



Use Cases for a Digital Twin within an integrated EPC and O&M Company

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en:tity

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en:light

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01

Introduction

About Enmova

About Enmova

Enmova is dedicated to providing trustworthy and pioneering O&M solutions, leveraging the latest advancements in data application within the solar industry. This commitment aims to boost Centroplan's rapid growth and enable full serviceability within the Centroplan Group.



Founded in 2021 as Spin-Off
of Fraunhofer ISE, originated
from a four-year R&D project
titled "*Optimized O&M*"

Born from



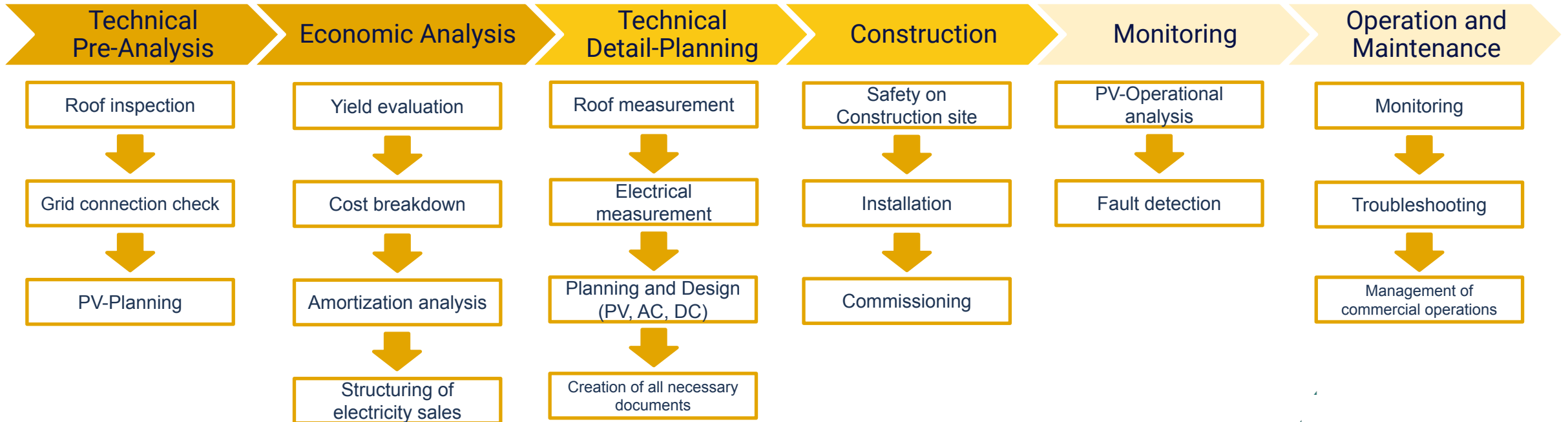
The Centroplan Group



START FEASIBILITY STUDY

START PROJECT IMPLEMENTATION

START COMMISSIONING AND MAINTENANCE



02

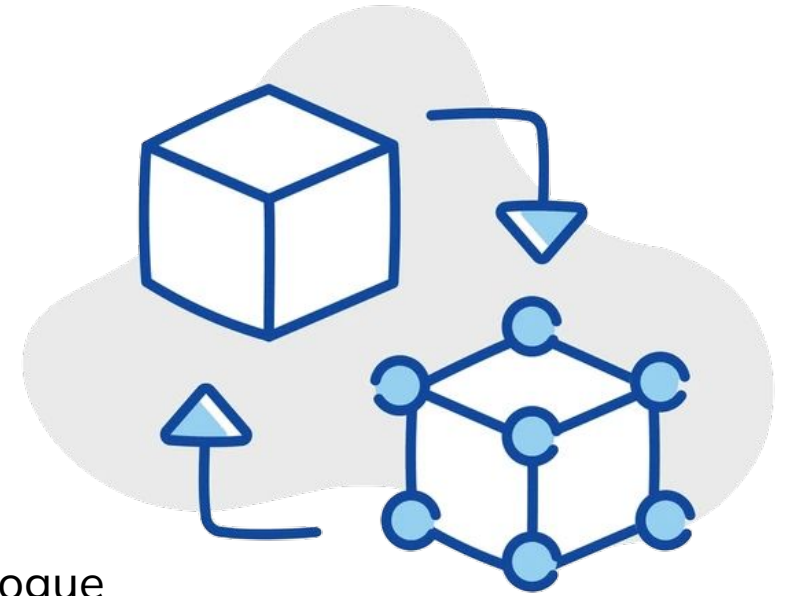
en:tity

Enmova's Digital Twin

en:ity - Enmova's Digital Twin

Characteristics and current status

- Characteristics
 - flexible and extendable
 - some kind of a simplified graph model
 - hierarchy inspired by “Orange Button”
 - TrustPV Risk Matrix “included”
 - views for different use cases and data exchange
 - PVSyst PAN and OND files for PV module and inverter catalogue
- Current status
 - currently data of about 650 German systems
 - about 600 attributes per system



en:ity - Enmova's Digital Twin

Implementation

- BigQuery x ORM (Object-Relational Mapping) data model using SQLAlchemy (Python)
 - Abstraction and Simplification, simplifying complex queries and exposes them as python objects
 - Cross-Database compatibility, could also run on e.g. SQLite or Postgres
 - Security, prevent SQL injections when using the Library
 - Schema management, Code reusability
- BigQuery is the data warehouse of Google Cloud
 - Simple to connect to Google Spreadsheets
 - Optimized for complex queries and large datasets

en_tity_v2_prod	☆	⋮
address	☆	⋮
cable_type	☆	⋮
comment	☆	⋮
communication_path	☆	⋮
communication_type	☆	⋮
contact	☆	⋮
contact_has_address	☆	⋮
contact_has_contact...	☆	⋮
contract	☆	⋮
contract_has_contra...	☆	⋮
contract_term	☆	⋮
customer_defined_fi...	☆	⋮
data_logger	☆	⋮
data_logger_catalog	☆	⋮
data_logger_configur...	☆	⋮
data_logger_has_lice...	☆	⋮
data_logger_has_sen...	☆	⋮
electricity_marketing	☆	⋮
id_mapping	☆	⋮
inverter	☆	⋮
inverter_catalog	☆	⋮
inverter_catalog_add...	☆	⋮
inverter_catalog_effi...	☆	⋮
inverter_catalog_effi...	☆	⋮
inverter_catalog_inp...	☆	⋮
inverter_catalog_inp...	☆	⋮
inverter_catalog_out...	☆	⋮
inverter_has_id_map...	☆	⋮
inverter_has_noafd...	☆	⋮
inverter_mppts	☆	⋮

Filter	Name oder Wert des Attributs eingeben			
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<input type="checkbox"/>	input_no	INTEGER	NULLABLE	-
<input type="checkbox"/>	cable_length_m	FLOAT	NULLABLE	-
<input type="checkbox"/>	cable_diameter_mm	FLOAT	NULLABLE	-
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SCHEMA BEARBEITEN

ZEILENZUGRIFFSRICHTLINIEN AUFRUFEN

03

Digital solutions

Connecting the Centroplan Group

Integration of Services



Feasibility Assessment

Planning

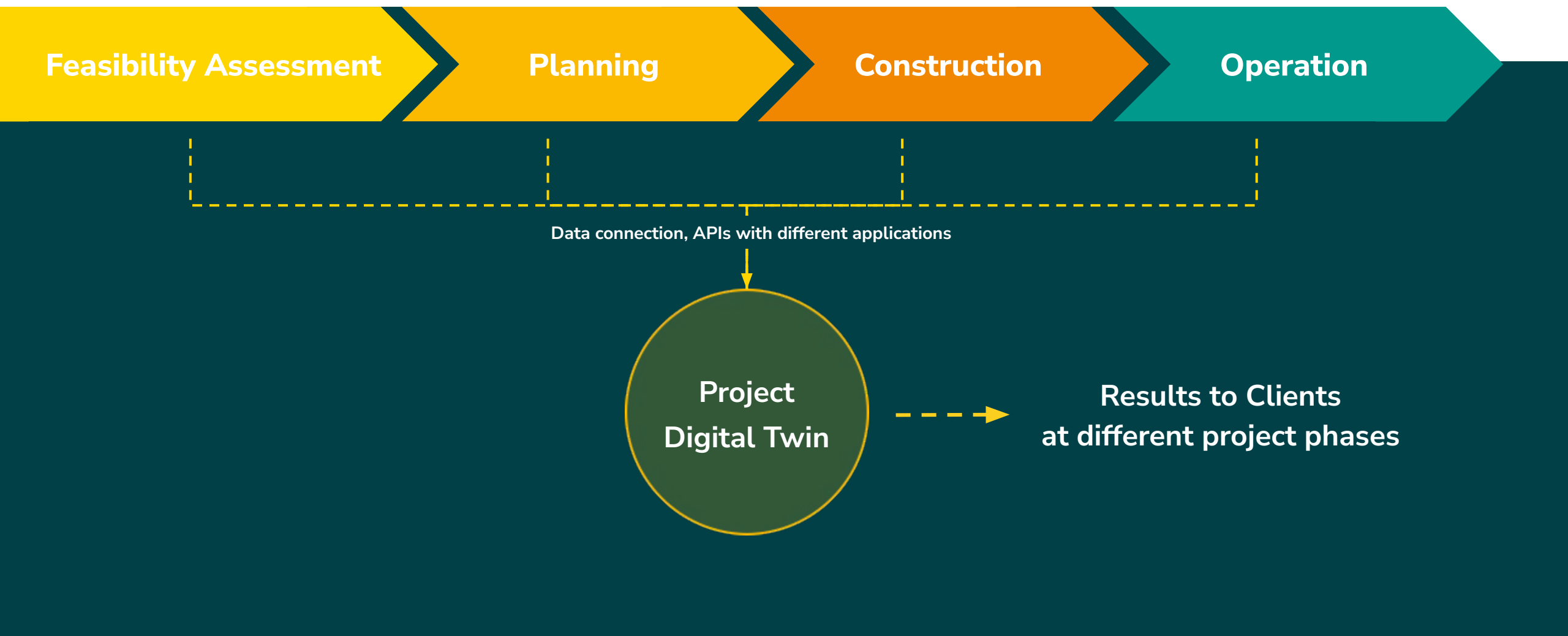
Construction

Operation

Data connection, APIs with different applications

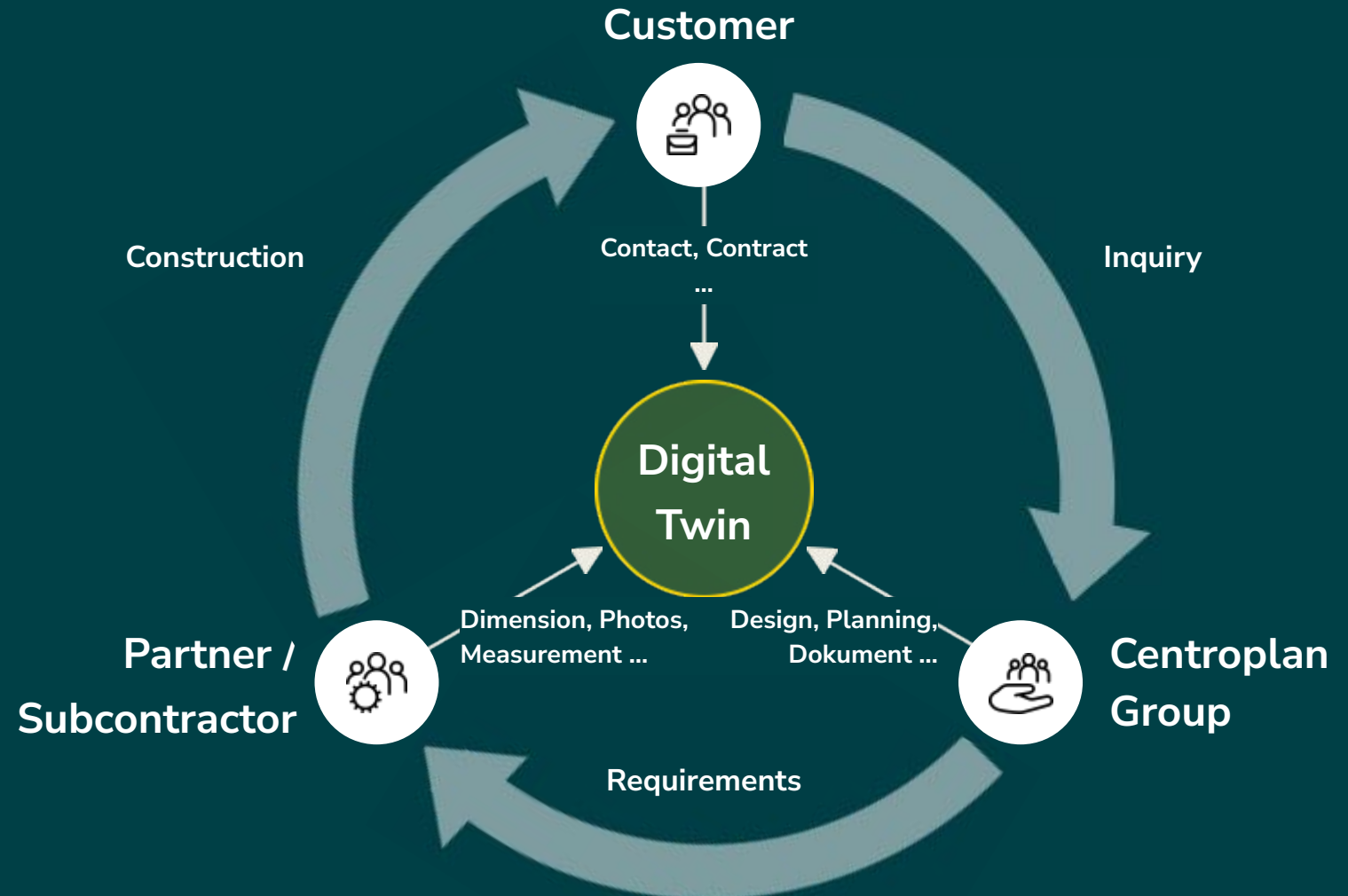
Project
Digital Twin

Results to Clients
at different project phases



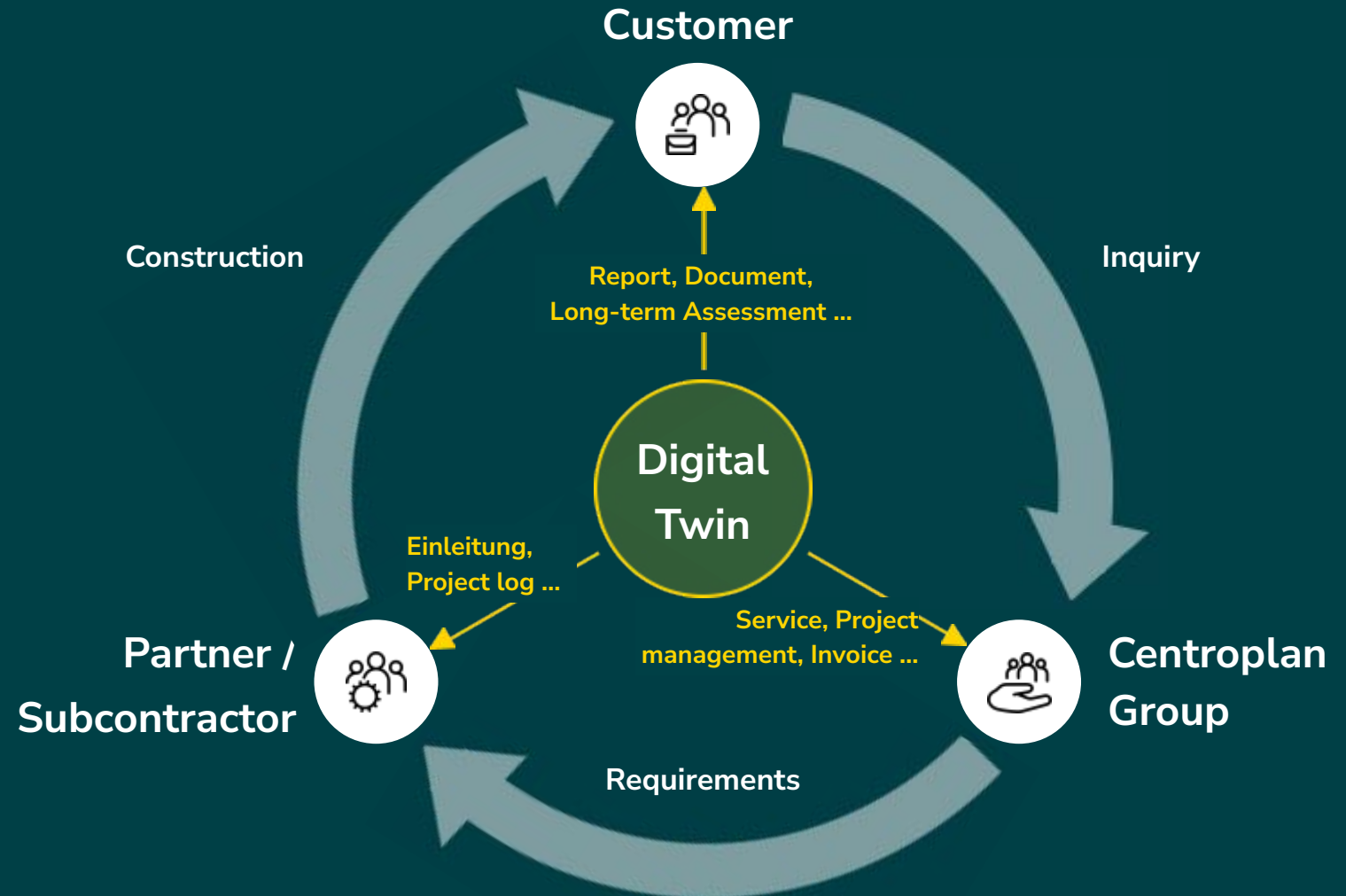
Efficiency Gain via Digitalization

Digital Twin as the Central Data Base for the Project Cycle



Efficiency Gain via Digitalization

Digital Twin as the Central Data Base for the Project Cycle



Digital Twin acts just like a Project's CV

All extensions and
new requests can be
easily served with
optimized solutions
during the project
life cycle



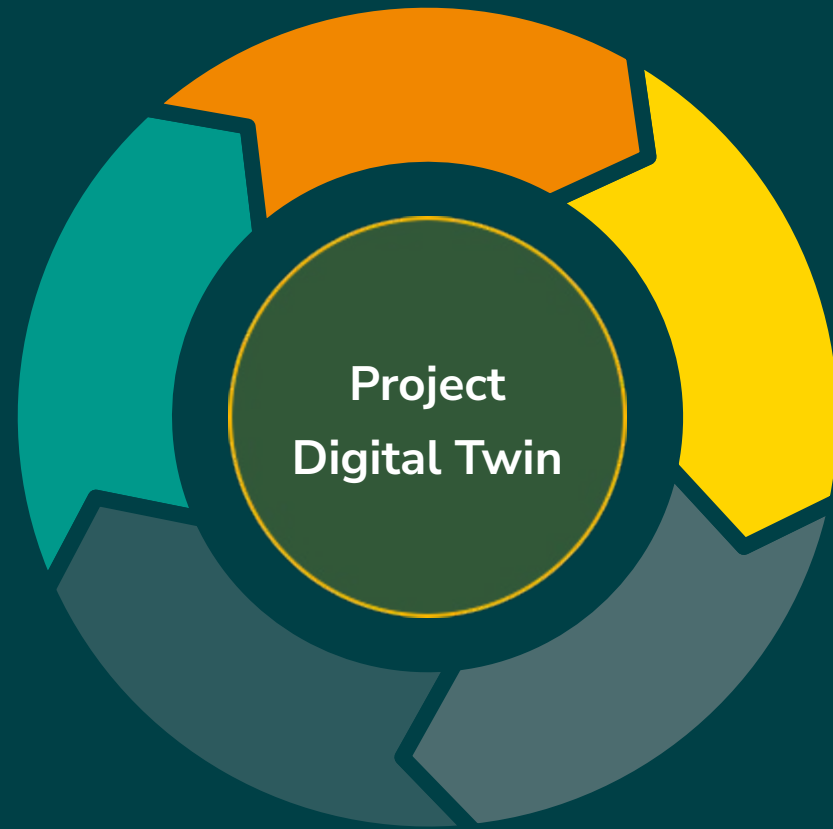
Consultant &
Assessment

Planning &
Construction

Operation &
Evaluation

Project
Digital Twin

New Request



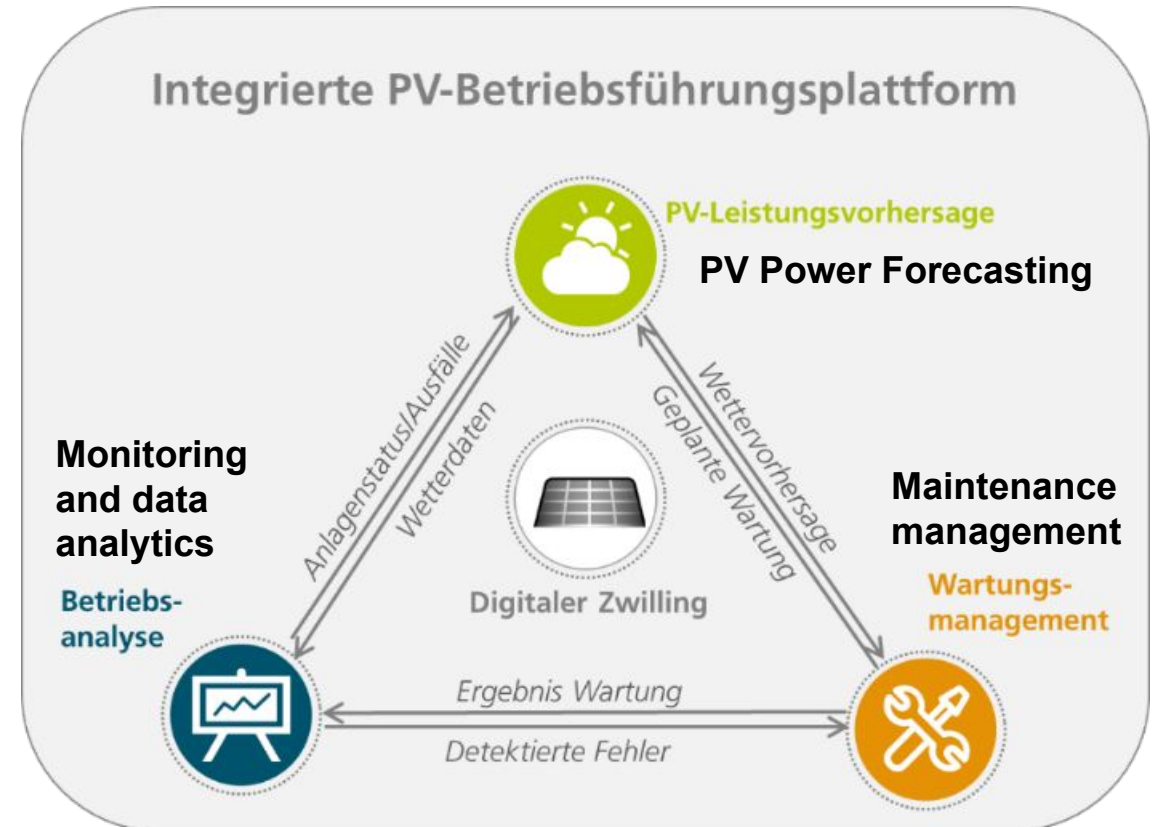
04

The IPVpro Project

Integrating monitoring, forecasting and maintenance

The IPVpro Project

- Research project
 - Funded by German BMWK (ID: 03EE1188B)
 - Partner: Fraunhofer ISE, Mondas GmbH
 - Duration: 2023/06/01 - 2026/05/31
- Project Goals
 - Modular PV operations management platform that combines and optimizes PV power forecasting, monitoring and data analytics and fault and maintenance management
 - Detailed mapping of PV power plants via system-specific digital twins with integrated PV simulation
- Status
 - Meta data system established
 - initial implementation



05

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Enmovas automatic failure detection and prioritization tools

Centroplan Systems in O&M Service



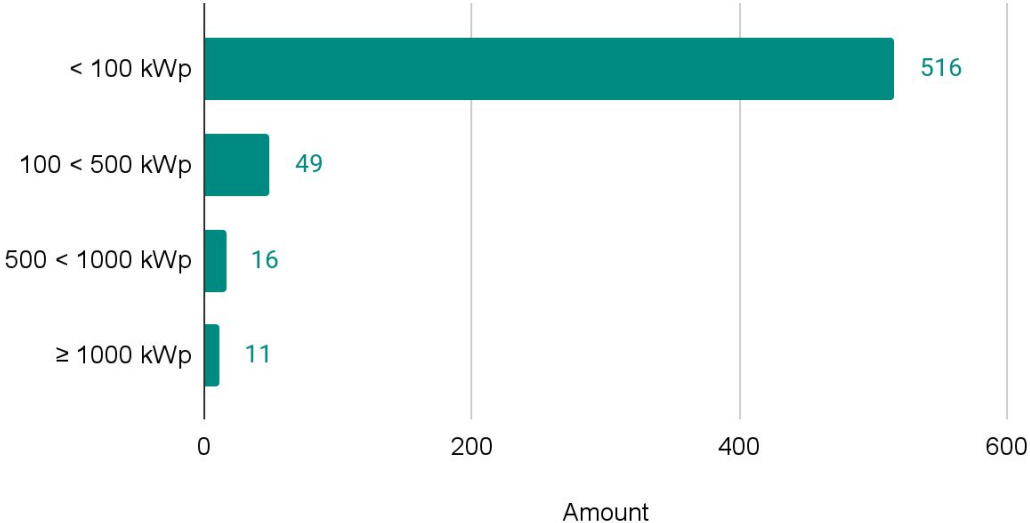
592 Centroplan
Systems in Service

(682 systems, 121 MWp
@ 2024-06)

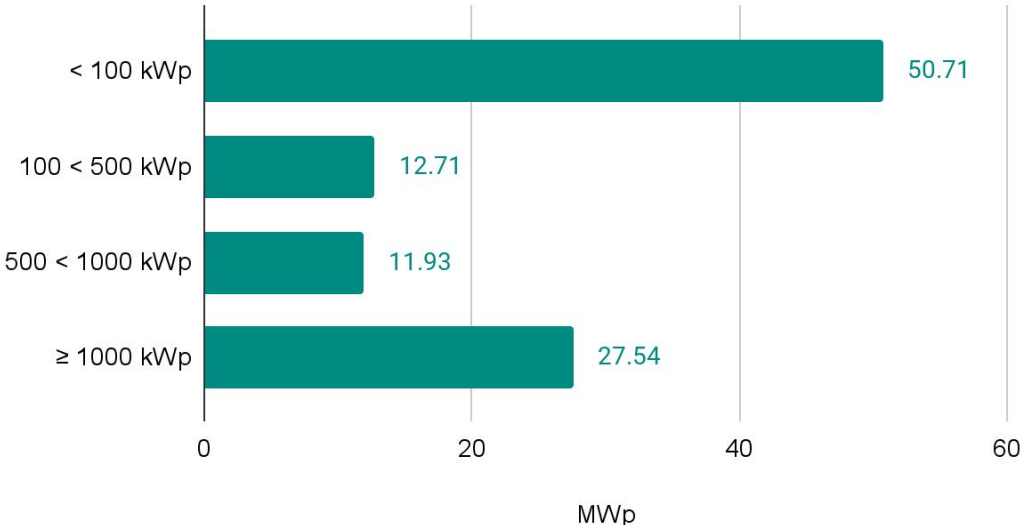


103 MWp

Amount of Systems by Size



Installed Capacity of Systems by Size

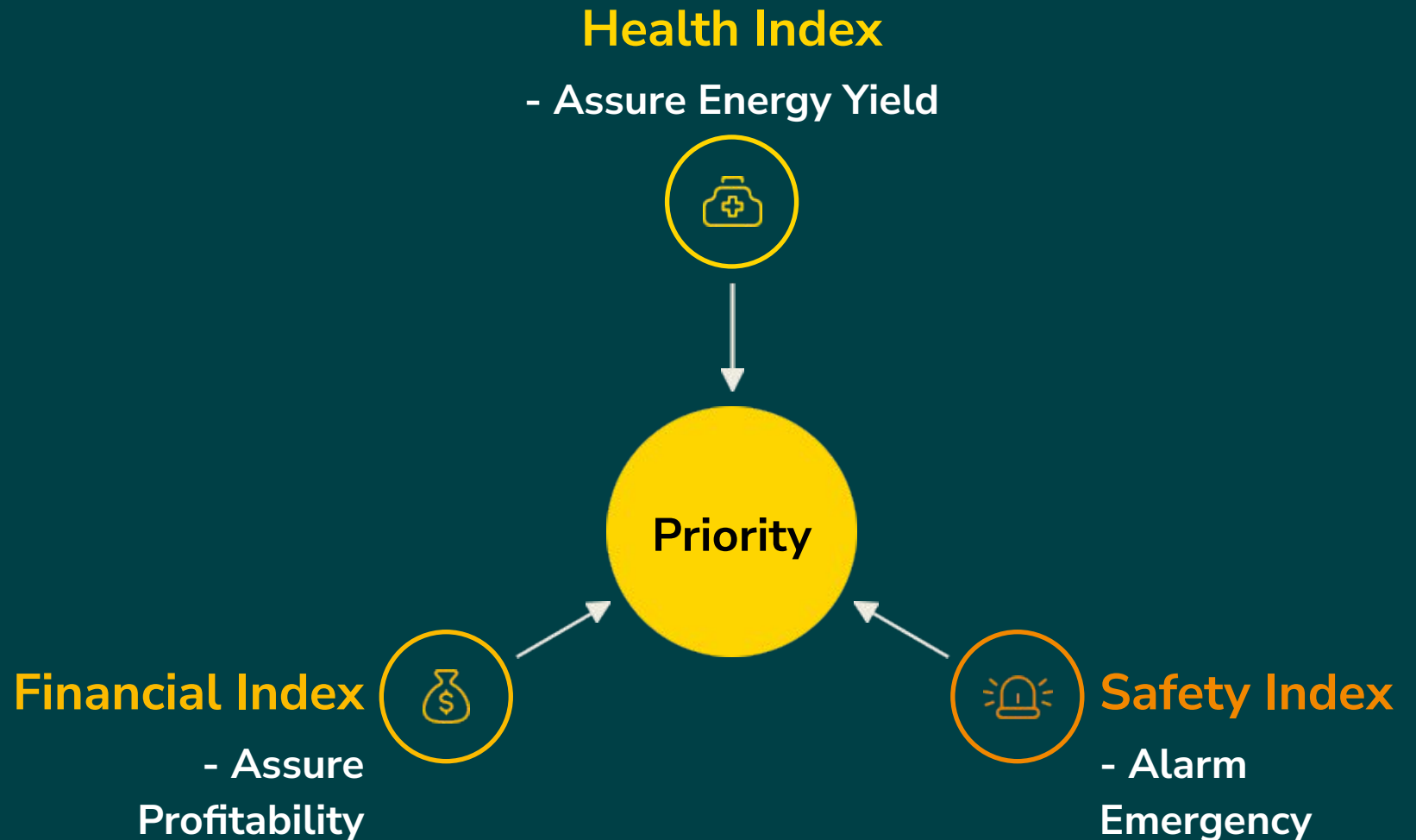


Monitoring with Priority

Prioritize systems with technical issues based on economical impact in routine monitoring

Alarm systems having potential security issues that require immediate intervention

en:tity as the basis for required information (technical and financial meta data, contracts, ...)





Thank You!

Enmova GmbH

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