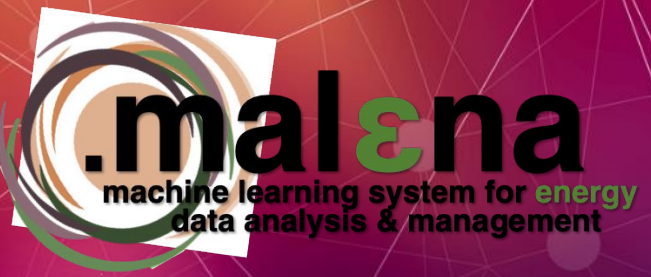
Innovating with AI: From the Lab to Industry

Grigorios Tsoumakas



This project has received funding under:

Ευρωπαϊκή Ένωση
Ευρωπαϊκό Ταμείο Περιφερειακής Ανάπτυξης

ΕΠΑνΕΚ 2014-2020
ΕΠΙΧΕΙΡΗΣΙΑΚΟ ΠΡΟΓΡΑΜΜΑ
ΑΝΤΑΓΩΝΙΣΤΙΚΟΤΗΤΑ
ΕΠΙΧΕΙΡΗΜΑΤΙΚΟΤΗΤΑ
ΚΑΙΝΟΤΟΜΙΑ

ΕΣΠΑ
2014-2020
ανάπτυξη - εργασία - αλληλεγγύη

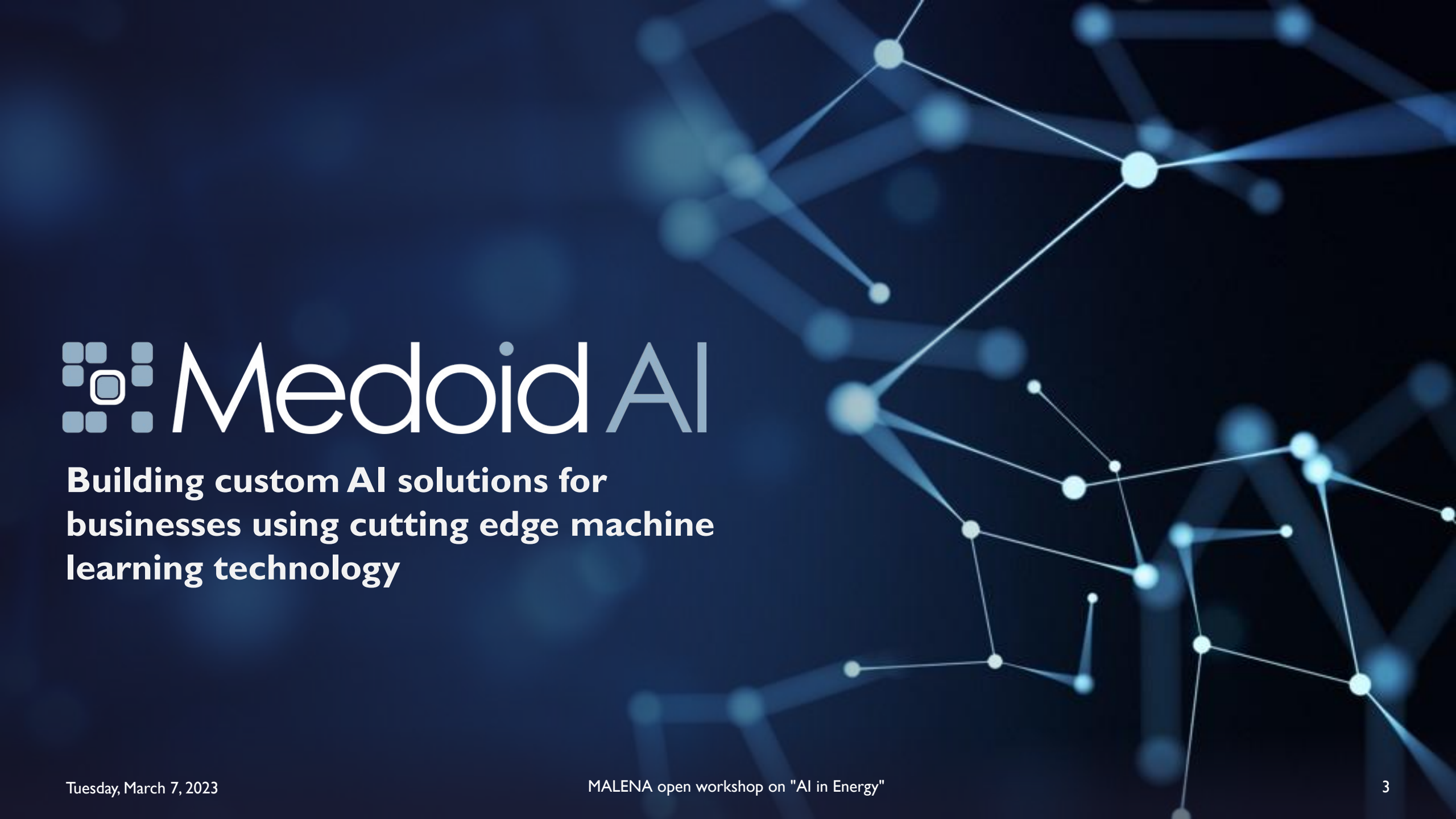
Medoid AI

Agenda

Medoid AI

AI in Energy: Development

AI in Energy: Research



Building custom AI solutions for businesses using cutting edge machine learning technology

Medoid AI

An AI research team transformed to an award-winning machine learning agency building **custom Artificial Intelligence (AI) solutions,** tailored to organizations' unique challenges.

Our clients enjoy optimized business processes, reduced costs, improved customer engagement, and significant revenue gains.

Our work has been recognized on several occasions, from winning the 2021 Patient-centric technologies challenge of Pfizer to one of our text summarization models having more downloads than its Google and Facebook counterparts!

ARISTOTLE UNIVERSITY OF THESSALONIKI

Pfizer · Atypon · ΜΑΣΟΥΤΗΣ · DIGITAL COMMERCE INTELLIGENCE · ABU DHABI PORTS · BETANO · STOIXIMAN · Quantos · evAI

HUGGING FACE · Pfizer · Media Motor Europe · web summit

Services and Solutions

*"I can highly recommend working with Medoid AI. They had **outperformed our expectations** and always delivered in time and budget, serving us with their high quality of work"*

*"**less than 6% error** rate to half of product categories leading to **reduced inventory levels** within 6 months"*

Intelligent Planning

- Demand Forecasting
- Adaptive Planning & Scheduling

Fraud Detection

- Behavioral Patterns detection
- Anti-money Laundering
- Account take over detection (ATO)

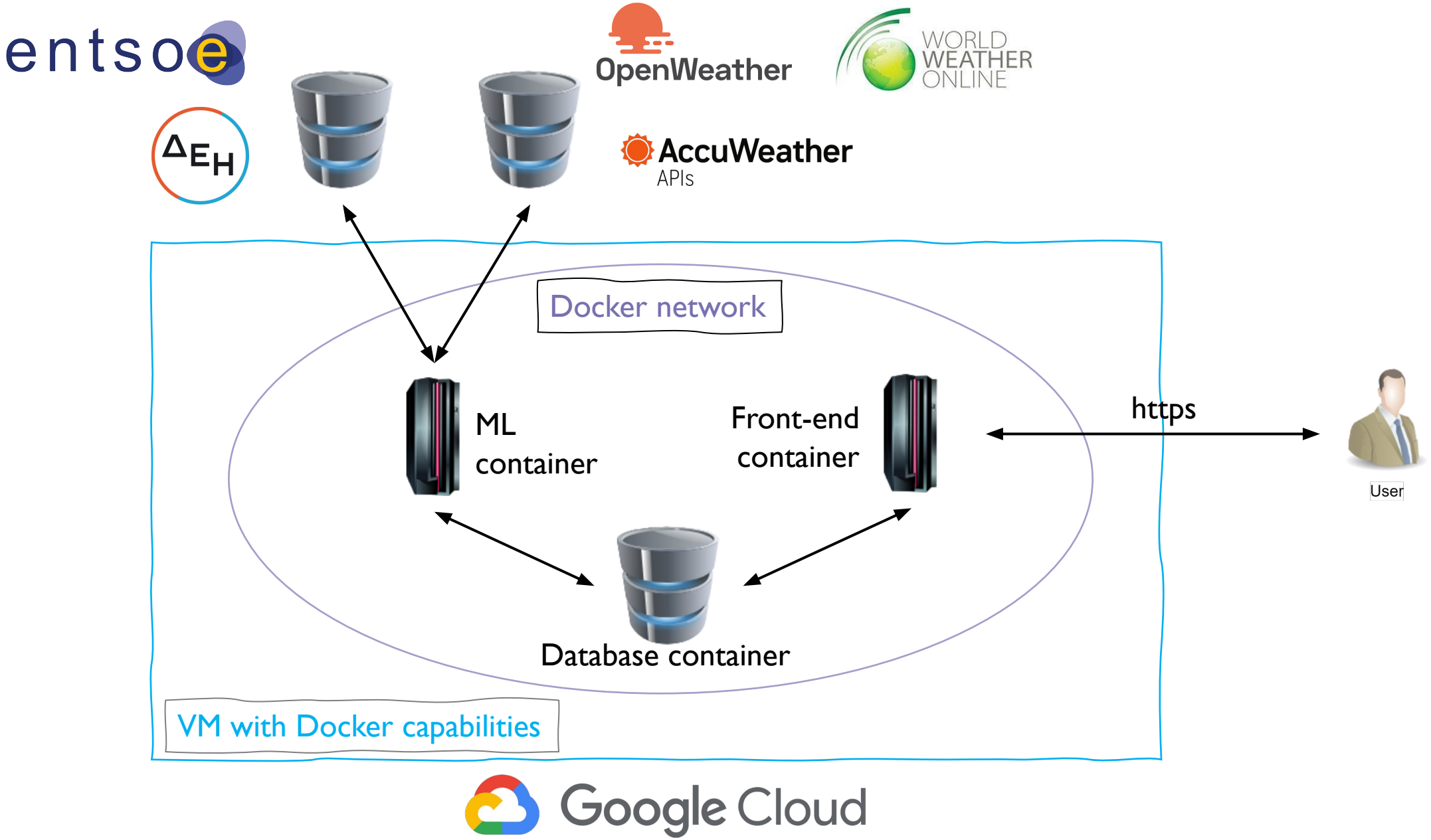
*"**2x faster detection** of ATOs for early account suspension, leading to thousands of Euros gains per fraudulent transaction"*

*"**Phenomenal** job!"*
*"It identifies **unknown entities in the text with a 95% precision** – it may soon replace the domain expert!"*

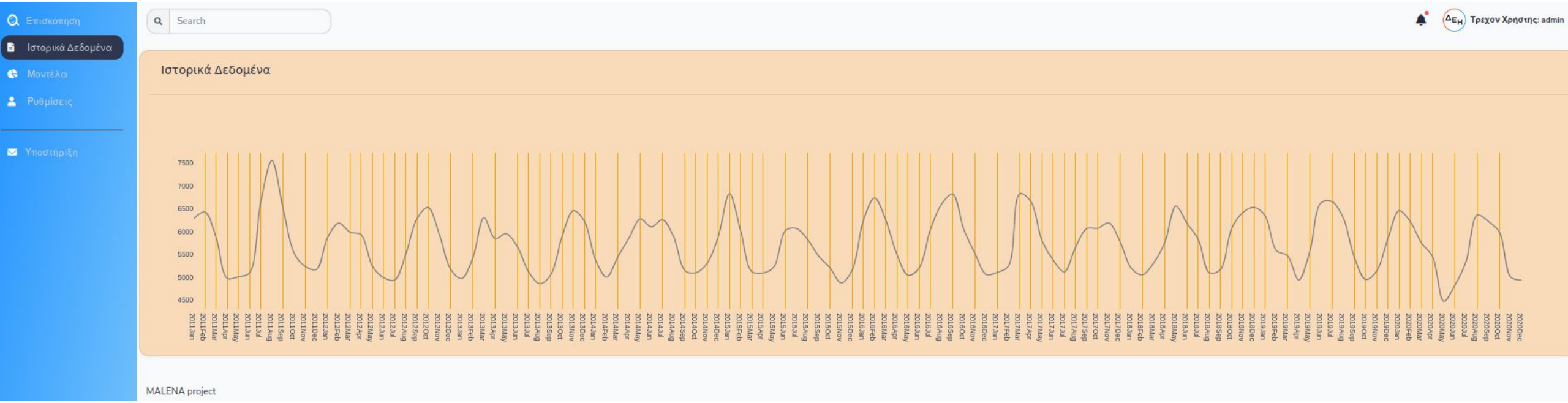
Document Intelligence

- Entity Recognition
- Semantic Indexing
- Automated Summarization
- Generative Chatbots

AI in Energy: Development


entsoe
OpenWeather
WORLD WEATHER ONLINE
AccuWeather APIs
Docker network
ML container
Front-end container
https
User
Database container
VM with Docker capabilities
Google Cloud


Επισκόπηση
Ιστορικά Δεδομένα
Μοντέλα
Ρυθμίσεις
Υποστήριξη
Search
Τρέχον Χρήστης: admin
Ιστορικά δεδομένα
Μήνας
Προβλέψεις κατανάλωσης
Εβδομάδα
Προβλέψεις vs Πραγματικές Τιμές
Μήνας
προβλέψεις
πραγματικές ιστορικές τιμές
MALENA project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Ιστορικά Δεδομένα
Μοντέλα
Ρυθμίσεις
Υποστήριξη
Search
Τρέχον Χρήστης: admin
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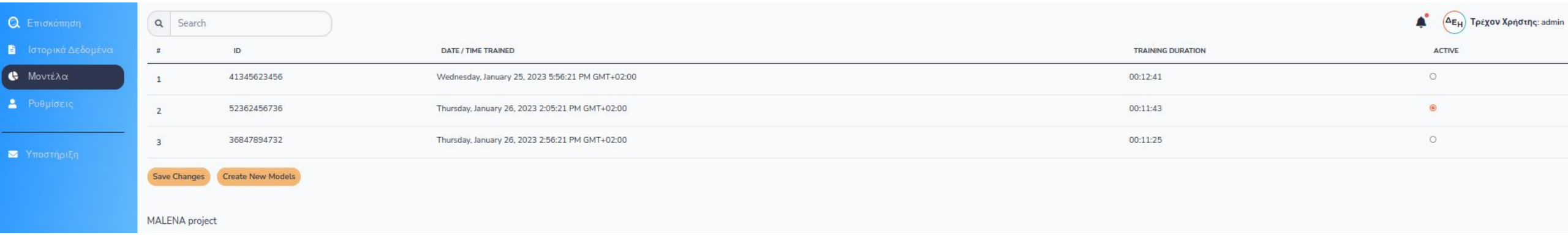
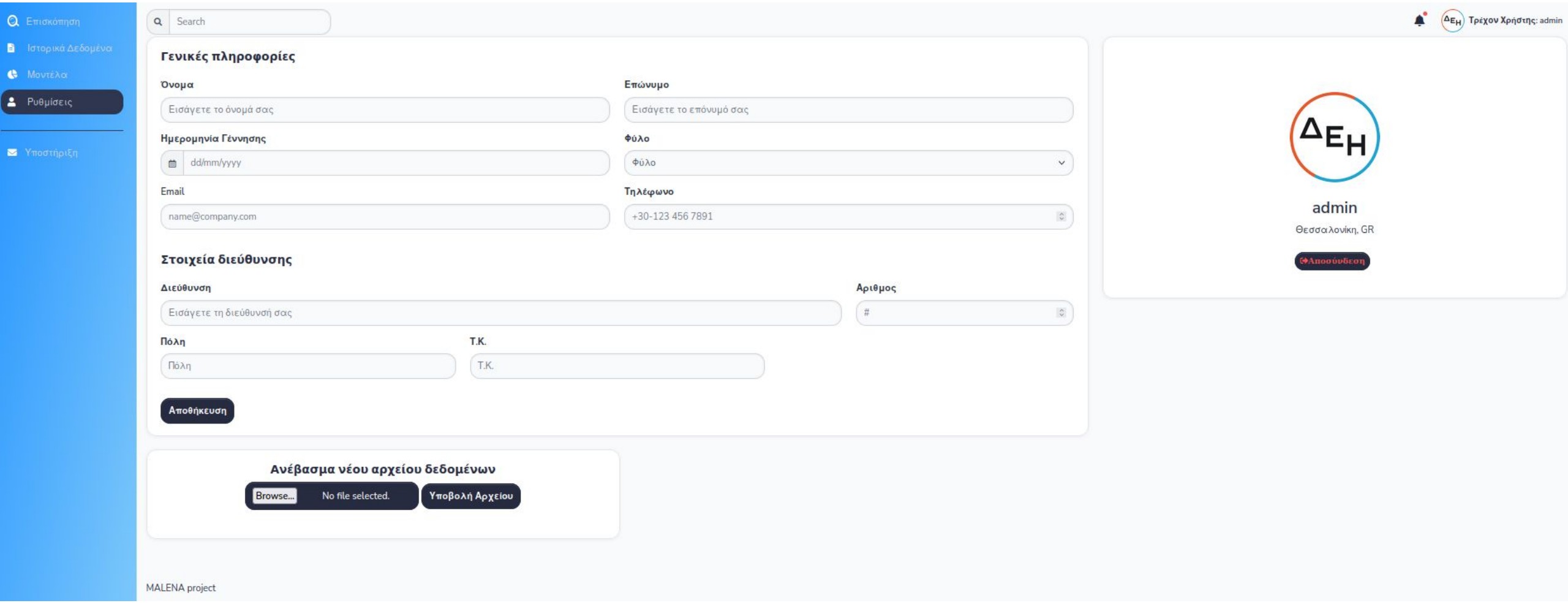
7000
6500
6000
5500
5000
4500
MALENA project


Επισκόπηση
Ιστορικά Δεδομένα
Μοντέλα
Ρυθμίσεις
Υποστήριξη
Search
Τρέχον Χρήστης: admin
ID DATE / TIME TRAINED TRAINING DURATION ACTIVE
1 41345623456 Wednesday, January 25, 2023 5:56:21 PM GMT+02:00 00:12:41
2 52362456736 Thursday, January 26, 2023 2:05:21 PM GMT+02:00 00:11:43
3 36847894732 Thursday, January 26, 2023 2:56:21 PM GMT+02:00 00:11:25
Save Changes
Create New Models
MALENA project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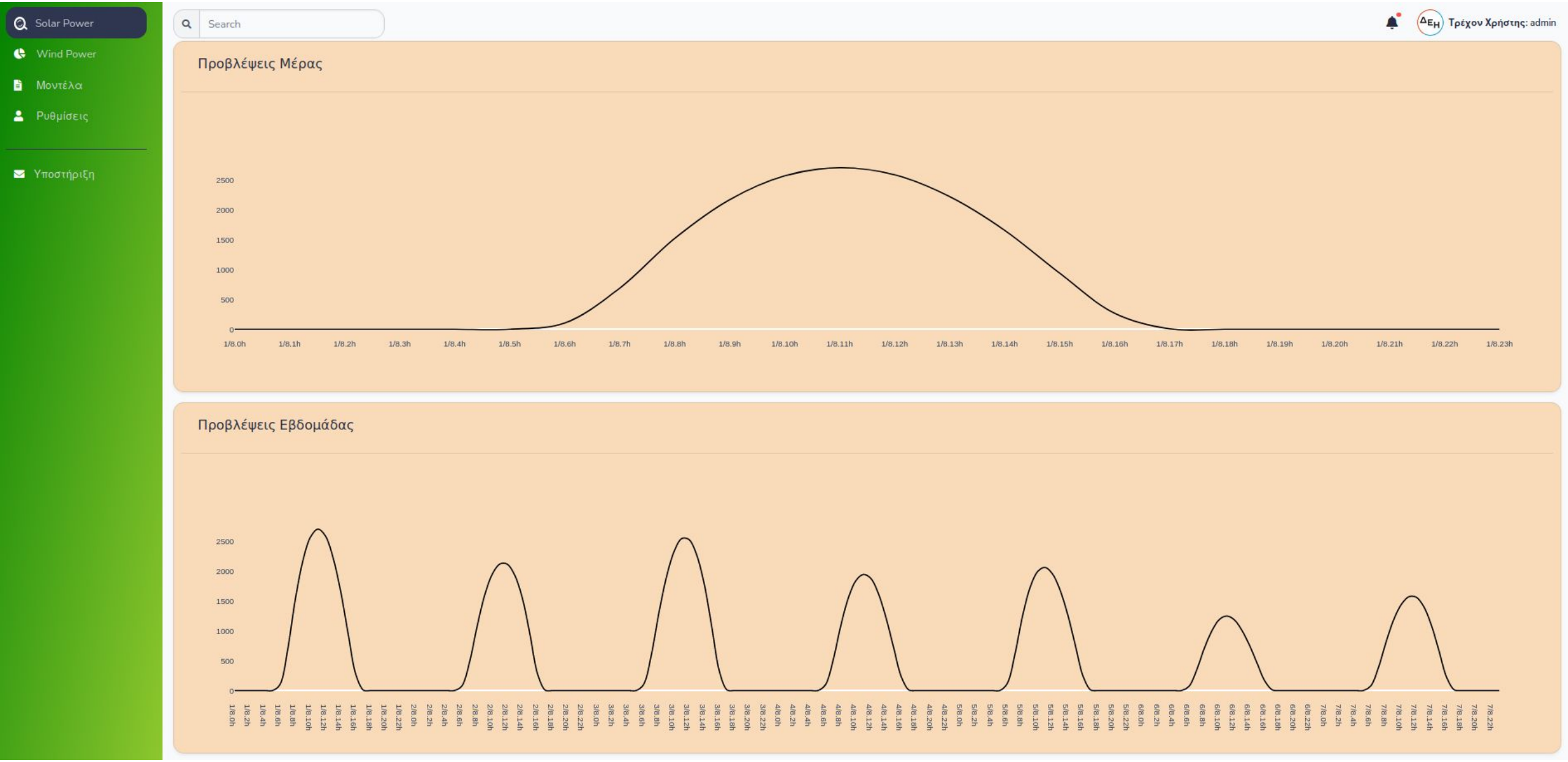
Ιστορικά Δεδομένα
Μοντέλα
Ρυθμίσεις
Υποστήριξη
Search
Τρέχον Χρήστης: admin
Γενικές πληροφορίες
Όνομα
Εισάγετε το όνομά σας
Επώνυμο
Εισάγετε το επώνυμό σας
Ημερομηνία Γέννησης
dd/mm/yyyy
Φύλο
Φύλο
Email
name@company.com
Τηλέφωνο
+30-123 456 7891
Στοιχεία διεύθυνσης
Διεύθυνση
Εισάγετε τη διεύθυνσή σας
Αριθμος
#
Πόλη
Πόλη
Τ.Κ.
Τ.Κ.
Αποθήκευση
admin
Θεσσαλονίκη, GR
Αποσύνδεση
Ανέβασμα νέου αρχείου δεδομένων
Browse...
No file selected.
Υποβολή Αρχείου
MALENA project


Solar Power
Wind Power
Μοντέλα
Ρυθμίσεις
Υποστήριξη
Search
Τρέχον Χρήστης: admin
Προβλέψεις Μέρας
2500
2000
1500
1000
500
0
1/8.0h
1/8.1h
1/8.2h
1/8.3h
1/8.4h
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1/8.6h
1/8.7h
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1/8.9h
1/8.10h
1/8.11h
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1/8.14h
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1/8.17h
1/8.18h
1/8.19h
1/8.20h
1/8.21h
1/8.22h
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Προβλέψεις Εβδομάδας
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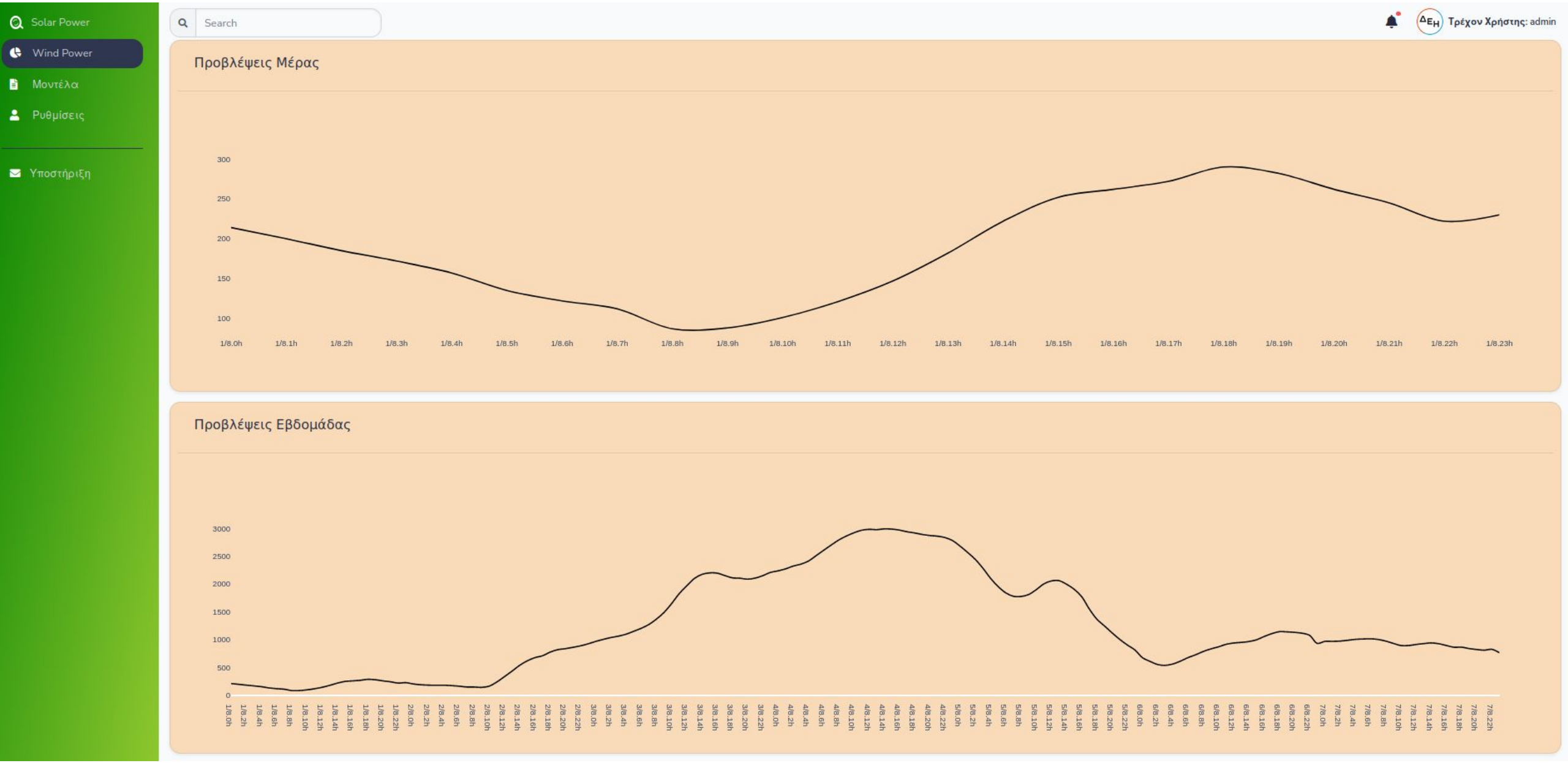
Solar Power
Wind Power
Μοντέλα
Ρυθμίσεις
Υποστήριξη
Search
Τρέχον Χρήστης: admin
Προβλέψεις Μέρας
300
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2500
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1500
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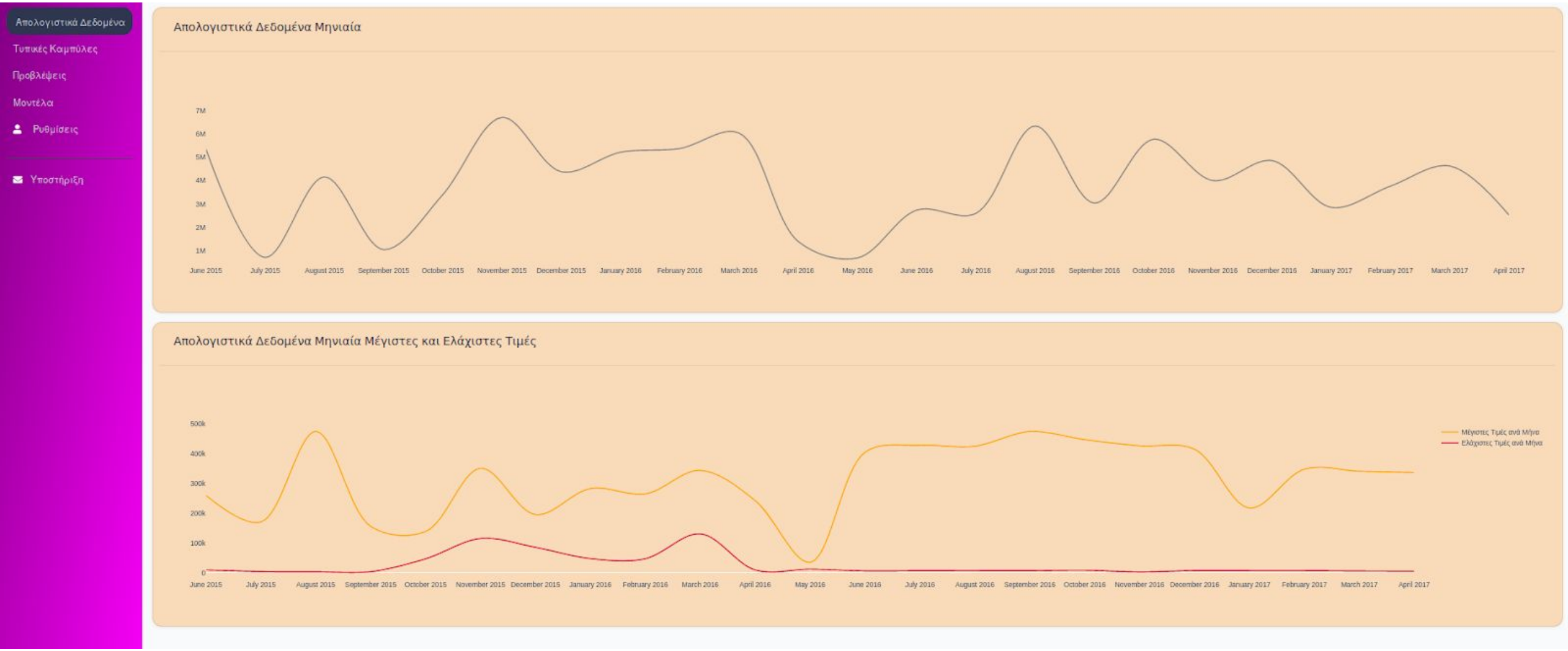
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Τυπικές Καμπύλες
Προβλέψεις
Μοντέλα
Ρυθμίσεις
Υποστήριξη
Απολογιστικά Δεδομένα Μηνιαία
7M
6M
5M
4M
3M
2M
1M
June 2015
July 2015
August 2015
September 2015
October 2015
November 2015
December 2015
January 2016
February 2016
March 2016
April 2016
May 2016
June 2016
July 2016
August 2016
September 2016
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November 2016
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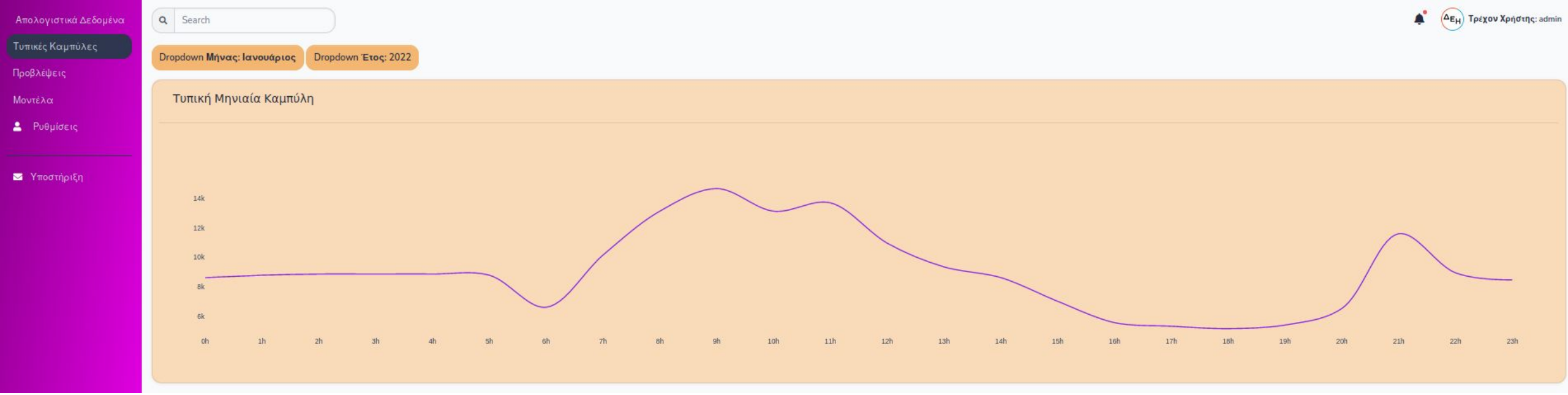
January 2017
February 2017
March 2017
April 2017
Απολογιστικά Δεδομένα Μηνιαία Μέγιστες και Ελάχιστες Τιμές
500k
400k
300k
200k
100k
0
Μέγιστες Τιμές ανά Μήνα
Ελάχιστες Τιμές ανά Μήνα


Απολογιστικά Δεδομένα
Τυπικές Καμπύλες
Προβλέψεις
Μοντέλα
Ρυθμίσεις
Υποστήριξη
Search
Τρέχον Χρήστης: admin
Dropdown Μήνας: Ιανουάριος
Dropdown Έτος: 2022
Τυπική Μηνιαία Καμπύλη
14k
12k
10k
8k
6k
0h
1h
2h
3h
4h
5h
6h
7h
8h
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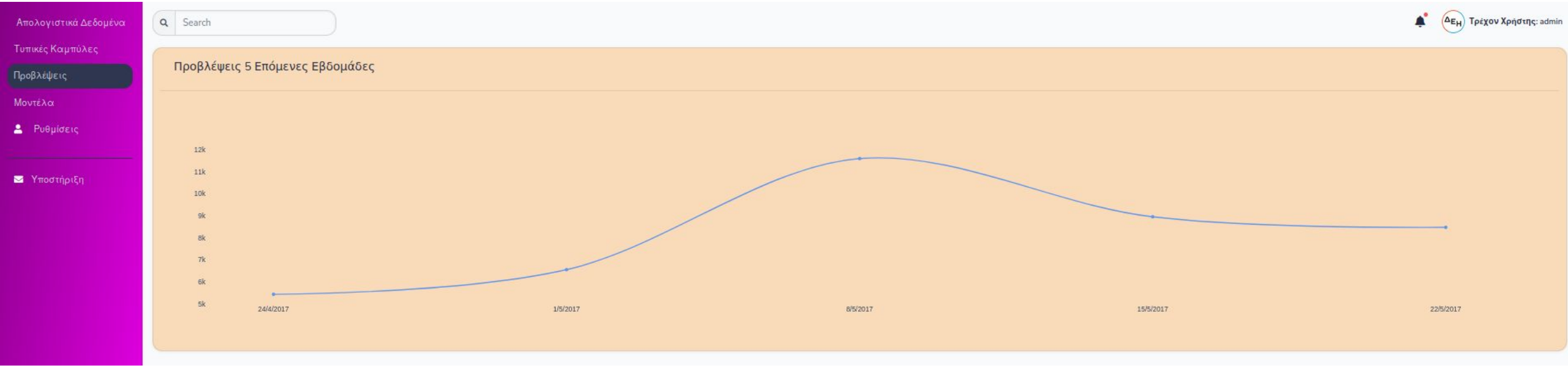
21h
22h
23h


Απολογιστικά Δεδομένα
Τυπικές Καμπύλες
Προβλέψεις
Μοντέλα
Ρυθμίσεις
Υποστήριξη
Search
Τρέχον Χρήστης: admin
Προβλέψεις 5 Επόμενες Εβδομάδες
12k
11k
10k
9k
8k
7k
6k
5k
24/4/2017
1/5/2017
8/5/2017
15/5/2017
22/5/2017

AI in Energy: Research

Energy Forecasting

Vartholomaios, Karlos, Kouloumpris, Tsoumakas (2021), Short-Term **Renewable Energy Forecasting** in Greece Using Prophet Decomposition and Tree-Based Ensembles, In Proc. DEXA 2021 Workshops

Kouloumpris, Konstantinou, Karlos, Tsoumakas, Vlahavas (2022) Short-term **Load Forecasting** With Clustered Hybrid Models Based On Hour Granularity, In Proc. SETN 2022

Data Sources

RES PRODUCTION

entsoe

European Network of Transmission System Operators for Electricity

WEATHER

OpenWeather

stormglass.io

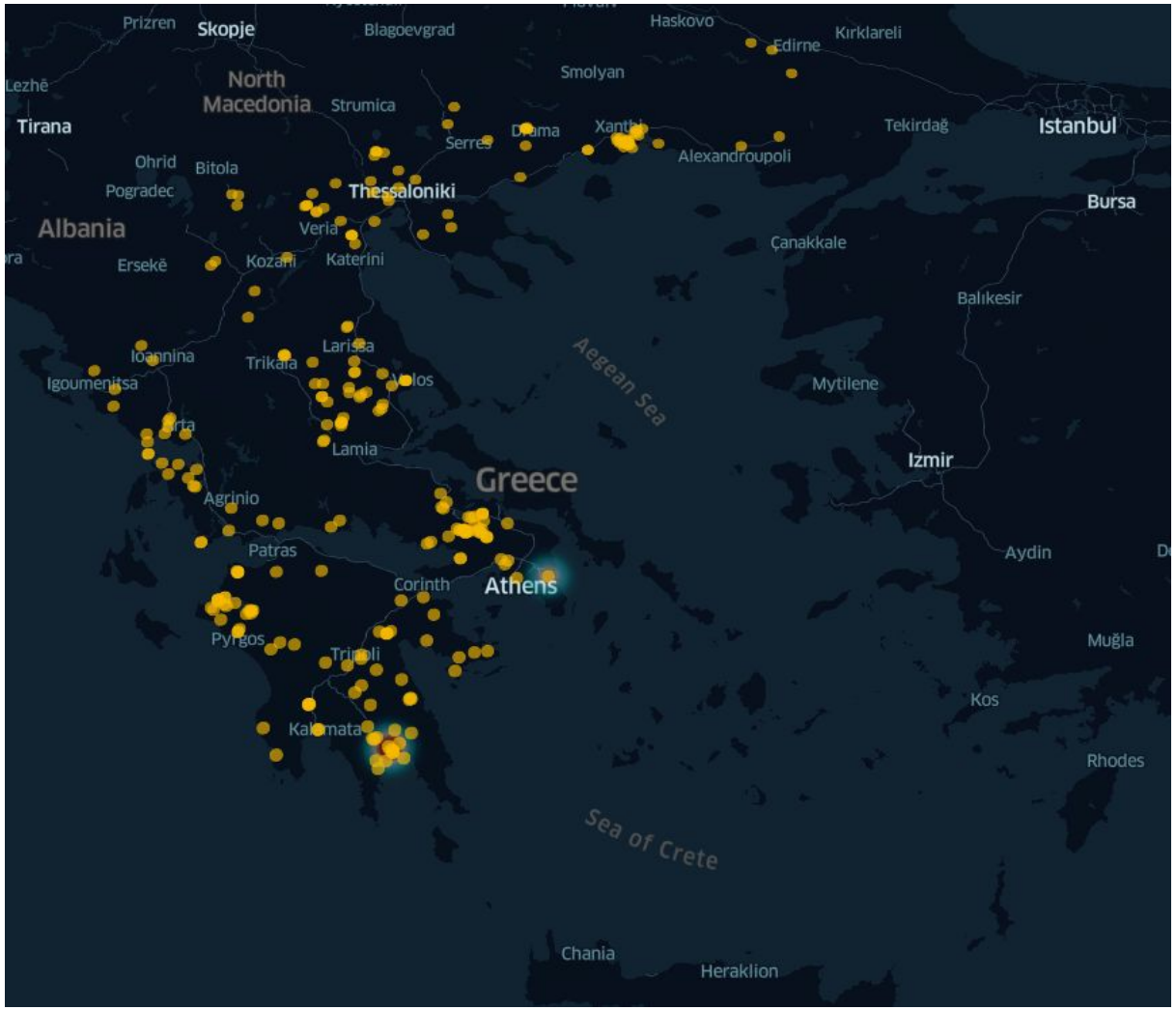
GEOLOCATION & CAPACITY

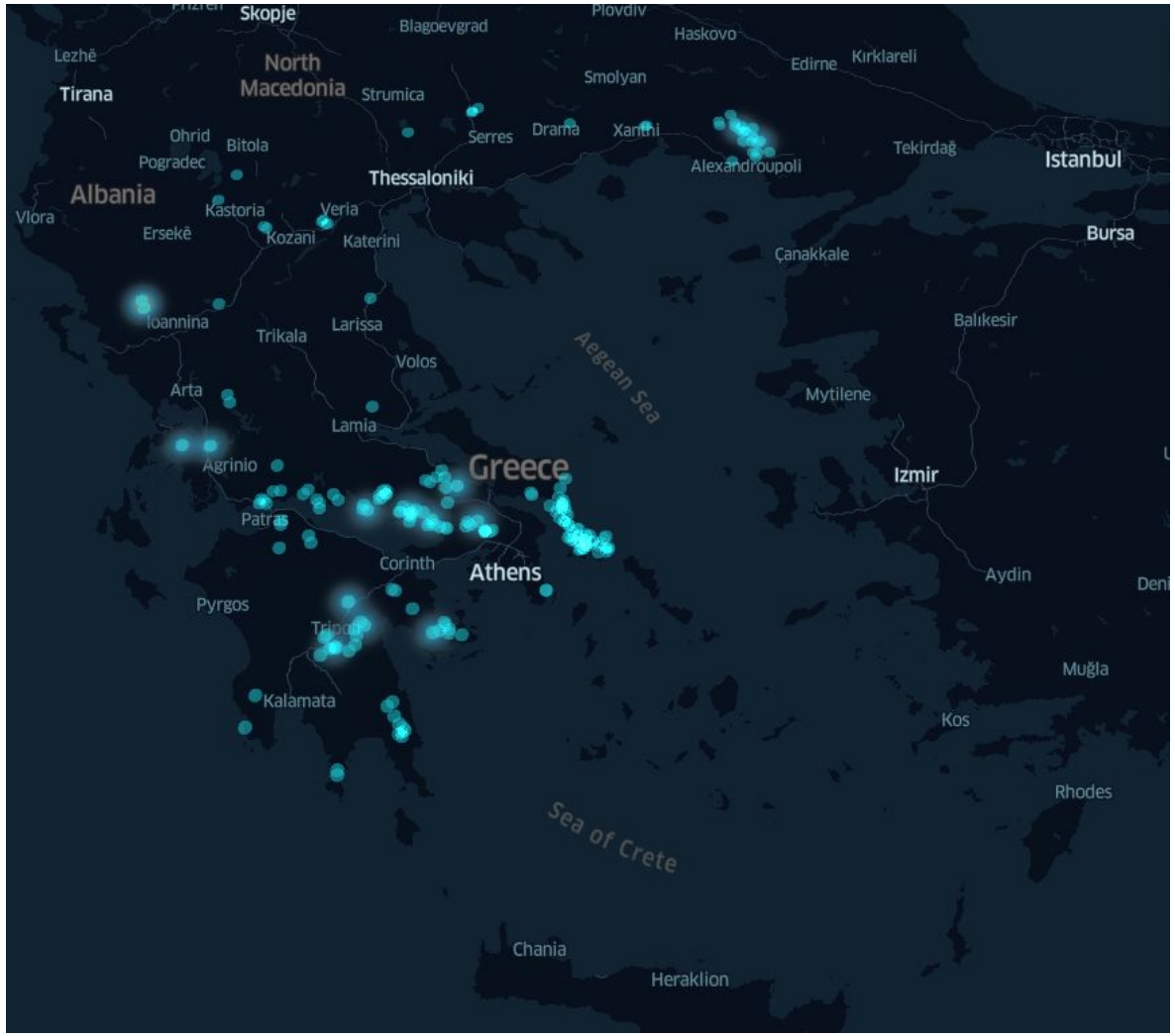
GEODATA.gov.gr

ΡΑΕ RAE

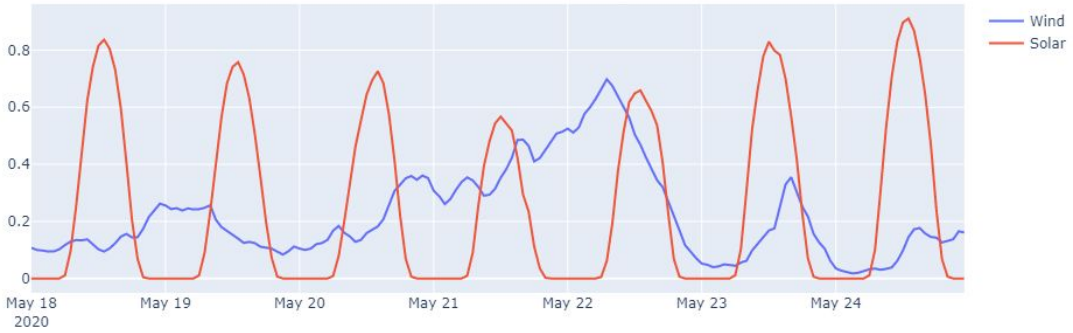
ΡΥΘΜΙΣΤΙΚΗ ΑΡΧΗ ΕΝΕΡΓΕΙΑΣ
REGULATORY AUTHORITY FOR ENERGY

Create a "virtual weather station", aggregating weather data from the regions where the top 20% of the Greek RES producers reside


Prizren
Skopje
Blagoevgrad
Haskovo
Edirne
Kırklareli
Lezhë
North Macedonia
Smolyan
Tirana
Strumica
Serres
Drama
Xanthi
Tekirdağ
Istanbul
Alexandroupoli
Ohrid
Bitola
Pogradec
Thessaloniki
Bursa
Albania
Veria
Çanakkale
Ersekë
Kozani
Katerini
Balıkesir
Ioannina
Larissa
Trikala
Aegean Sea
Igoumenitsa
Volos
Mytilene
Arta
Lamia
Izmir
Agrinio
Greece
Patras
Aydin
Corinth
Athens
Pyrgos
Muğla
Kos
Kalamata
Rhodes
Sea of Crete
Chania
Heraklion

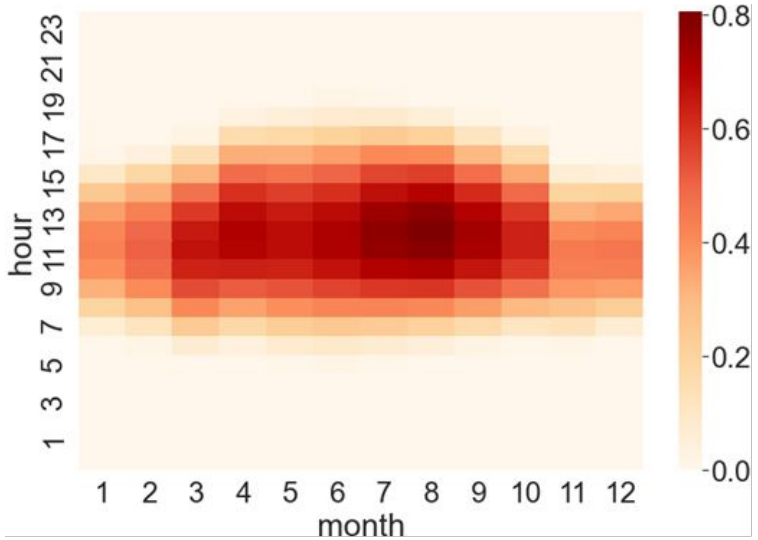

Skopje
Blagoevgrad
Plovdiv
Haskovo
Lezhë
Edirne
Kırklareli
North Macedonia
Tirana
Smolyan
Strumica
Ohrid
Bitola
Serres
Drama
Xanthi
Tekirdağ
Istanbul
Pogradec
Thessaloniki
Alexandroupoli
Albania
Vlora
Kastoria
Veria
Bursa
Ersekë
Kozani
Katerini
Çanakkale
Ioannina
Trikala
Larissa
Balıkesir
Volos
Aegean Sea
Arta
Mytilene
Lamia
Agrinio
Greece
Izmir
Patras
Corinth
Athens
Aydin
Pyrgos
Muğla
Kalamata
Kos
Rhodes
Sea of Crete
Chania
Heraklion

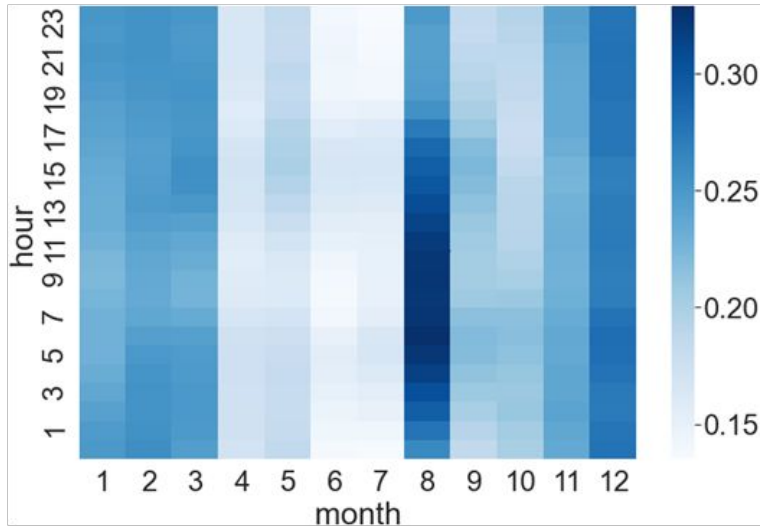
Data Exploration



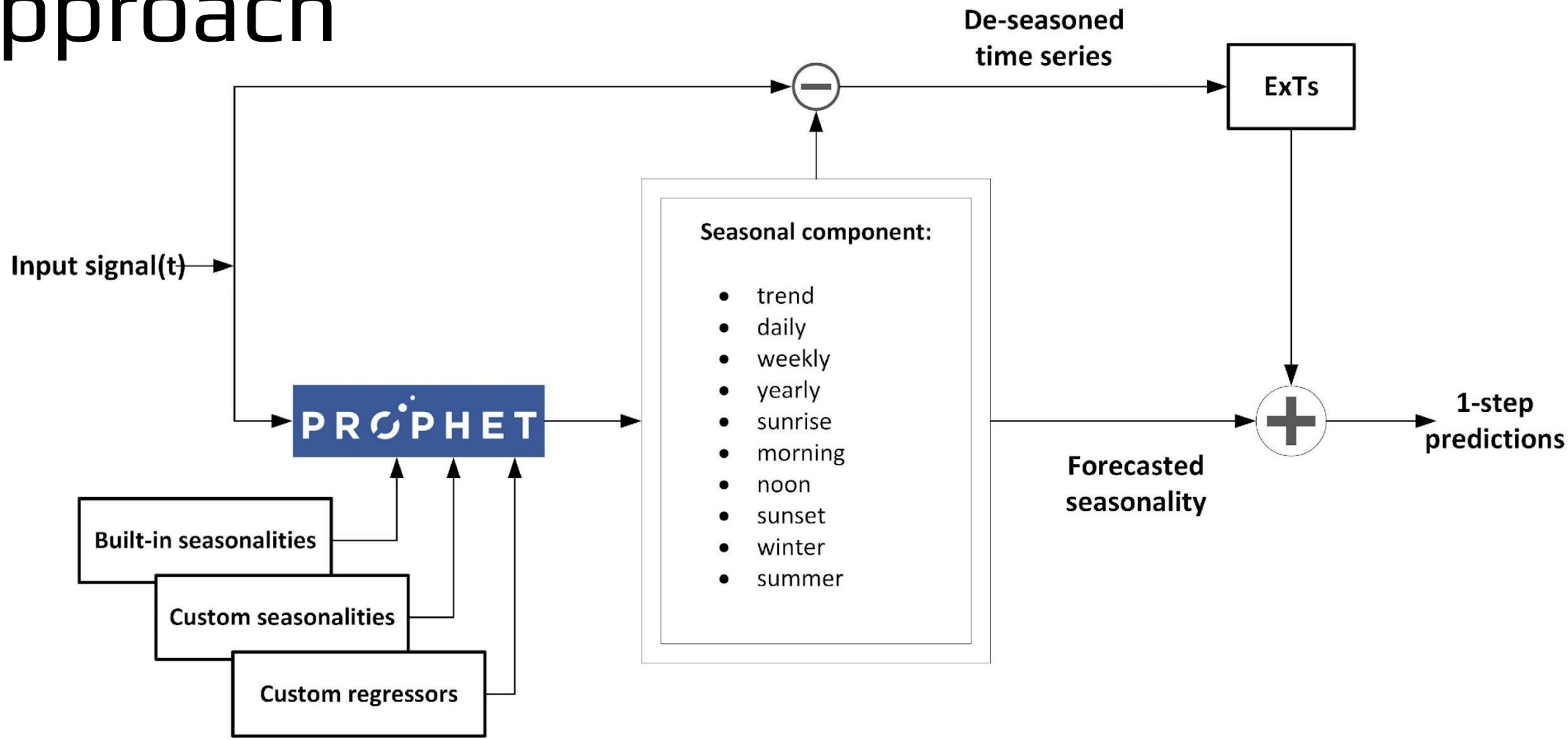
Visualization of the generated solar and wind energy for week 2020-05-18

Heat maps of scaled solar and wind energy generation for each hour of each month averaged over 4 years (2017 – 2020)





Approach


De-seasoned
time series
ExTs
Input signal(t)
Seasonal component:
trend
daily
weekly
yearly
sunrise
morning
noon
sunset
winter
summer
PROPHET
Built-in seasonalities
Custom seasonalities
Custom regressors
Forecasted
seasonality
1-step
predictions

Results

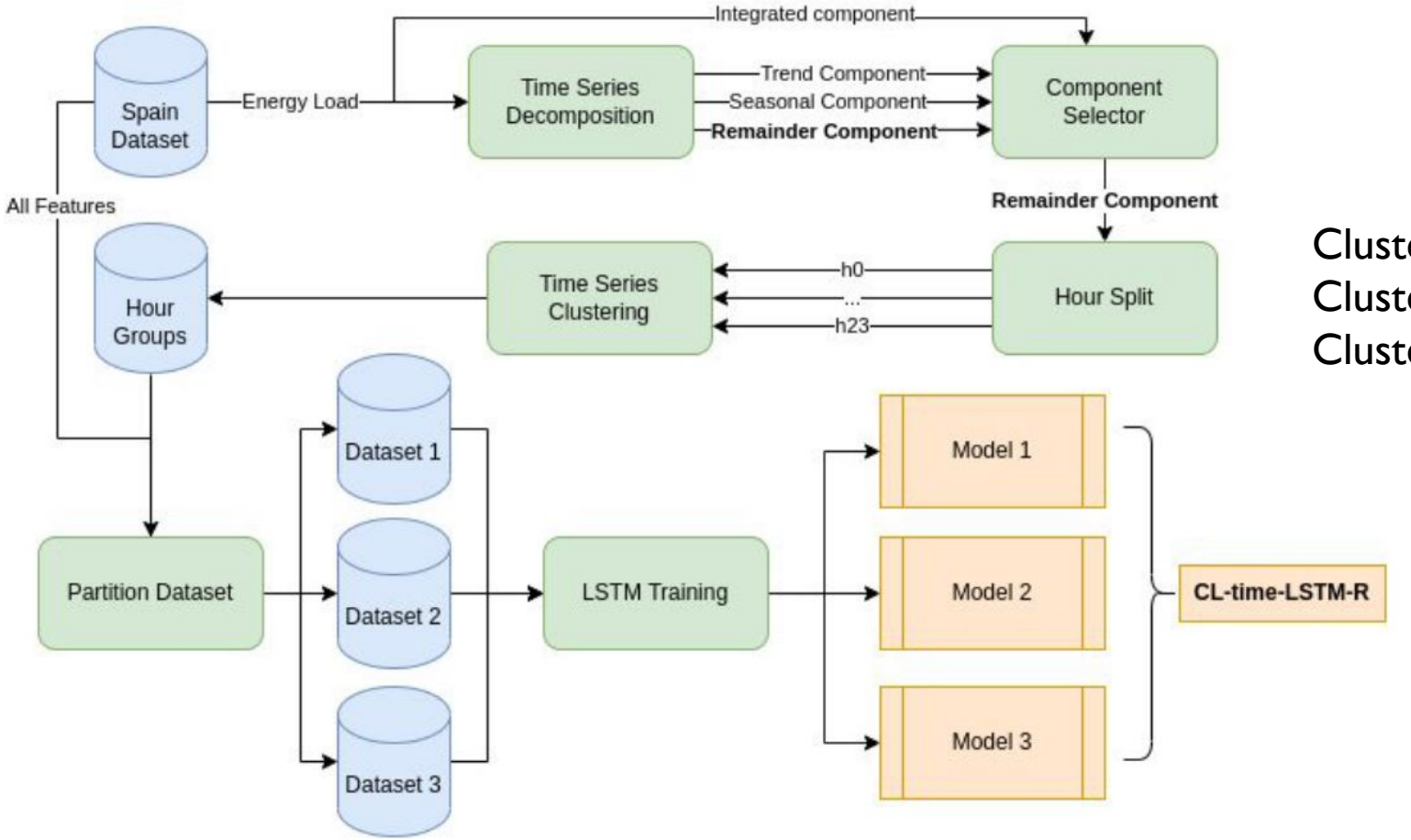
	Solar		Wind	
	MAE	RMSE	MAE	RMSE
Prophet + ExTs	**0.041**	**0.067**	**0.069**	**0.088**
ExTs	0.045	0.081	0.081	0.110
Prophet	0.055	0.080	0.083	0.104
Persistence t-2	0.049	0.107	0.226	0.287

Energy Forecasting

Vartholomaios, Karlos, Kouloumpris, Tsoumakas (2021), Short-Term **Renewable Energy Forecasting** in Greece Using Prophet Decomposition and Tree-Based Ensembles, In Proc. DEXA 2021 Workshops

Kouloumpris, Konstantinou, Karlos, Tsoumakas, Vlahavas (2022) Short-term **Load Forecasting** With Clustered Hybrid Models Based On Hour Granularity, In Proc. SETN 2022

Overall Architecture



Cluster 1: 12 – 21
Cluster 2: 22 – 06
Cluster 3: 07 – 11

Results

Model	MAPE	MAE	RMSE	RRMSE	R^2	[0,10]	(10,15]	(15,100]
Model$_{cluster1}$	6.75%	0.051	0.07	9.12%	0.311	75.83%	13.21%	10.96%
Model$_{cluster2}$	4.20%	0.026	0.035	5.75%	0.473	91.51%	6.36%	2.13%
Model$_{cluster3}$	7.102%	0.051	0.072	9.73%	0.4	78.27%	9.82%	11.92%
CL-time-LSTM-R	5.88%	0.042	0.06	8.54%	0.394	82.32%	9.80%	7.89%
LSTM-HP$_{cluster1}$	7.048%	0.054	0.074	9.662%	0.232	76.267%	10.684%	13.047%
LSTM-HP$_{cluster2}$	4.983%	0.031	0.041	6.711%	0.302	88.858%	7.488%	3.652%
LSTM-HP$_{cluster3}$	7.334%	0.055	0.077	10.130%	0.277	77.142%	9.863%	12.994%
LSTM-HP	6.357%	0.045	0.065	9.223%	0.272	81.244%	9.247%	9.509%

Regressors	MAPE	MAE	RMSE	RRMSE	R^2	[0,10]	(10,15]	(15,100]
Linear regression	7.73%	0.055	0.083	11.72%	-0.15	74.06%	14.77%	11.16%
Ridge regression	6.70%	0.048	0.064	9.09%	0.28	78.62%	13.16%	8.22%
Decision tree	7.01%	0.049	0.072	10.23%	0.07	77.14%	10.45%	12.42%
SVR	7.65%	0.055	0.07	9.88%	0.1	70.15%	19.86%	9.99%
LSTM-HP	6.35%	0.045	0.065	9.22%	0.27	81.24%	9.25%	9.51%
CL-time-LSTM-R	5.88%	0.042	0.06	8.53%	0.39	82.32%	9.80%	7.89%




Summary

Medoid AI

AI in Energy: Development

AI in Energy: Research

Thank You

Grigorios Tsoumakas

greg@medoid.ai

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