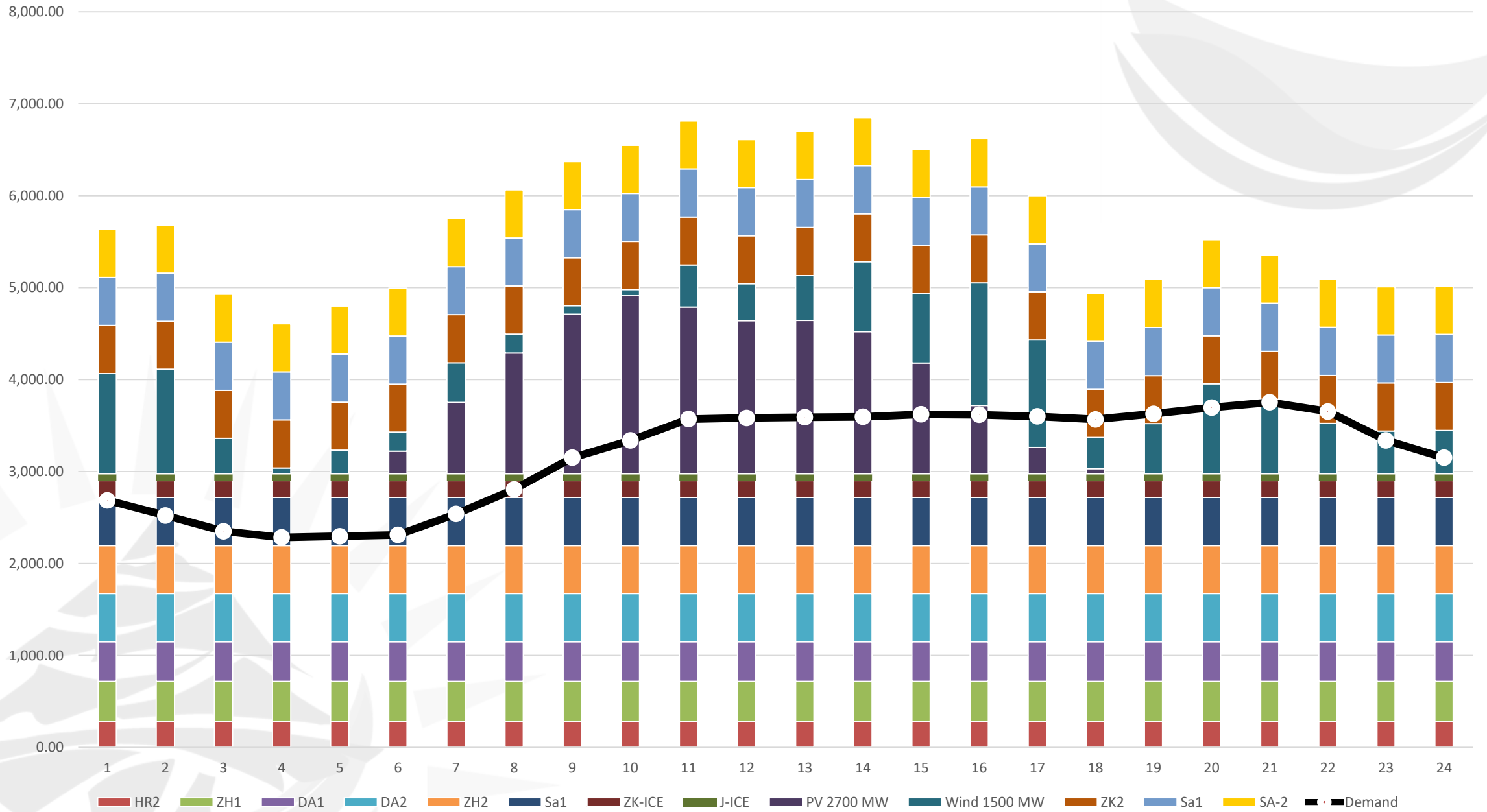


Adjusted Generation August

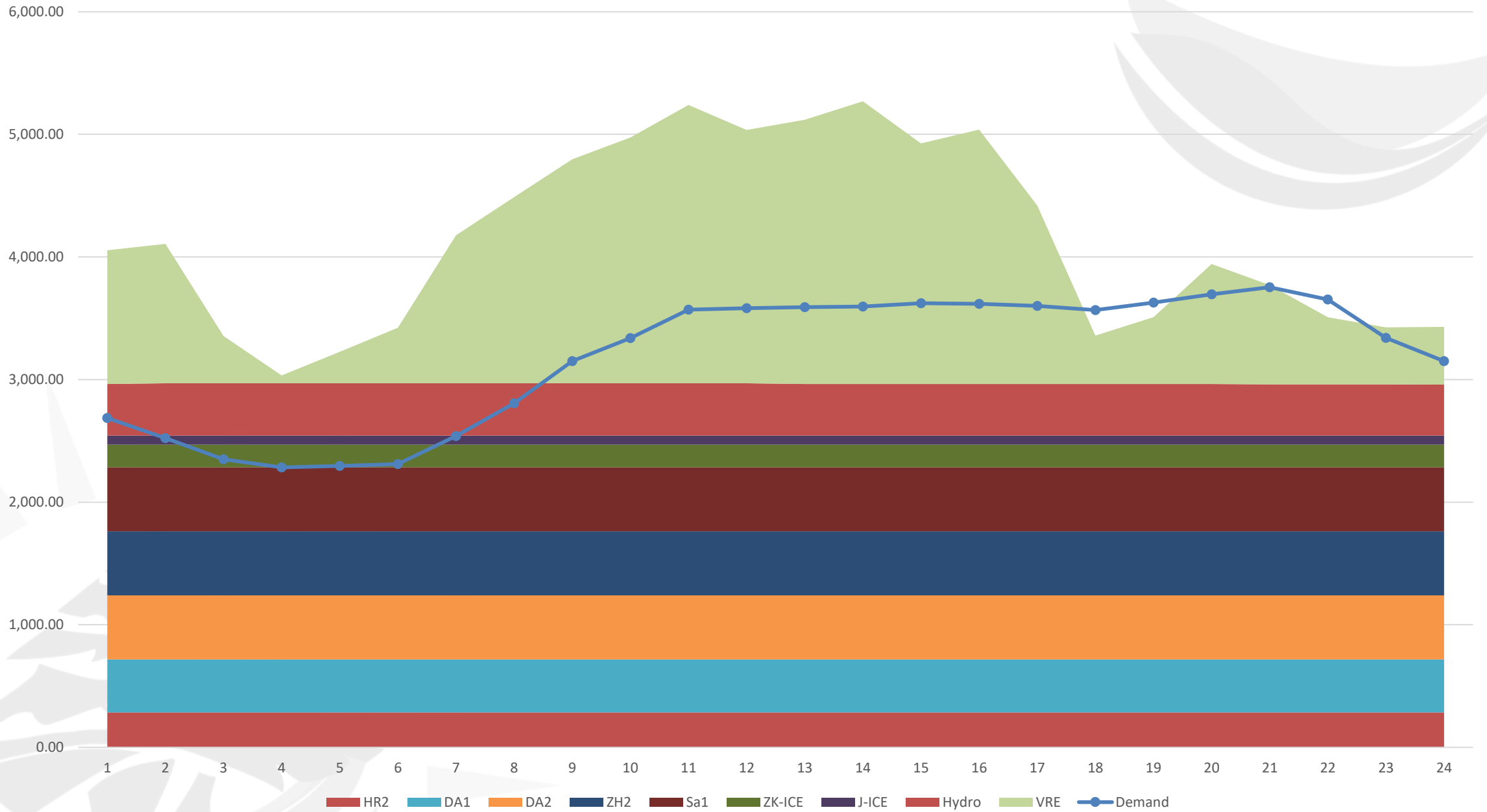
NOVEMBER 2030



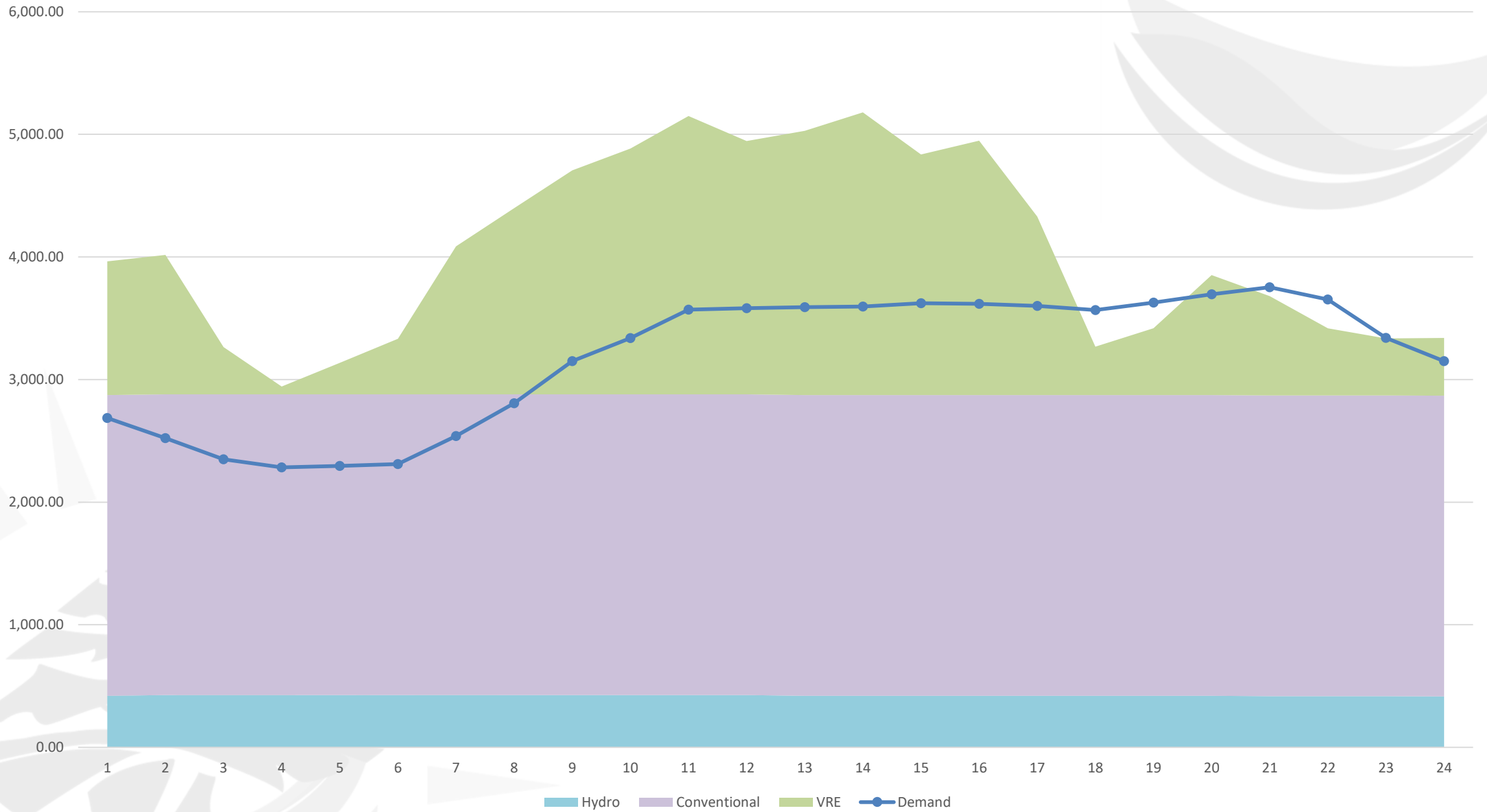
MAY 2030



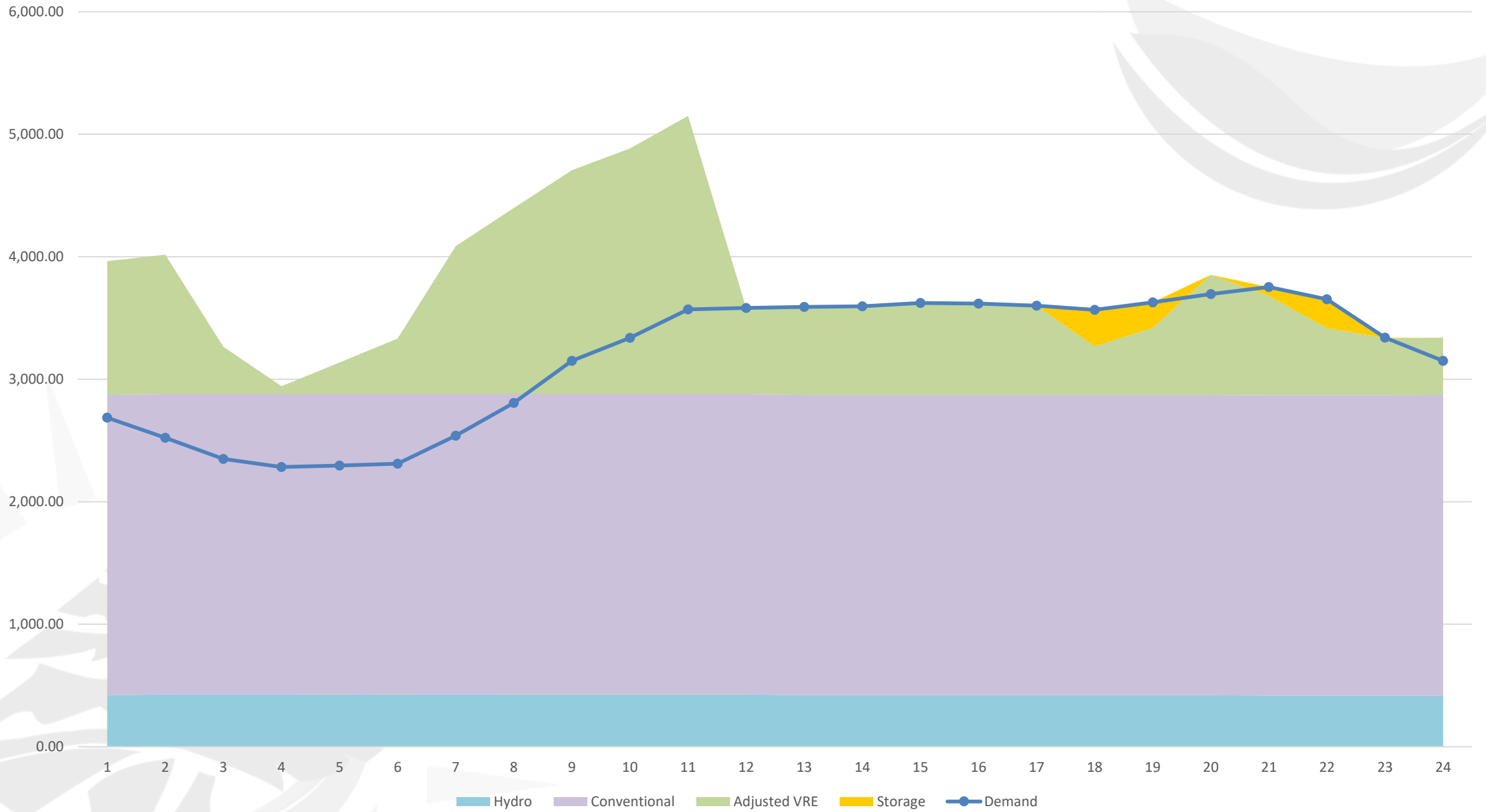
MAY 2030



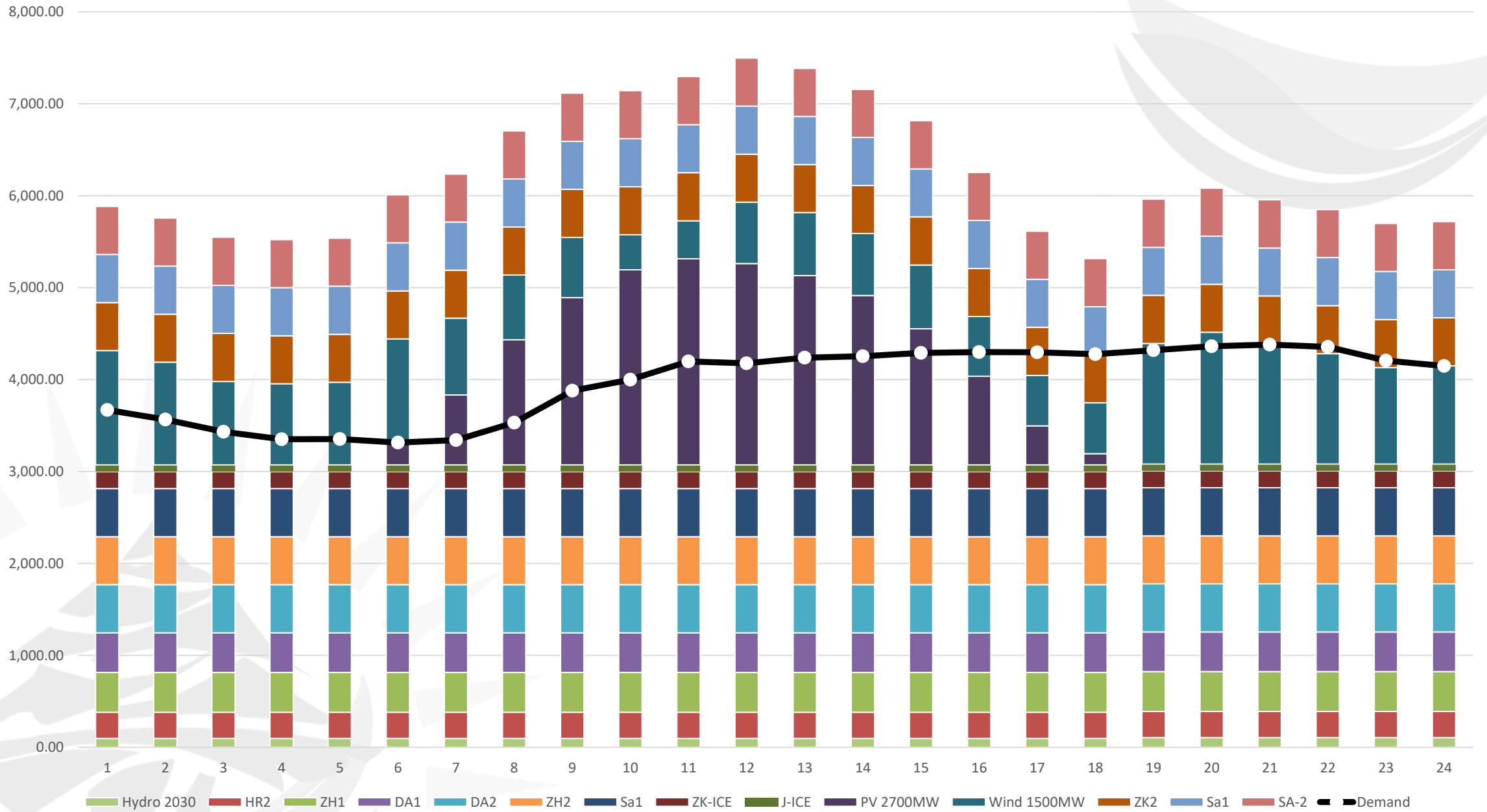
MAY 2030



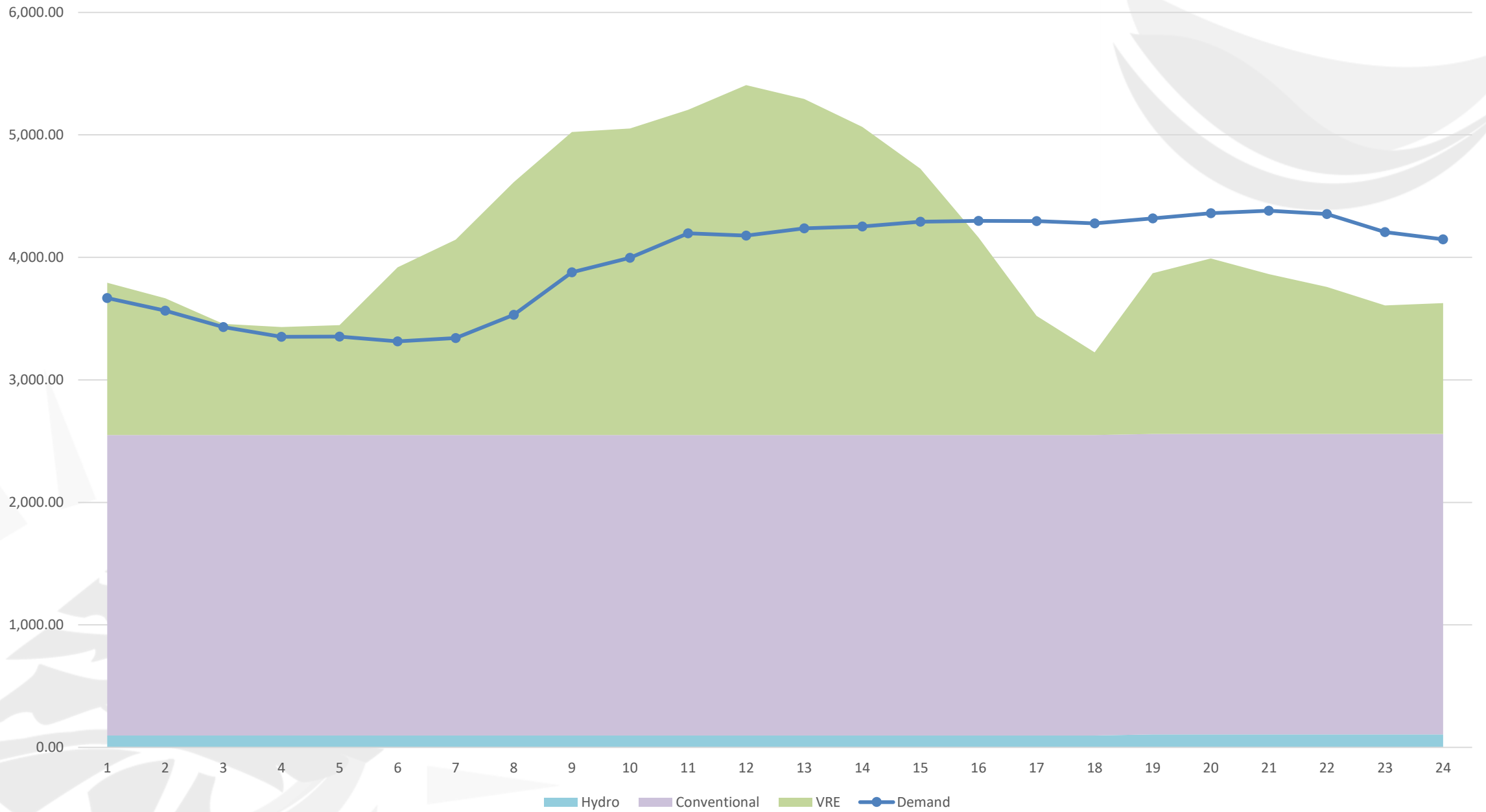
MAY 2030



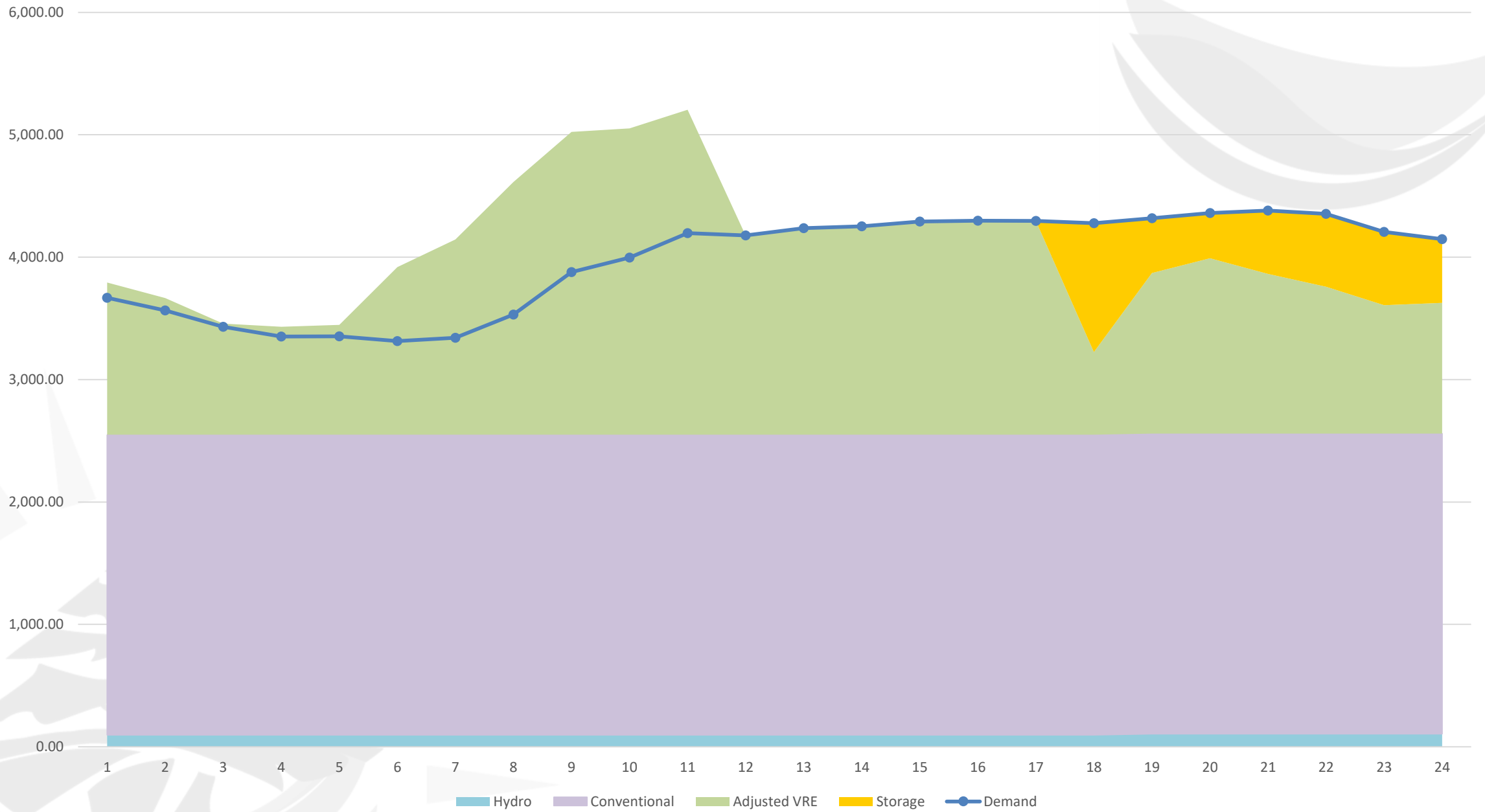
August 2030



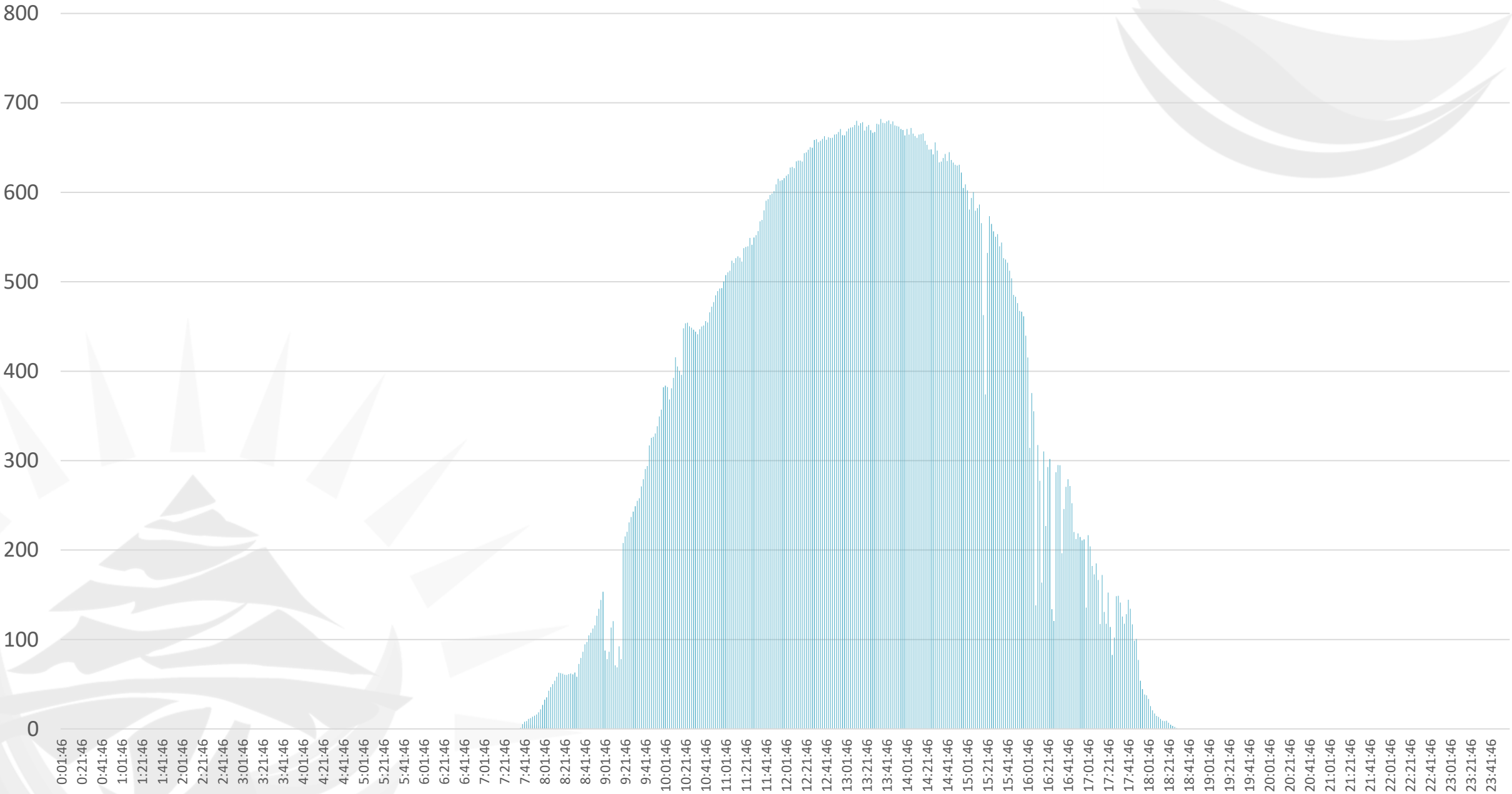
August 2030



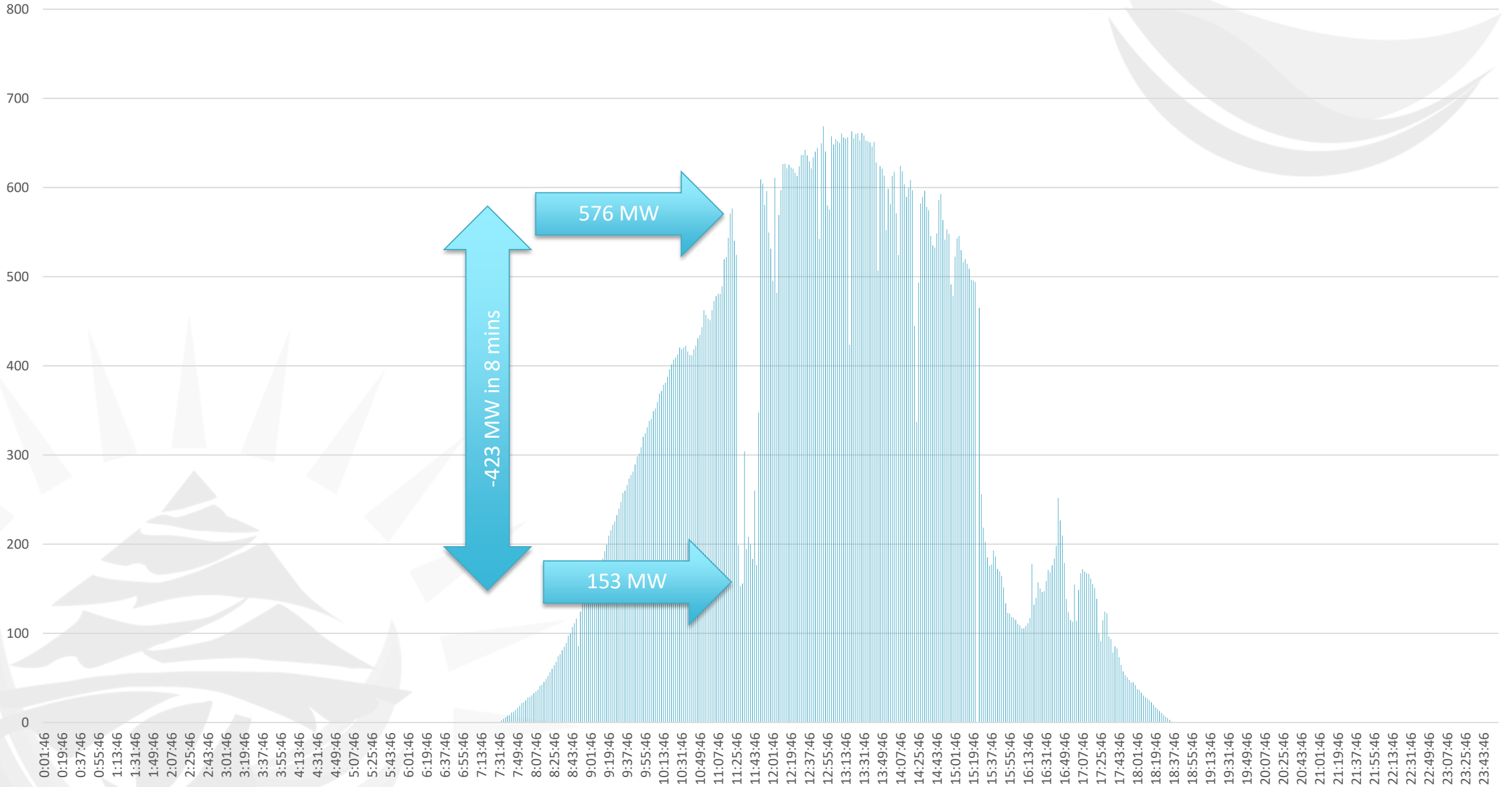
August 2030



24/02/2019



23/02/2019



In Conclusion:

There is a big potential for energy storage in Lebanon:

- **For frequency regulation**
- **For load shifting**
- **For PP output regulation**

It has a very positive impact stabilizing VRE

But also it can help the needed investment for new PP





Stay tuned!



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Thank You!

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