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SOLAR PV, PERFORMANCE & RELIABILITY

Context-sensitive PV plant component benchmarking based on monitoring data

PEARL PV Workshop 23/09/2021

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Also presented and recorded at EU PVSEC 2021
4CO.3.6 Context-sensitive PV plant component benchmarking based on monitoring data
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3E

3E services

Digital Solutions

SynaptiQ is the go-to digital platform for development, operational asset management and analytics. The platform combines all our leading SaaS products into a one-stop solution for each phase of your renewable energy project.

Expert Services

Our experienced team delivers bankable expert services for engineering, technical and strategic decision support and is ready to fast-track your next renewable energy project.

SynaptiQ

is the go-to digital platform for development, operational asset management and analytics of your renewable energy projects.

SynaptiQ combines all of our leading SaaS products that bring more value to your assets over the lifecycle.

The go-to digital platform

Domain Excellence

Open data and software architecture

1999
3E foundation as a spin-off of IMEC

2014
Launch of Solar Data Services

2021
Launch of Wind Analytics LivLiner Inside

1999 - 2007
Organic growth, international presence

2017
Launch of Solar Analytics & Sensor Check

1

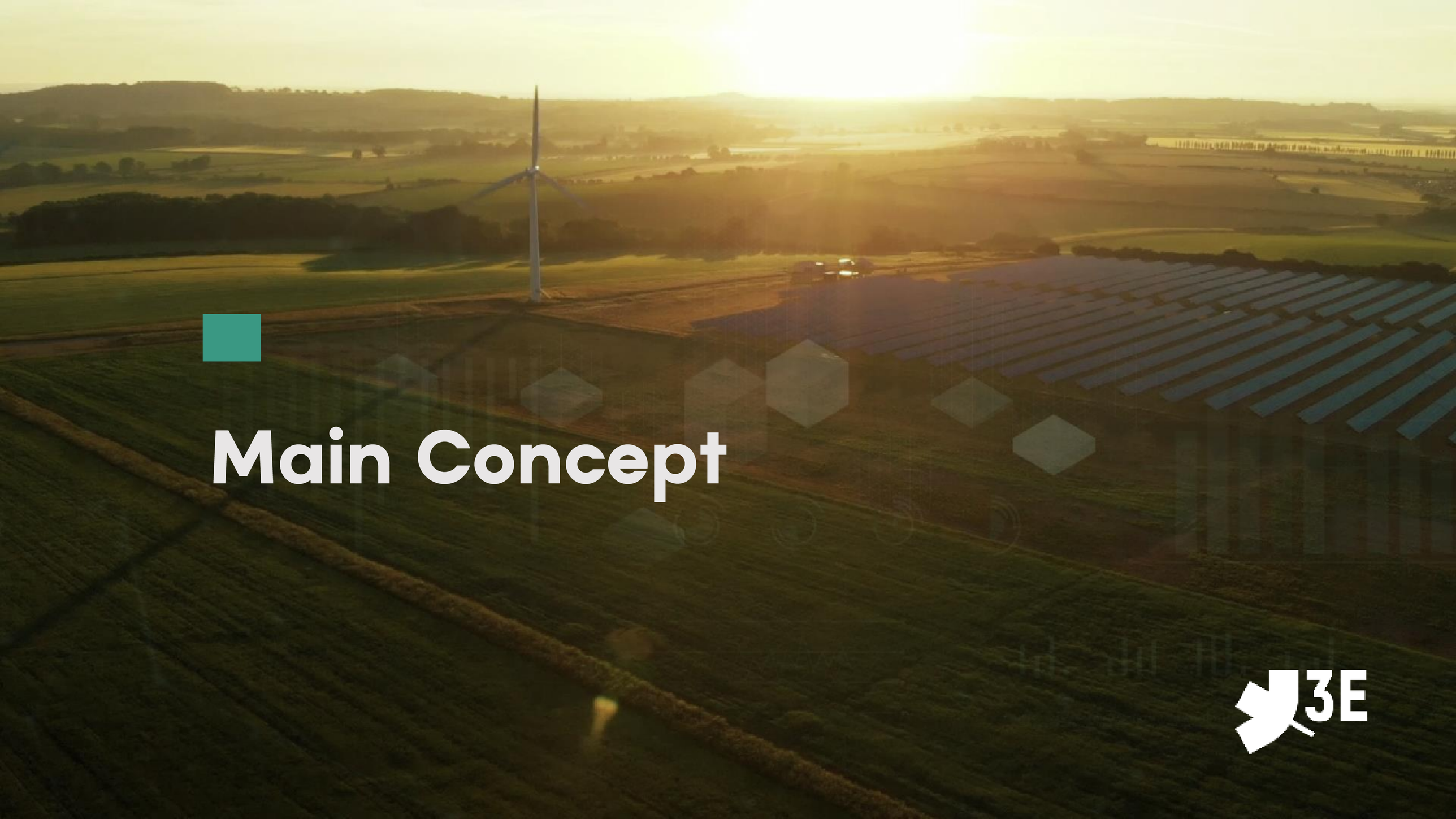
Main Concept

2

Research and Validation

3

Basic tools and case studies

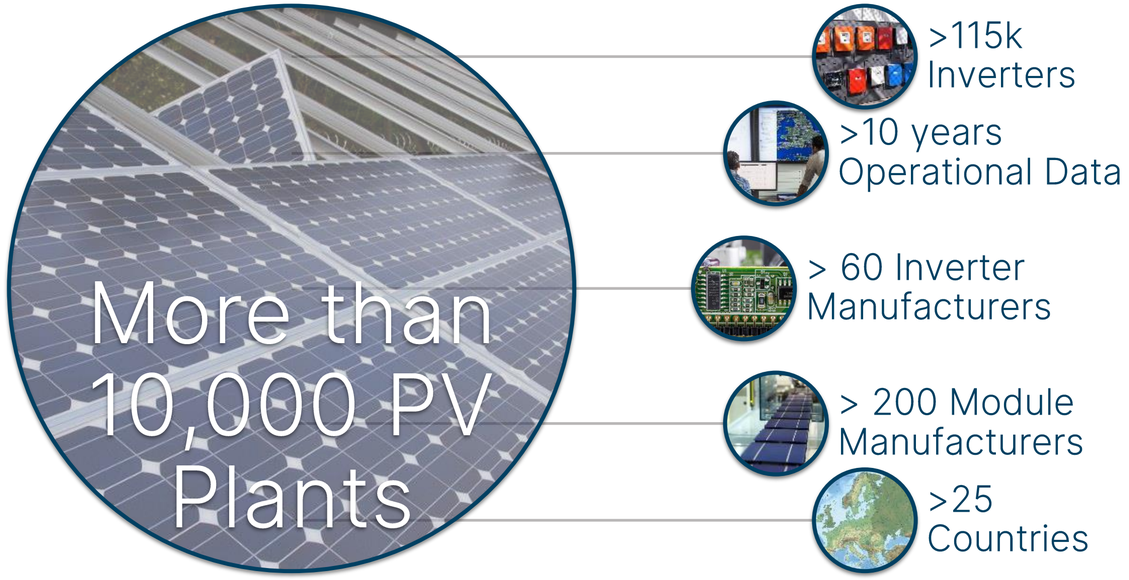


Main Concept

SQ Database with monitoring data

Powered by big data techniques and smart IT architectures

- Learn about/from/with our own data
- Easy access to real insights
- Data-driven Benchmark
  - Manufacturers
  - Models
  - Configurations
  - Technologies
- Compare to your peers
- Make qualitative AND quantitative decisions



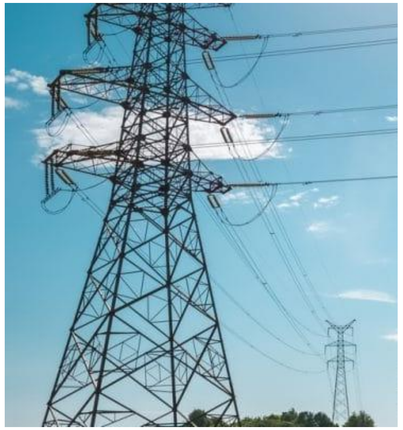
PV plant components

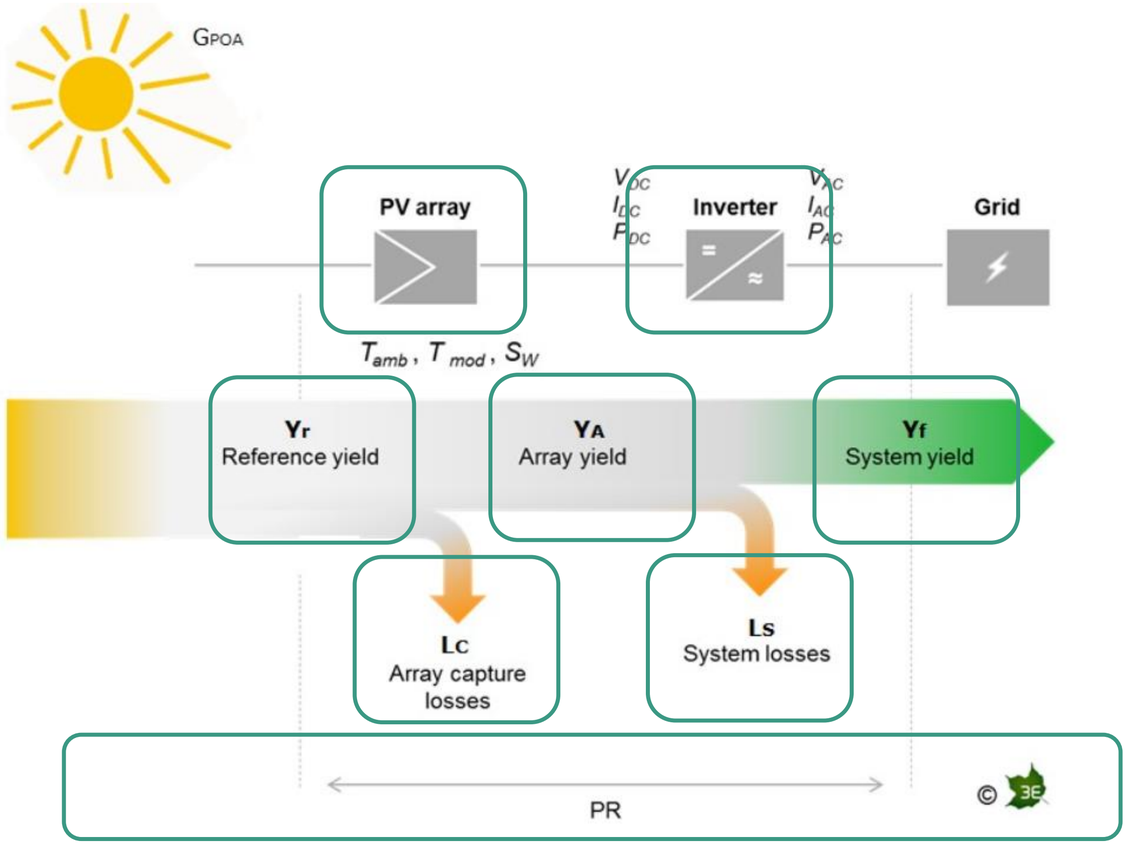
PV Array

PV Modules

Inverter

Grid





Context-sensitive benchmarking

- OPERATIONAL KPIs

Measured	Capacity Factor
	Performance Ratio
	.....
Estimated	PVM Temperature
	Degradation
	Energy Simulation
	.....
CPN Methodology	Time to Failure
	Energy Loss/Costs
	CPN
	.....

- FEATURES

Useful Features TYPE Clustering		Useful Features GEO Clustering	
Manufacturers	PV Module	Administrative Classifications	Country
	Inverter		Region
	.....		.....
Technology	PV Module Type	Climate Classifications	KG Zone
	Mounting Type		PVD Zone
	Mounting Position		KGPV Zone
	.....		.....
Numerical Features	Power Capacity	Undefined Options	Lat x Lon
	Rated Efficiency		Weather data
	Number of Cells		Geography
	.....		.....

Performance Metric

Filters

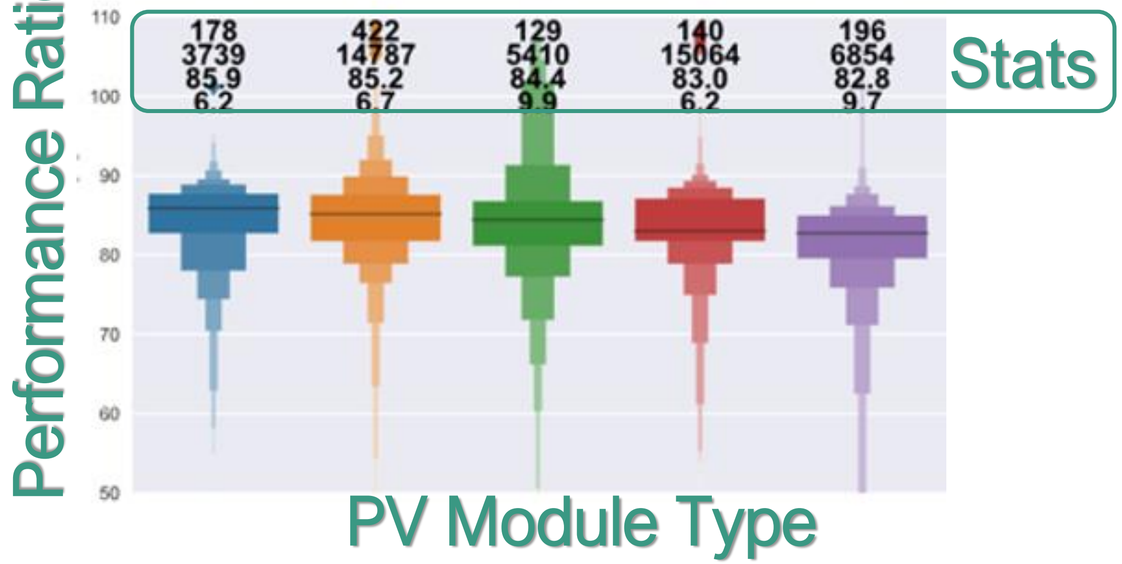
Show : KPI 1

Versus : Feature 1

Filtered by : Feature 2/3/4/...

Example

Show: Performance Ratio
versus: PV Module Type
Filtered by: rooftops in temperate climate



Benchmarking meets professional needs

- What is the average performance, degradation, etc. at a particular location ?
- Which is the best and worst performer in a particular country ?
- How good is my PV plant performing in comparison to neighbours/peers?
- Which PV module and inverter manufacturer is high performing in a specific country?
- When should I replace my inverter? After how many years inverters of brand X start to fail more often?

Research and Validation

3E Component-Benchmarking

H2020 TrustPV

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3E nv

- Over +10k PV Systems
- Over +10GW installed Capacity
- Approx, 3/4 Rooftop, 1/4 Ground

BayWa r.e. Italy

- Over +190 PV Systems
- Over +0.2GW installed Capacity
- Approx, 3/4 Ground, 1/4 Rooftop

Enel Green Power

- Over +100 PV Systems
- Over +4GW installed Capacity
- Approx, Half Fixed, Half Tracker

Innosea

- Identification of Floating PV Systems
- Engagement of clients
- Target +5 Floating Systems

Huawei

- Theoretical information
- Insights from laboratories

Innosea

- Over +90 PV Systems
- Over +0.9GW installed Capacity
- Approx, 2/3 String, 1/3 Central Inverter

 *Company figures from april 2021

Basic tool and case studies

3E Component-Benchmarking

Basic tool proof-of-concept

3E Component-Benchmarking - *Insights from 3E SynaptiQ Solar*

Standalone Tool v1.0 (Test Dataset)

Internal use - 3E

Client

fleetaid_plant_id

All

User Input

country

Belgium

KG_zone

All

inverter_model

All

inverter_manufacturer

Multiple selections

module_model

All

module_manufacturer

Multiple selections

module_installation_type

All

Performance Ratio [%]

80.56

78.2

Performance Index [%]

100.84

97.8

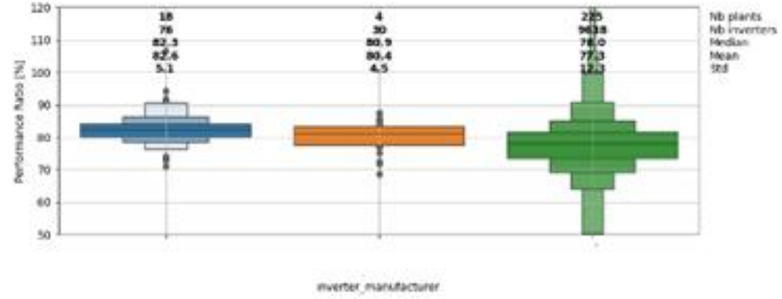
Availability [%]

100.00

97.3

Map of selected locations

inverter_manufacturer, fleetaid_plant_id, Average of overall mean performance ratio and Inverter

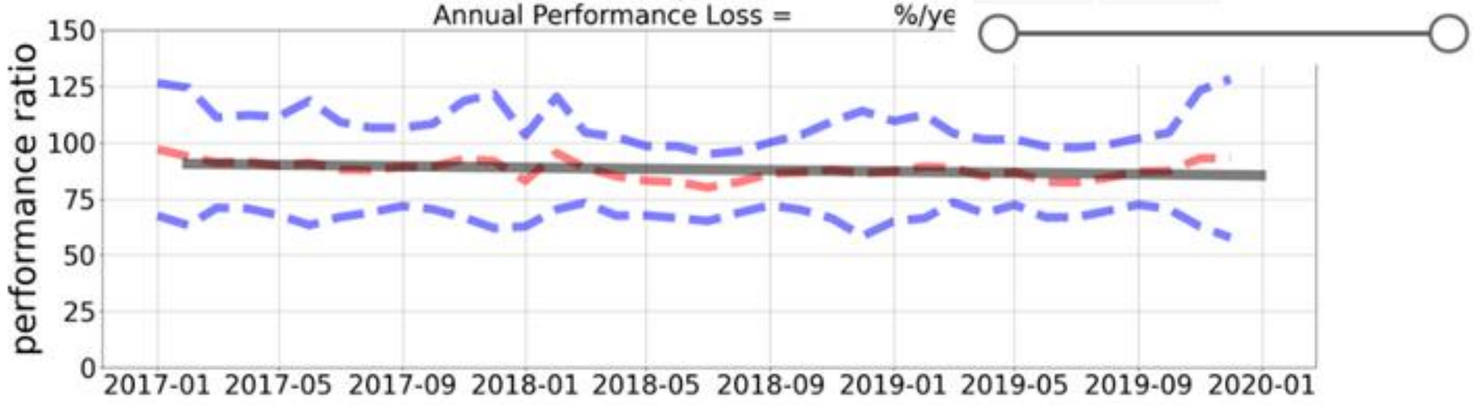


index energy simulation, Site, Date, Median of performance ratio, inverter_manufacturer and

Intercept = 90.525

Annual Performance Loss = %/ye

01/01/2017 01/12/2019



Case study 1: Peer benchmarking

Portfolio (7 PV Plants)
vs 65 Rooftop Systems

Specific Context
Environment
Geographical Region

INVERTER C + PV MODULE X

2019
- Operating Year 3E SynaptiQ Solar

79.5% vs 80.2%
- Performance Ratio

99.4% vs 98.6%
- Availability

107.7% vs 111.2%
- Performance Index

Best Performer

INVERTER D + PV MODULE Y

2019
- Operating Year 3E SynaptiQ Solar

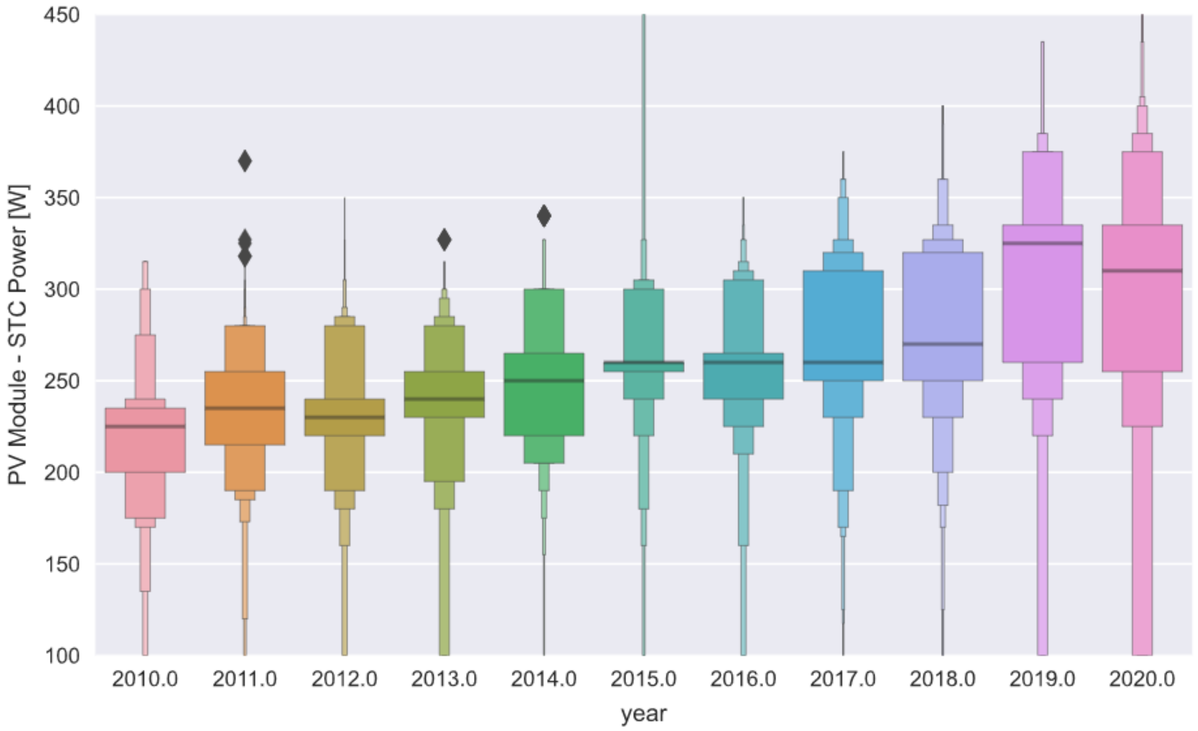
79.5% vs 86.78%
- Performance Ratio

99.4% vs 99.37%
- Availability

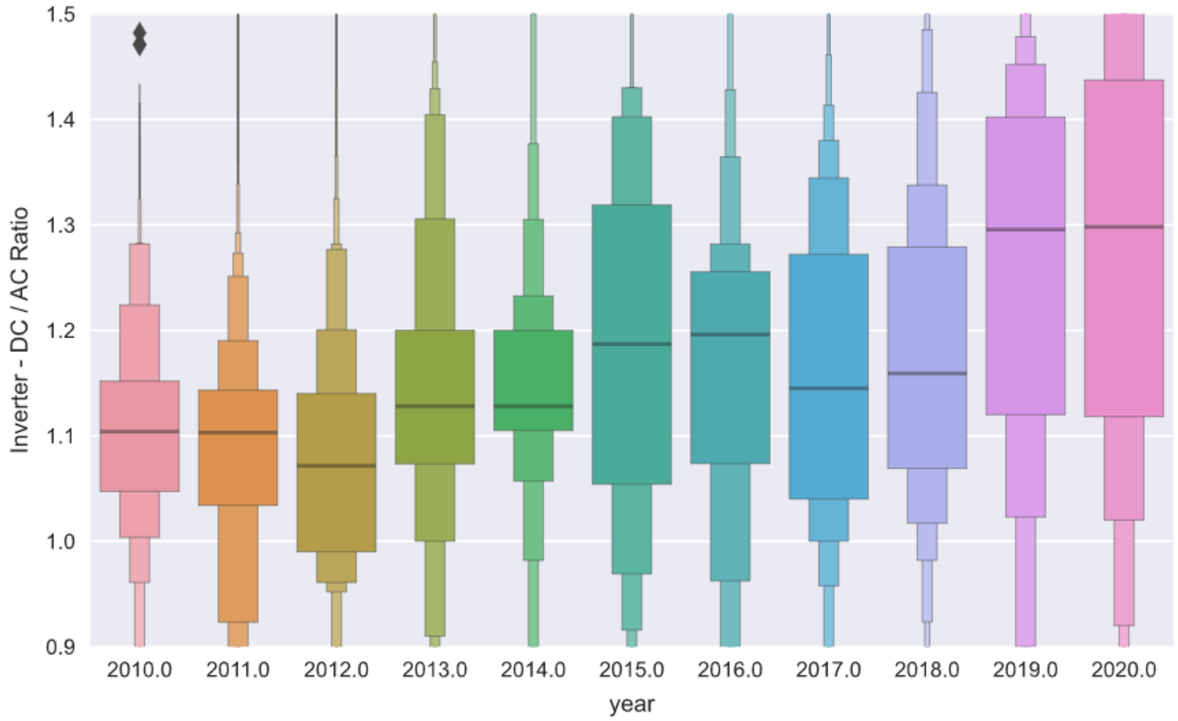
107.7% vs 105.5%
- Performance Index

Case study 2: Identify market trends

- PV Module Design Trends (Powerful modules)

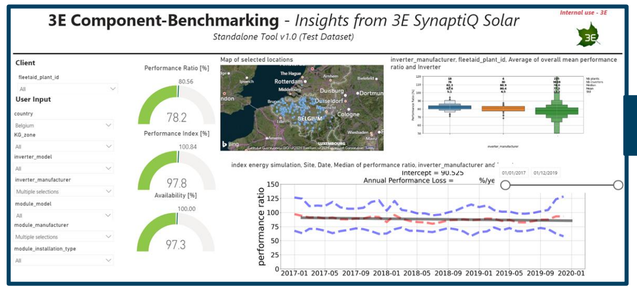


- Inverter Design Trends (Oversizing trend)



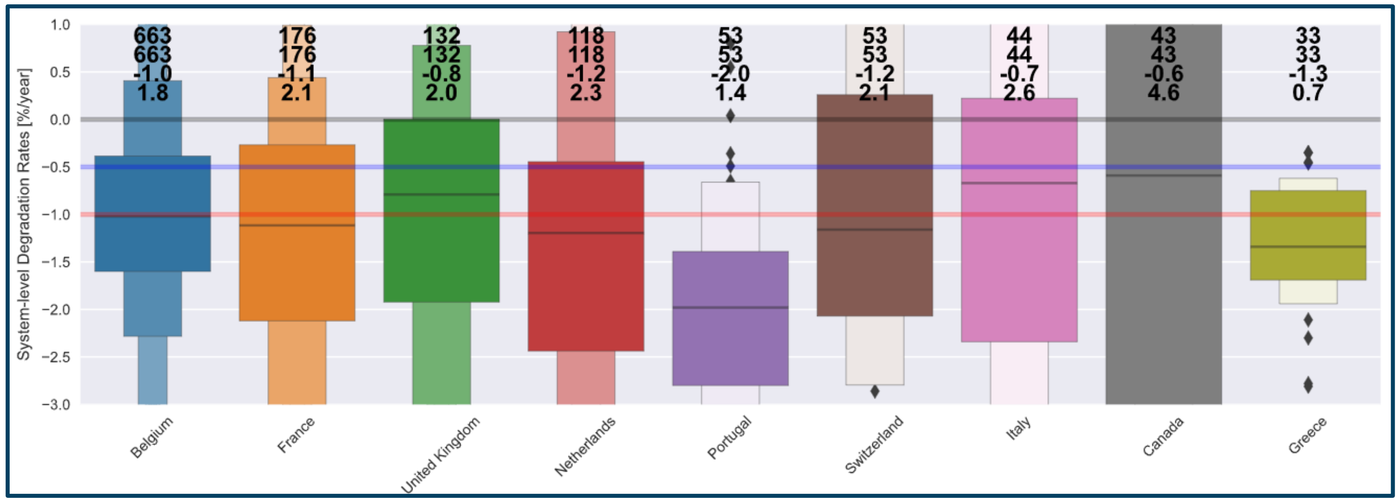
Case study 3: Integrate advanced KPIs

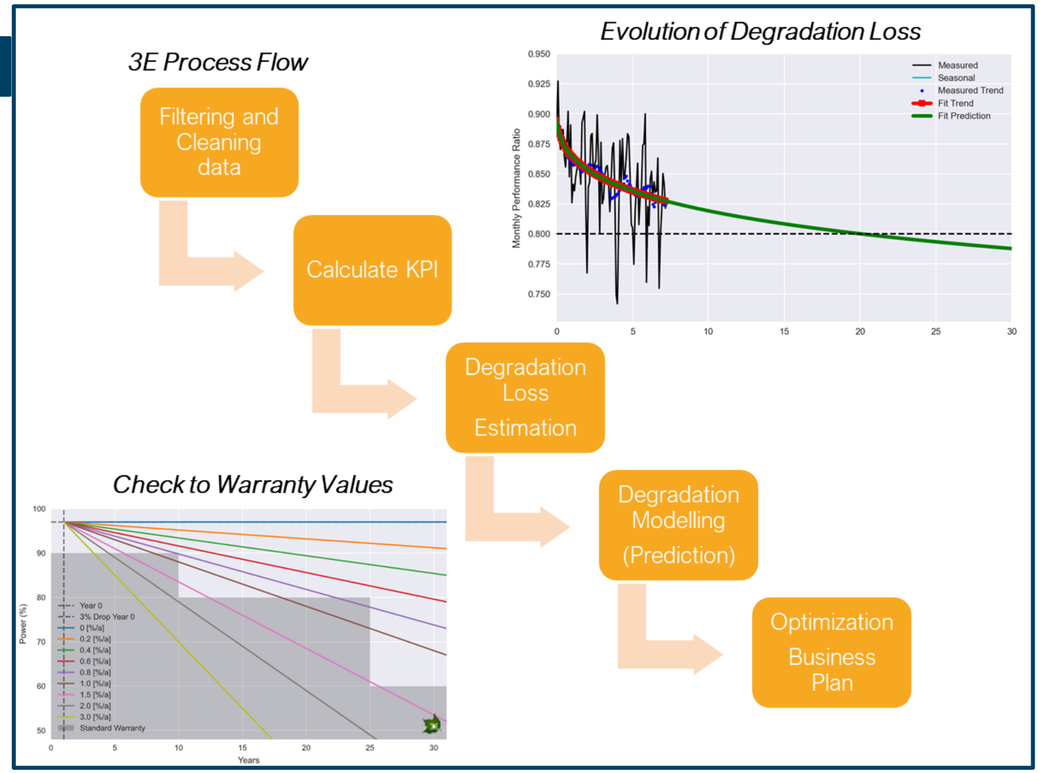
Basic Benchmarking Tool



Advanced Benchmarking Tool

Advanced Solar Analytics - PV Degradation Assessment





What is next?

- Integrate Advanced Operational KPIs in tool
- Integrate asset maintenance data in the tool
- Further validate methodologies

Let’s fly even higher, together

Thank you

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