

Improving Real-time and Spatial Decision Making by Combining the PI System with Esri ArcGIS

Presented by **Anders Røpke & Peter Clemmensen**



LEADING THE ENERGY TRANSFORMATION

September 2014

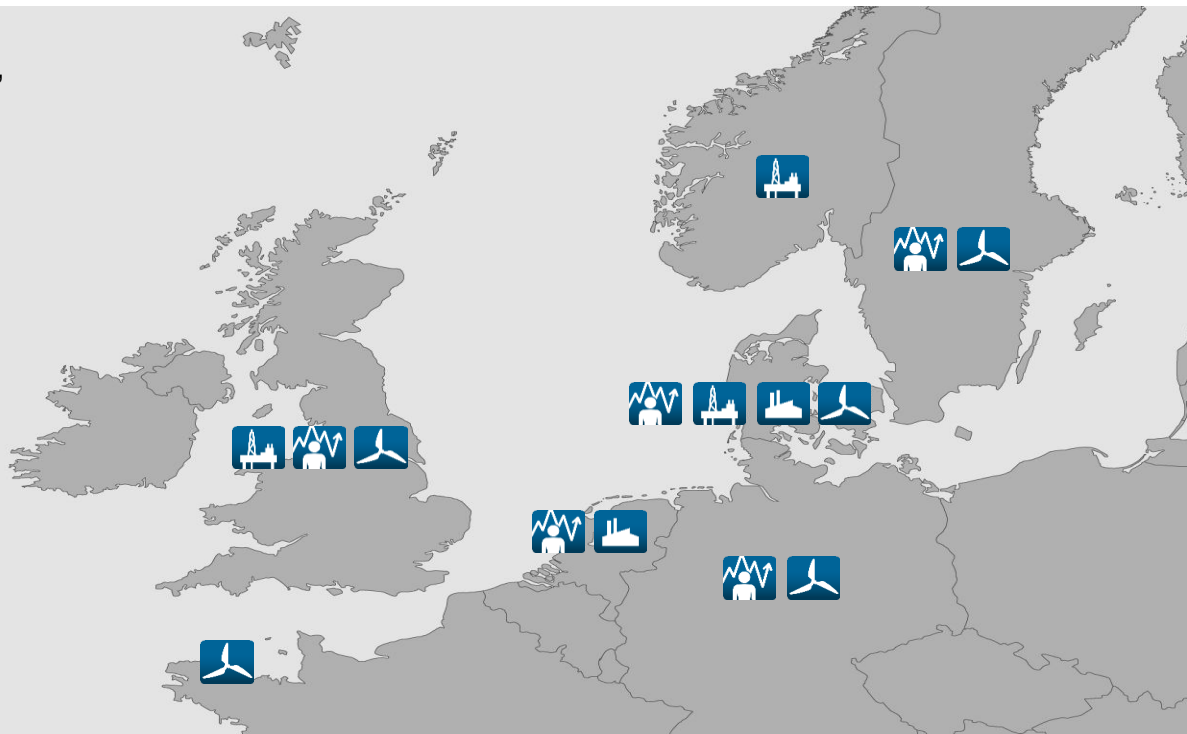


DONG Energy is one of the leading energy groups in Northern Europe

Our business is based on procuring, producing, distributing and trading in energy and related products in Northern Europe.

DONG Energy has 6,500 employees and is headquartered in Denmark.

-  Exploration & Production
-  Wind Power
-  Thermal Power
-  Customers & Markets



DONG Energy has a Strategic Focus on Offshore Wind

DONG Energy will have 6.5 GW installed capacity from approx. 1.800 offshore wind turbines in 2020

Offshore Wind

Market leadership; growth and value creation

Priorities

- Mature and construct project pipeline
- Reduce cost of energy
- Further develop industrial and financial partnerships
- Standardise and increase operational efficiency

Targets

- Installed gross capacity of 6.5GW in 2020
- Offshore cost-of-energy below €100/MWh in 2020¹
- ROCE of 6-8% by 2016; 12-14% by 2020



Strategic focus

OFFSHORE WIND

DONG Energy capacity¹
GW

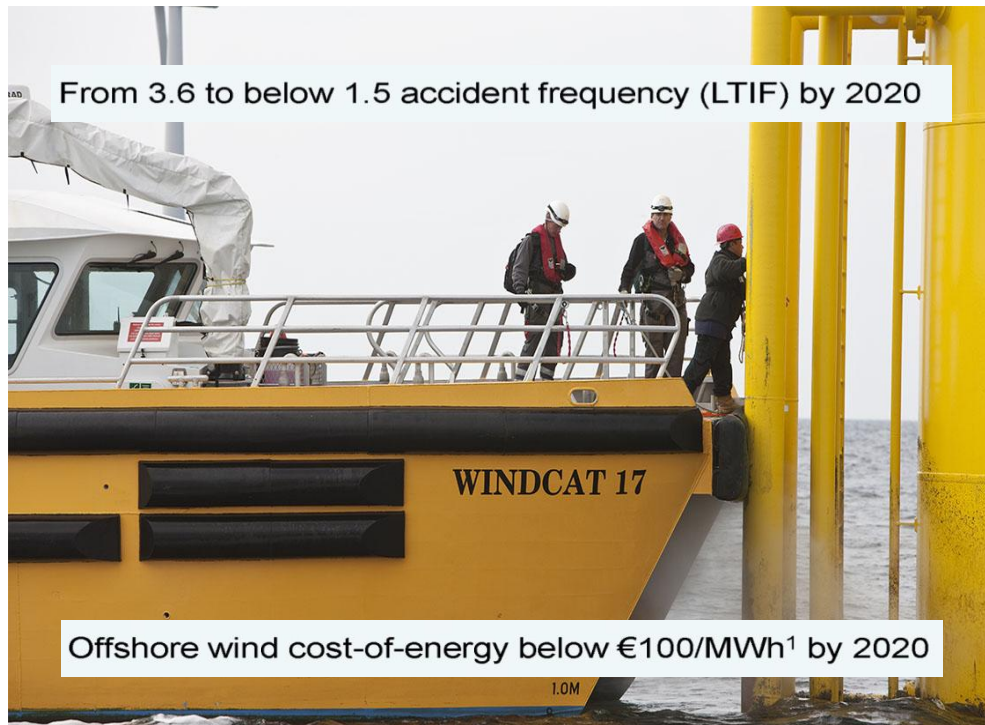


- Fastest growing renewable
- Market leader
- High share of regulated income
- Solid returns

HSE and OPEX cost are top of mind in DONG Energy

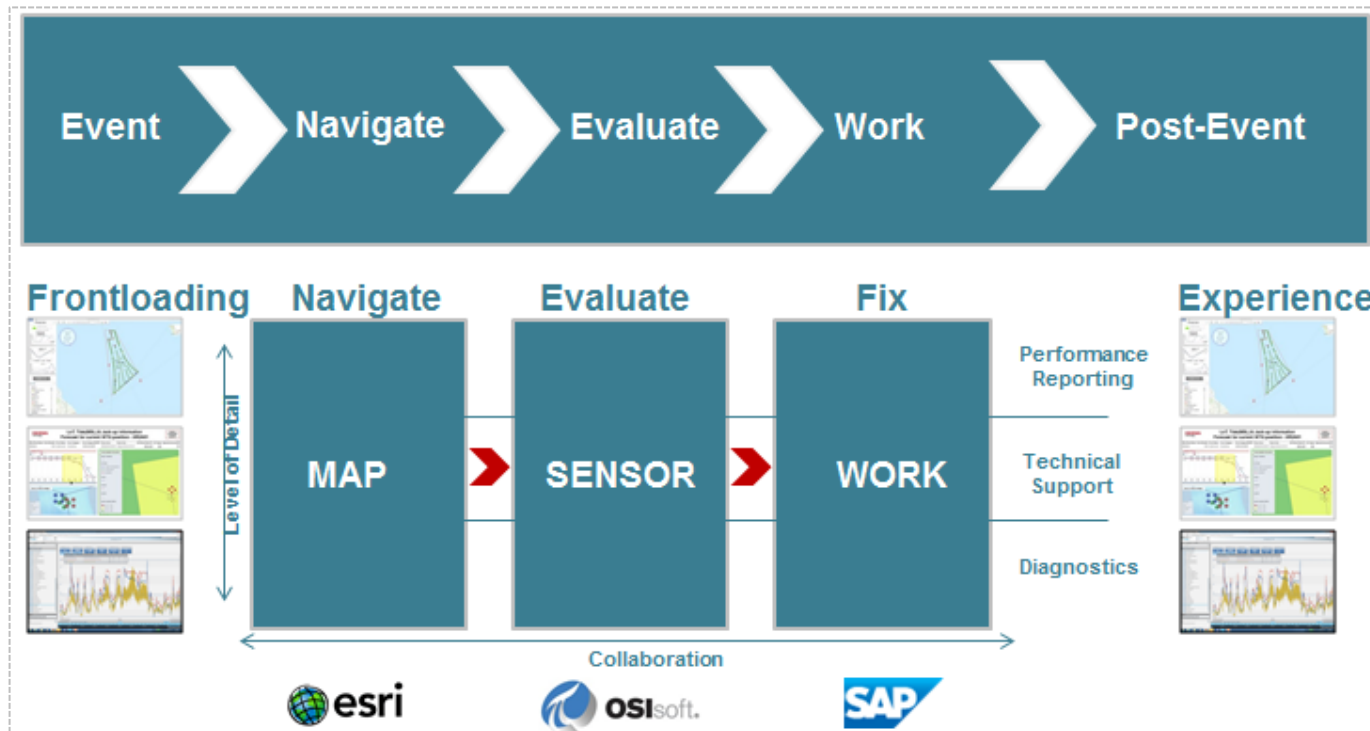
Transfer from crew vessels to wind turbine boat landings is the most dangerous operation in offshore wind
Working offshore is 15 times more expensive compared to similar work onshore

- Working offshore is one of the most dangerous workplaces in the world and any offshore organisation must have a strong focus on HSE
- Offshore activities are 15 times more costly than similar onshore activities and should be avoided if possible
- Lost production can be avoided by better logistical planning through access to production and spatial data on a map



Generic Workflow in Offshore Wind Power Operations

Reduced lead time and improved quality in decision making in index 1500 repair planning through frontloading



Key benefits

- Improved quality in reporting
- Fast decision making in Technical Support
- Improved data quality for Diagnostics

Supporting Line of Business in leveraging knowledge

Reduced lead time and improved quality in decision making in index 1500 repair planning through frontloading

Line of Business – Value creation through improved Business Processes

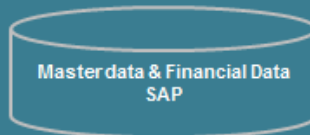
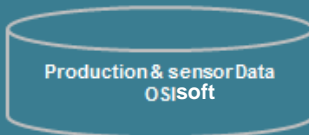
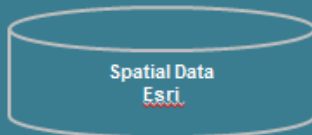


- INDEX 1500 OFFSHORE
- SAFETY
- LEADING EDGE

Business Process Support through data access



Data - Real time & Historic



Key benefits

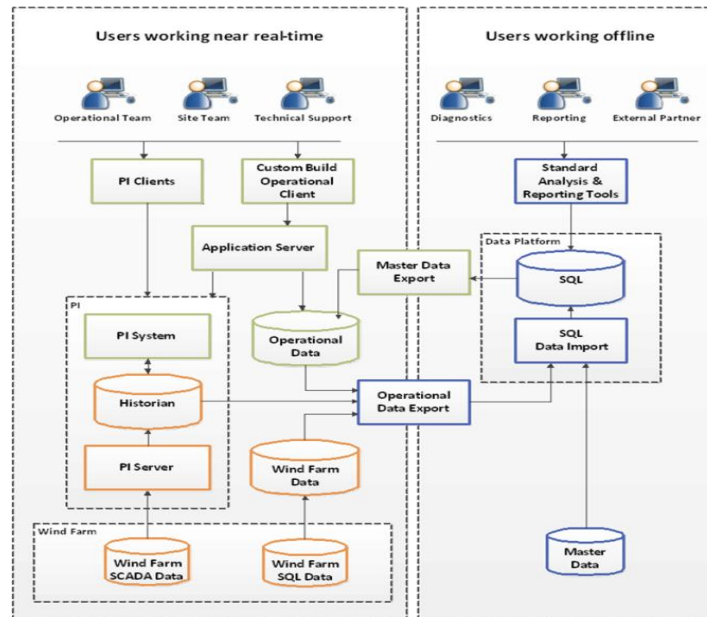
- Collaboration across platforms and data sources
- Transparent data flow
- Improved data accessibility for LoB

OSIsoft solution at DONG Energy

Scope & Architectural Vision

The scope of operational data project is split up in three overall areas

- The yellow part which represents the data collection platform, which purpose is to provide a reliable and scalable data collection.
- Then the blue part representing the analysis and reporting platform including the prioritized master data integrations, which will be the main source of data for the wind power organisation.
- Last part is the near real-time platform, which is planned to deliver operational data to the technical support and site teams.



Key benefits

- IEC
- RDSPP
- Quality

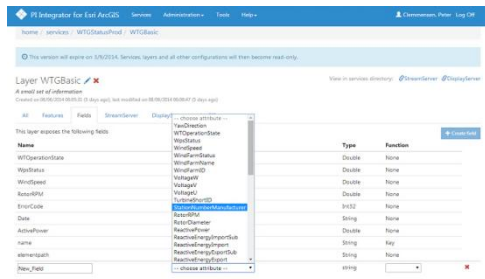
How to integrate Esri & OSIsoft platforms

Mapping and setting up the service as a part of the Esri-OSIsoft beta integrator project



Data

- Structured data sources



PI Geo

- Setup

Stream Service Layer WTGBaseHR2 (0)

Receiving data (193 features received)

- ☒ Use secure web socket
- ☒ Use bulk mode (JSON array)

```

{
  "ambtemp": 14,
  "wtoperationsstate": 0,
  "vpsstatus": 2,
  "windspeed": 13.600000381469727,
  "rotorrpm": 15,
  "reactivepower": -14,
  "generatorrpm": 1461,
  "frequency": 50,
  "errorcode": 0,
  "date": "09-09-2014 08:51:13",
  "averror": 0,
  "activepower": 2280,
  "name": "HRZL07",
  "retrievaltime": "2014-09-09T07:51:19.7677612Z"
},
{
  "geometry": {
    "x": 0,
    "y": 0
  }
}
  
```

Using Web socket URL: <ws://dong.pigeo.pipreview.com:80/api/services/WTGSFROMTEST/WTGSFROMTEST>

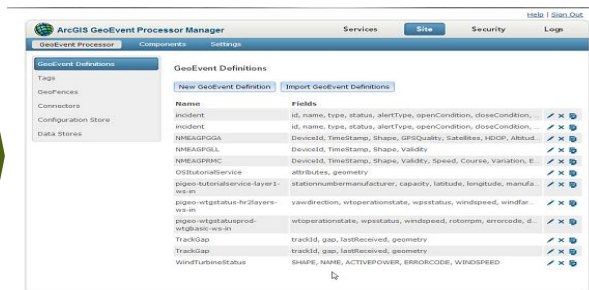
Using Web socket URL [SECURE]: <wss://dong.pigeo.pipreview.com:443/api/services/WTGSFROMTEST/WTGSFROMTEST>

PI Geo

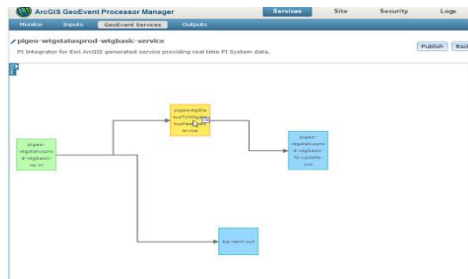
- Broad casting

How to integrate Esri & OSIsoft platforms

Connections & feature services



GeoEvent Processor
- Transport



GeoEvent Processor
- Transform & Distribute

Name	Status	In	Count	Rate (over last 5 mins)	Max Rate	Time Since Last
pigeo-wtstatusprod-wtstatusprod-ws-in	STARTED	In	626	0.00/sec	6.66/sec	4 days, 04:33:45
pigeo-wtstatusprod-wtstatusprod-ws-out	STARTED	Out	1672	0.00/sec	13.66/sec	4 days, 04:33:45
pigeo-wtstatusprod-wtstatusprod-ws-out	STARTED	In	3336160	44.80/sec	47.66/sec	00:00:00
pigeo-wtstatusprod-wtstatusprod-ws-out	STARTED	Out	6670216	89.59/sec	95.66/sec	00:00:00

Name	Status	Count	Rate (over last 5 mins)	Max Rate	Time Since Last
pigeo-wtstatusprod-wtstatusprod-ws-in	STARTED	626	0.00/sec	7.00/sec	4 days, 04:33:45
pigeo-wtstatusprod-wtstatusprod-ws-out	STARTED	4243014	44.81/sec	47.50/sec	00:00:01

Name	Status	Count	Rate (over last 5 mins)	Max Rate	Time Since Last
pigeo-wtstatusprod-wtstatusprod-ws-out	STARTED	2622	0.00/sec	6.62/sec	4 days, 00:00:40
pigeo-wtstatusprod-wtstatusprod-ws-out	STARTED	3676060	44.81/sec	47.50/sec	00:00:00
pigeo-wtstatusprod-wtstatusprod-ws-out	STARTED	4243660	44.81/sec	47.50/sec	00:00:00

GeoEvent Processor
- Monitor data getting through

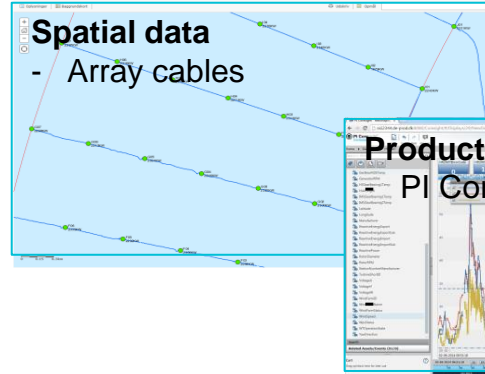


How to integrate Esri & OSIsoft platforms

Application, mobility & business process integration

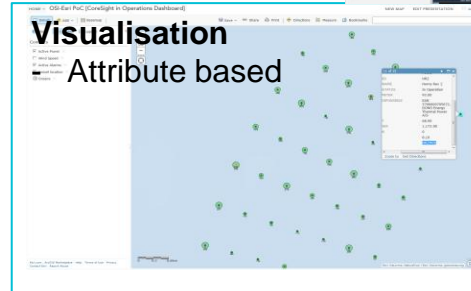
PI System data on a map

- Combine with other data sources



Production data

- PI Coresight



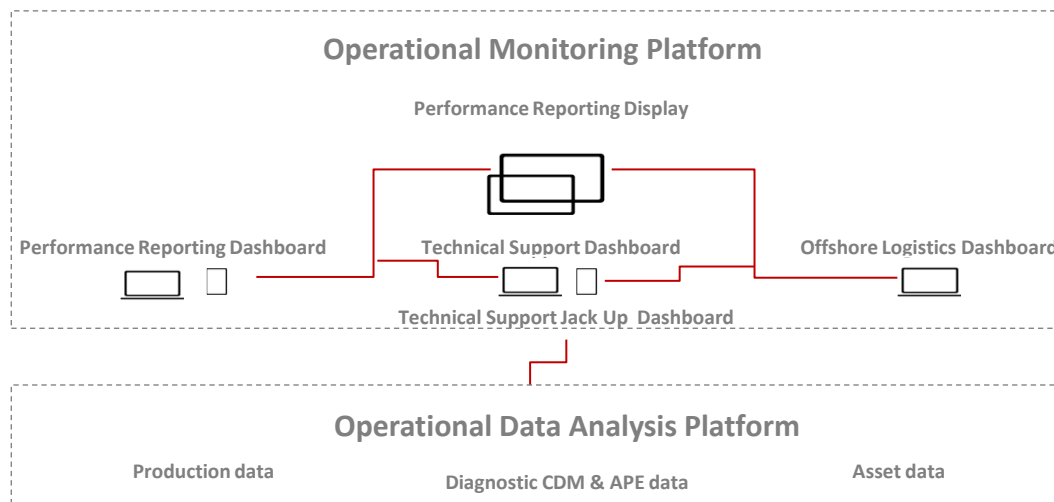
Mobility

- Mobile devices



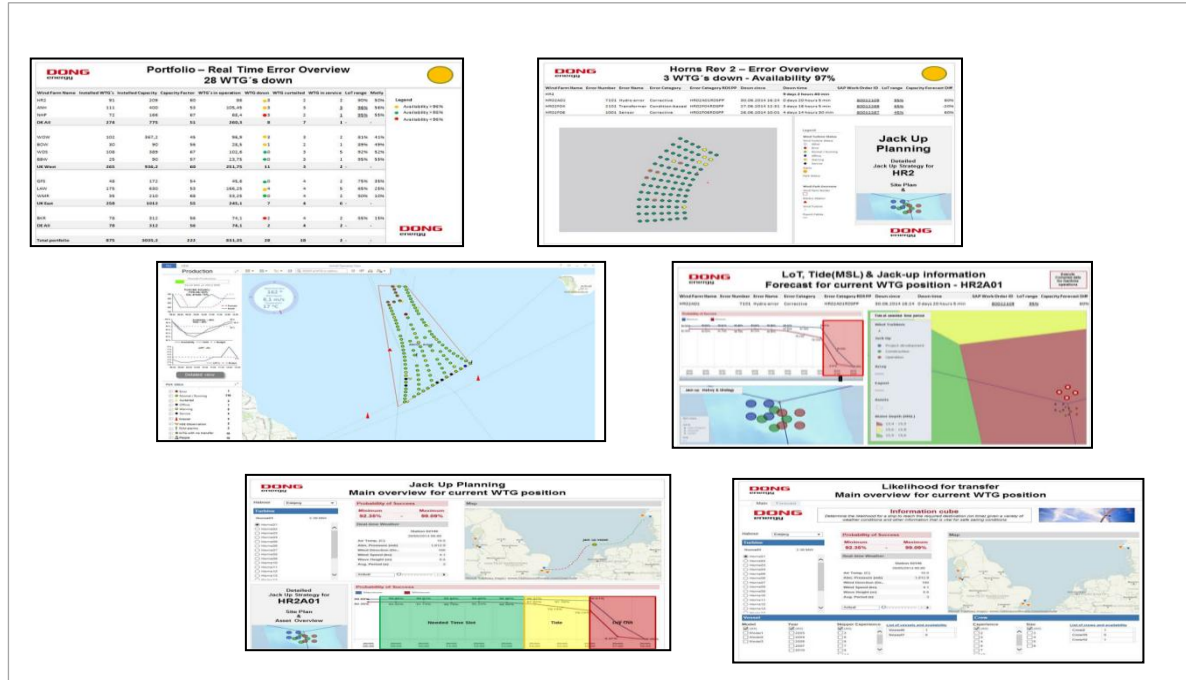
Vision Statement

Provide Line of Business access to operational data- *One truth*



Use Cases & Fast Prototyping

Investigation of To Be processes in relation to data needs and Line of Business access



Use Cases & Fast Prototyping: Asset Performance

Investigation of To Be processes in relation to data needs and Line of Business access

Improved Asset Integrity

- ✓ Overview of Portfolio
- ✓ Lost production
- ✓ Alarms
- ✓ Forecasts
- ✓ Capacity

DONGenergy

Portfolio – Real Time Error Overview

28 WTG's down

Turbine down log (last 7 days - most recent on top)	Wind Farm Name	WTG down	WTG In service	WTG curtailed	WTG's In operation	Capacity Factor	Intra day forecast	LoT range	Installed WTG's
HRD2A01 7101 Hydro error - 30.06.14 16:24	HR2	<div></div>	2	2	86	60	50%	90%	9
HRD2F04 2101 Transformer - 27.06.14 12:31	ANH	<div></div>	3	3	105	53	56%	96%	11
HRD2F06 1001 Sensor - 26.06.14 10:01	NHP	<div></div>	1	2	68	67	55%	95%	7
WOW02A01 7101 Hydro error - 30.05.14 16:24	DK All	8	1	7	260	51 -	-	-	27
WOW02F04 2101 Transformer - 27.05.14 12:31									
WOW 02F06 1001 Sensor - 26.05.14 10:01	WOW	<div></div>	2	3	97	45	41%	81%	10
BOWA01 7101 Hydro error - 15.05.14 16:24	BOW	<div></div>	1	2	29	56	49%	89%	3
BOW02F04 2101 Transformer - 13.05.14 12:31	WDS	<div></div>	5	3	103	67	52%	92%	10
BOW 02F06 1001 Sensor - 10.05.14 10:01	BBW	<div></div>	1	3	24	57	55%	95%	2
LAWA01 7101 Hydro error - 30.04.14 16:24	UK West	11	2	3	252	60 -	-	-	26
LAWF04 2101 Transformer - 27.04.14 12:31									
LAWF06 1001 Sensor - 26.04.14 10:01	GFS	<div></div>	2	4	46	54	35%	75%	4
GFS A01 7101 Hydro error - 15.04.14 16:24	LAW	<div></div>	5	4	166	53	25%	65%	17
GFS F04 2101 Transformer - 13.04.14 12:31	WMR	<div></div>	2	4	33	68	10%	50%	3
GFS F06 1001 Sensor - 10.04.14 10:01	UK East	7	6	4	245	55 -	-	-	25
ANH A01 7101 Hydro error - 15.04.14 16:24									
ANH F04 2101 Transformer - 13.04.14 12:31	BKR	<div></div>	2	4	74	56	15%	55%	7
ANH F06 1001 Sensor - 10.03.14 10:01	DE All	2	2	4	74	56 -	-	-	7
ANH F06 1001 Sensor - 08.03.14 10:02									
ANH F06 1001 Sensor - 07.03.14 10:02	Total portfolio	28	2	18	831,25	222 -	-	-	87
<div><div>Legend</div><div><div></div>Availability > 98%</div><div><div></div>Availability > 96%</div><div><div></div>Availability < 96%</div></div>									
<div><div>DONGenergy</div></div>									

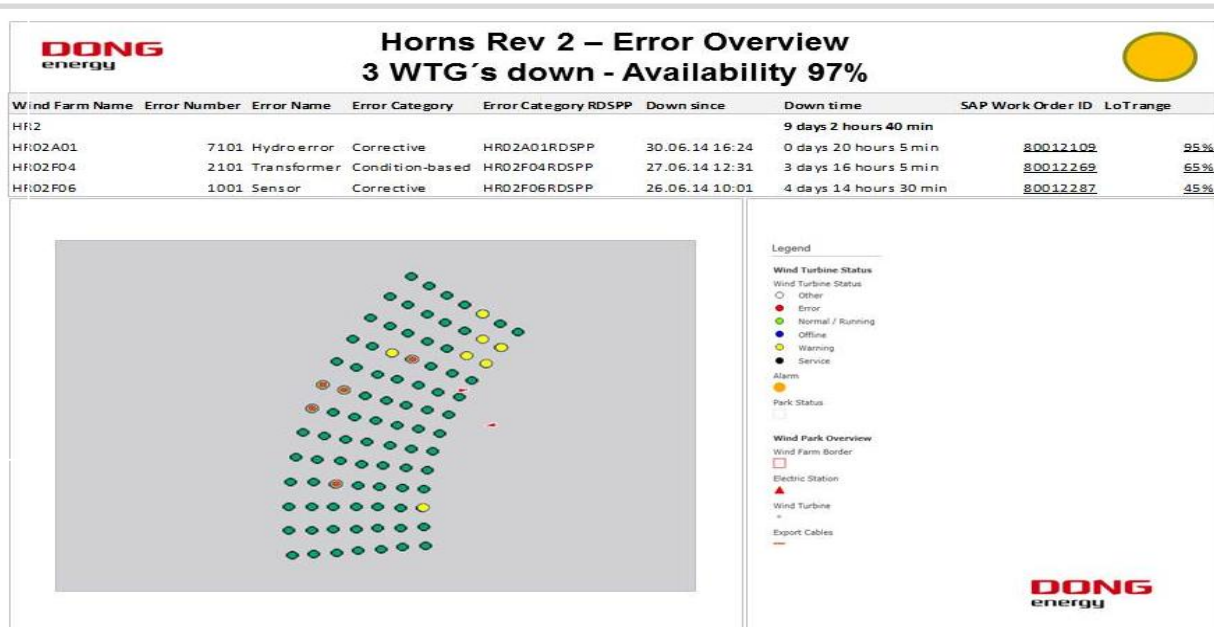
Use Cases & Fast Prototyping: Specific Asset Overview

Investigation of To Be processes in relation to data needs and Line of Business access

Improved Asset Integrity

- ✓ Overview of Portfolio
- ✓ Lost production
- ✓ Alarms
- ✓ Forecasts
- ✓ Capacity

+ Location



Use Cases & Fast Prototyping: Relevant Details

Investigation of To Be processes in relation to data needs and Line of Business access

Improved Asset Integrity

- ✓ Overview of Portfolio
- ✓ Lost production
- ✓ Alarms
- ✓ Forecasts
- ✓ Capacity

+ Time



Use Cases & Fast Prototyping: Corrective Maintenance

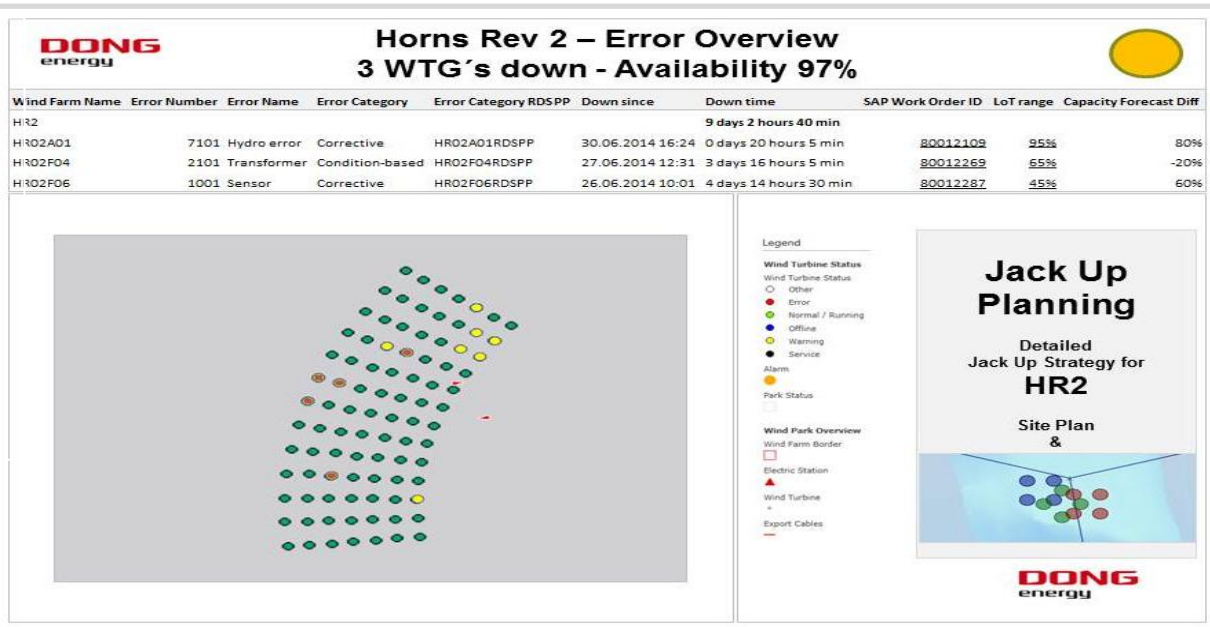
Investigation of To Be processes in relation to data needs and Line of Business access

Improved Asset Integrity

- ✓ Overview of Portfolio
- ✓ Lost production
- ✓ Alarms
- ✓ Forecasts
- ✓ Capacity

+ Time: operational data

+ Space: spatial data



Use Cases & Fast Prototyping: Maintenance Planning

Investigation of To Be processes in relation to data needs and Line of Business access

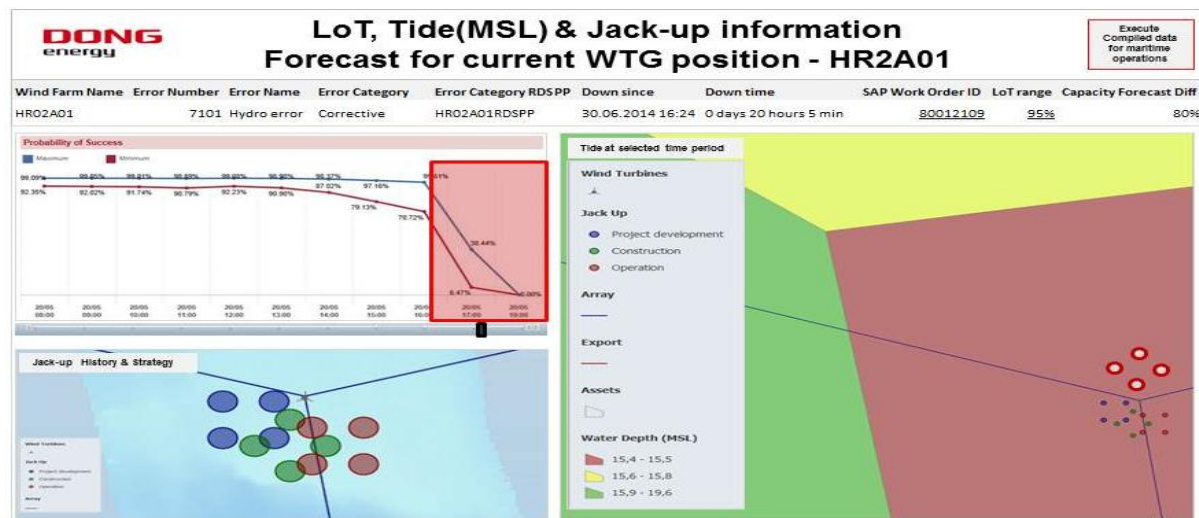
Improved Asset Integrity

- ✓ Overview of Portfolio
- ✓ Lost production
- ✓ Alarms
- ✓ Forecasts
- ✓ Capacity

+ Time: operational data

- + **Space: spatial data**

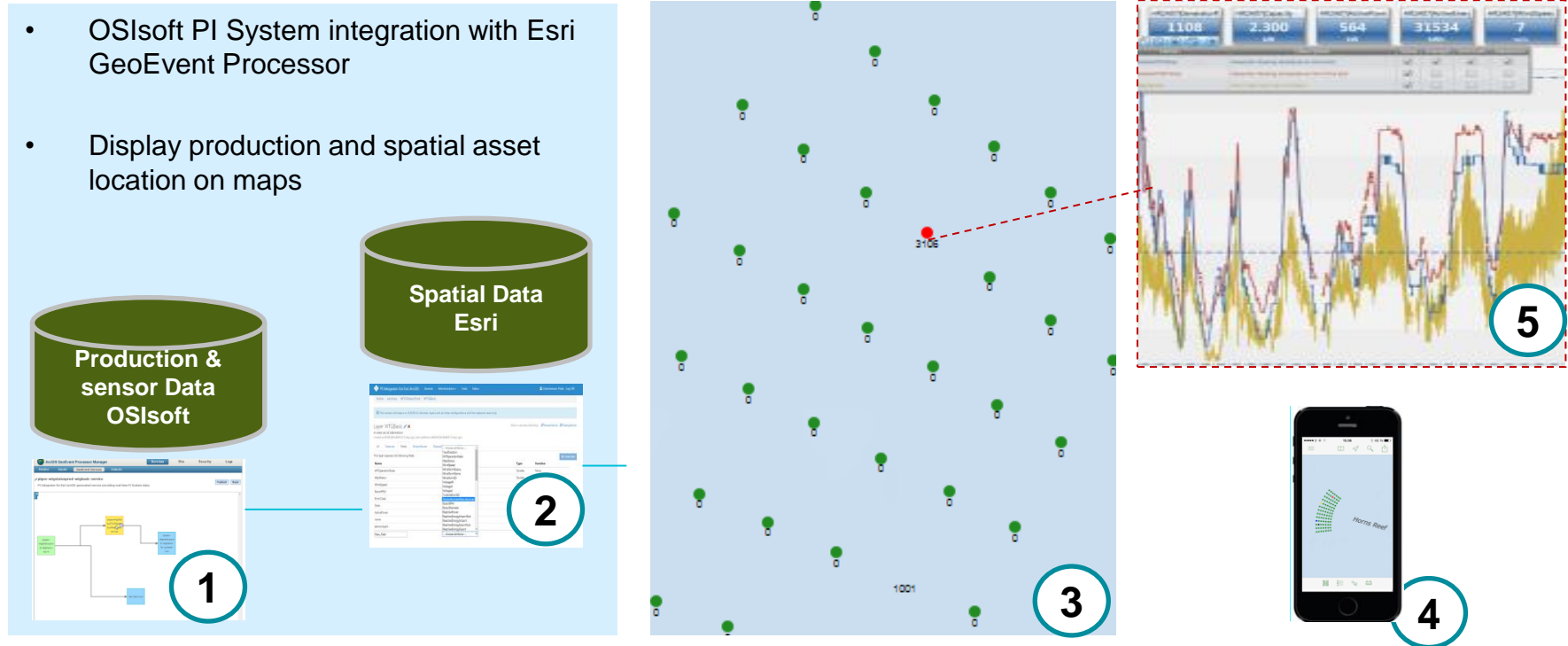
+ Planning on Facts, Findings & Forecasts



Portfolio Overview of through OSIsoft and Esri platforms

Will reduce HSE risk and OPEX cost through improved asset integrity

- OSIsoft PI System integration with Esri GeoEvent Processor
- Display production and spatial asset location on maps



Improved planning through spatial overview

4 unscheduled visits lowered to 2 per turbine / year will moderate HSE risk significant in offshore activities and can potentially reduce OPEX cost with up to ~20 EURm / year (NPV)

- Asset integrity improvements will reduce the total number of unscheduled visits to 1.800 offshore wind turbines in 2020
- Avoiding offshore maintenance visits due to better asset integrity and operational transparency will reduce HSE risk

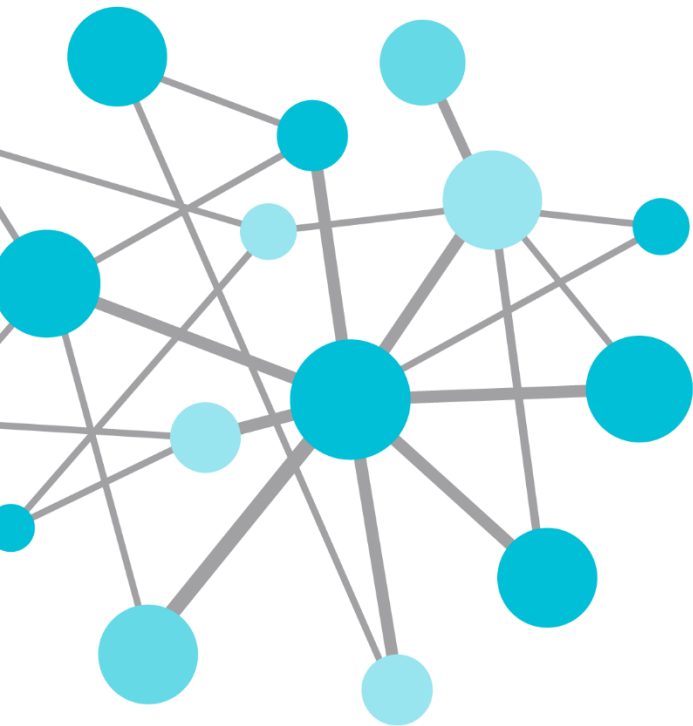


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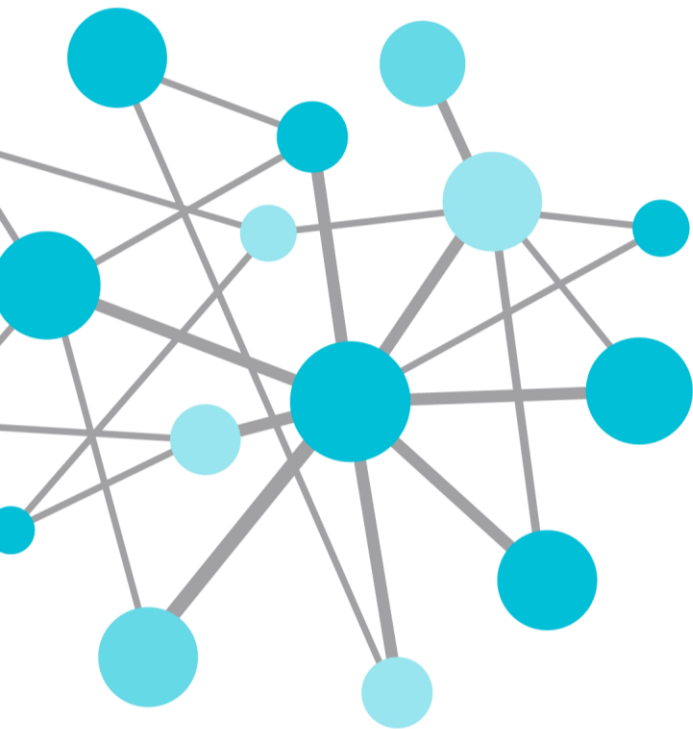


Questions

Please wait for
the **microphone**
before asking
your questions



State your
**name &
company**



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