



# Tecnología Aplicada a la Gestión de Activos:

# Autonomía y Sustentabilidad



Asociación  
Colombiana  
de Ingenieros

CIMGA 2023



# Visión



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Colombiana  
de Ingenieros



# Evolución de la Gestión de Activos



## Maintenance 1.0 CMMS

Reactivo. Correr hasta a fallar y, a continuación, corregir.



## Maintenance 2.0 CMMS and EAM

Mantenimiento preventivo por calendario y Registro de OT



## Maintenance 3.0 EAM

Mantenimiento basado en la condición: los sensores monitorean la condición y envían alertas.

Mantenimiento predictivo: basado en datos de sensores.



## Maintenance 4.0 APM

Mantenimiento predictivo: los algoritmos y los modelos de aprendizaje automático determinan cuándo fallará un activo.

Mantenimiento prescriptivo: diseña personas, procesos y herramientas para solucionar problema.



## Industry 5.0 Sustentabilidad y Autonomía

Robótica, máquinas inteligentes y humanos trabajando juntos, mejor y más rápido, aprovechando tecnologías avanzadas como IoT y big data en pos de la autonomía

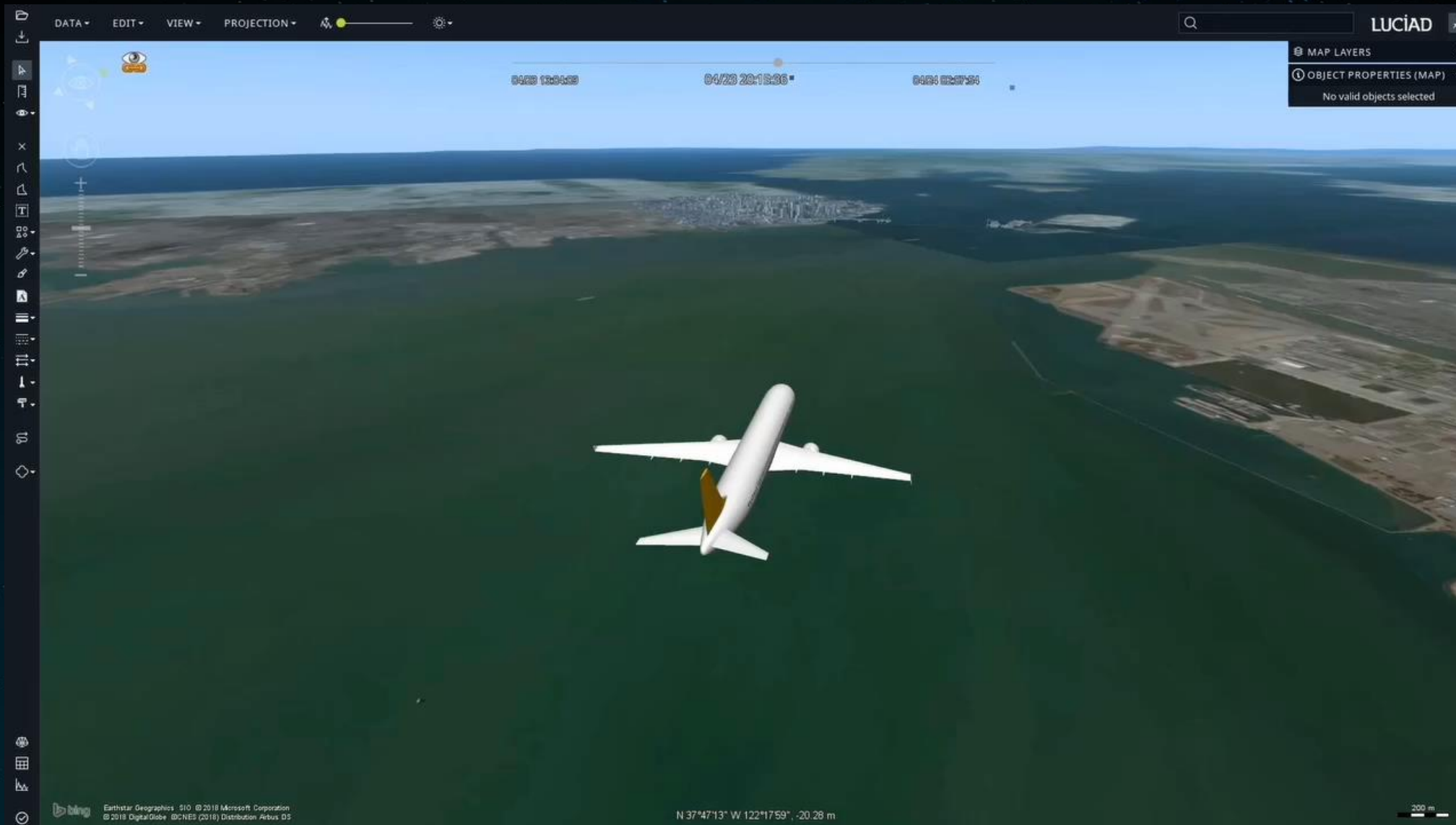
La Industria 5.0 expande los objetivos 4.0 al colocar seguridad, habilitación y tecnología para la sustentabilidad y la productividad en todas las industrias.



Fuente de definición: IndustryWeek 2<sup>nd</sup> June 2020 (Maintenance 1.0 – 4.0)  
Understanding the enterprise asset maintenance maturity model

Fuente de definición: Hexagon September 2021 (Industry 5.0)  
How Digitalization Drives Sustainable Transformation

# Hexagon desde un vistazo



# Nuestra Visión

## Nuestro enfoque es la **autonomía**

Aprovechar los datos al máximo de su potencial, yendo más allá de la automatización, hacia la autonomía



## Nuestro marco es la **Sustentabilidad**

Seguridad, eficiencia, productividad y calidad dan como resultado una sustentabilidad escalable

## Nuestro metodología es la **innovación**

Con casi 4,000 empleados en I+D y más de 3,700 patentes activas

## Nuestra estabilidad está **constantemente probada**

Crecimiento de las ventas de 500 millones de USD en 2,000 a 3,800 millones de USD en 2020 con aproximadamente 21,000 empleados en 50 países

Líder mundial en soluciones **de realidad digital** que están empoderando un futuro autónomo y sustentable al poner los datos a trabajar



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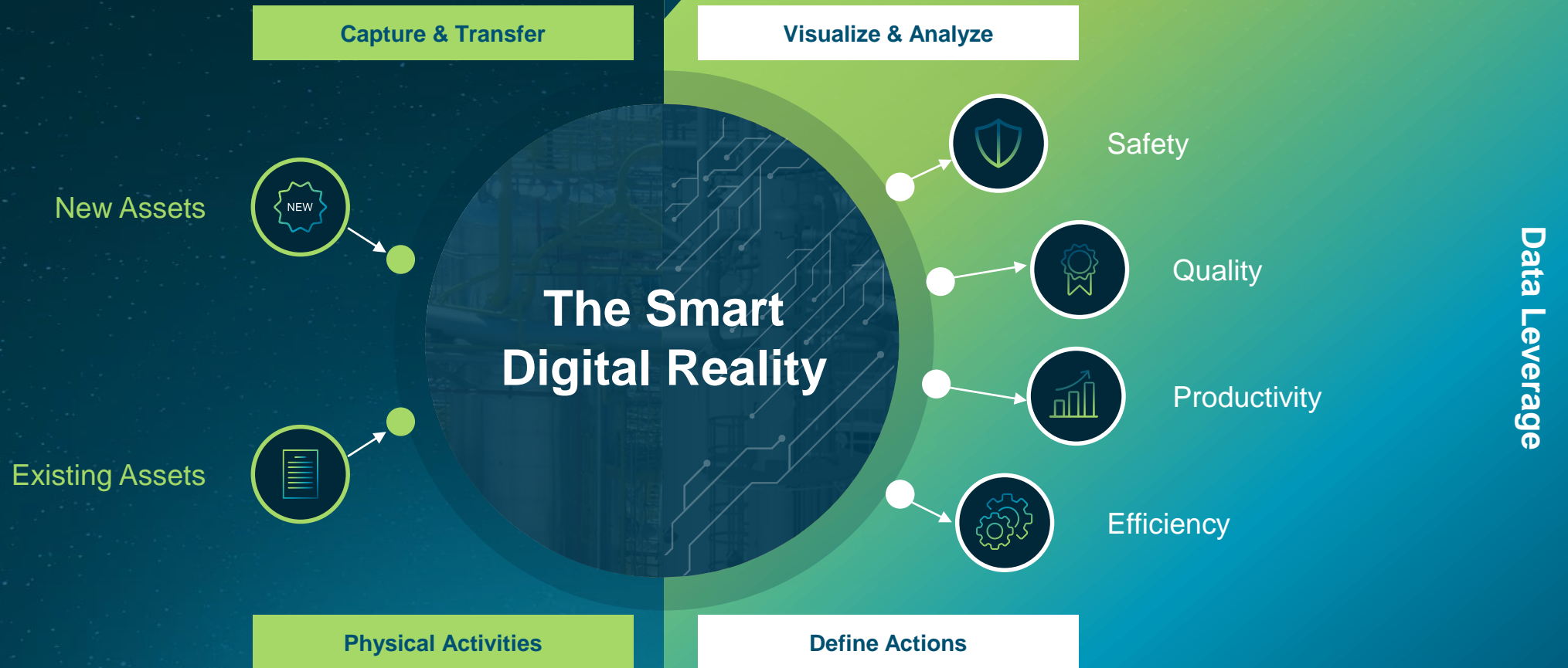


# Industrial Facilities – Realizing Value from Your Data

Autonomous Data Collection

## Mundo Real

## Gemelo Digital



# Nuestro Portfolio para la Gestión Inteligente del Ciclo de Vida de Activos



SAFETY



QUALITY



EFFICIENCY



PRODUCTIVITY

## Digital Projects

## Digital Assets

Plan	Design			Execute			Operate	Maintain			Secure
Portfolio & Project Planning	Conceptual Design	Detailed Engineering	Supply Chain	Fabrication	Construction	Operations Management	Environment, Health & Safety Risk	Maintenance Management	Asset Integrity & Reliability	Sustaining Engineering	OT / ICS Cybersecurity

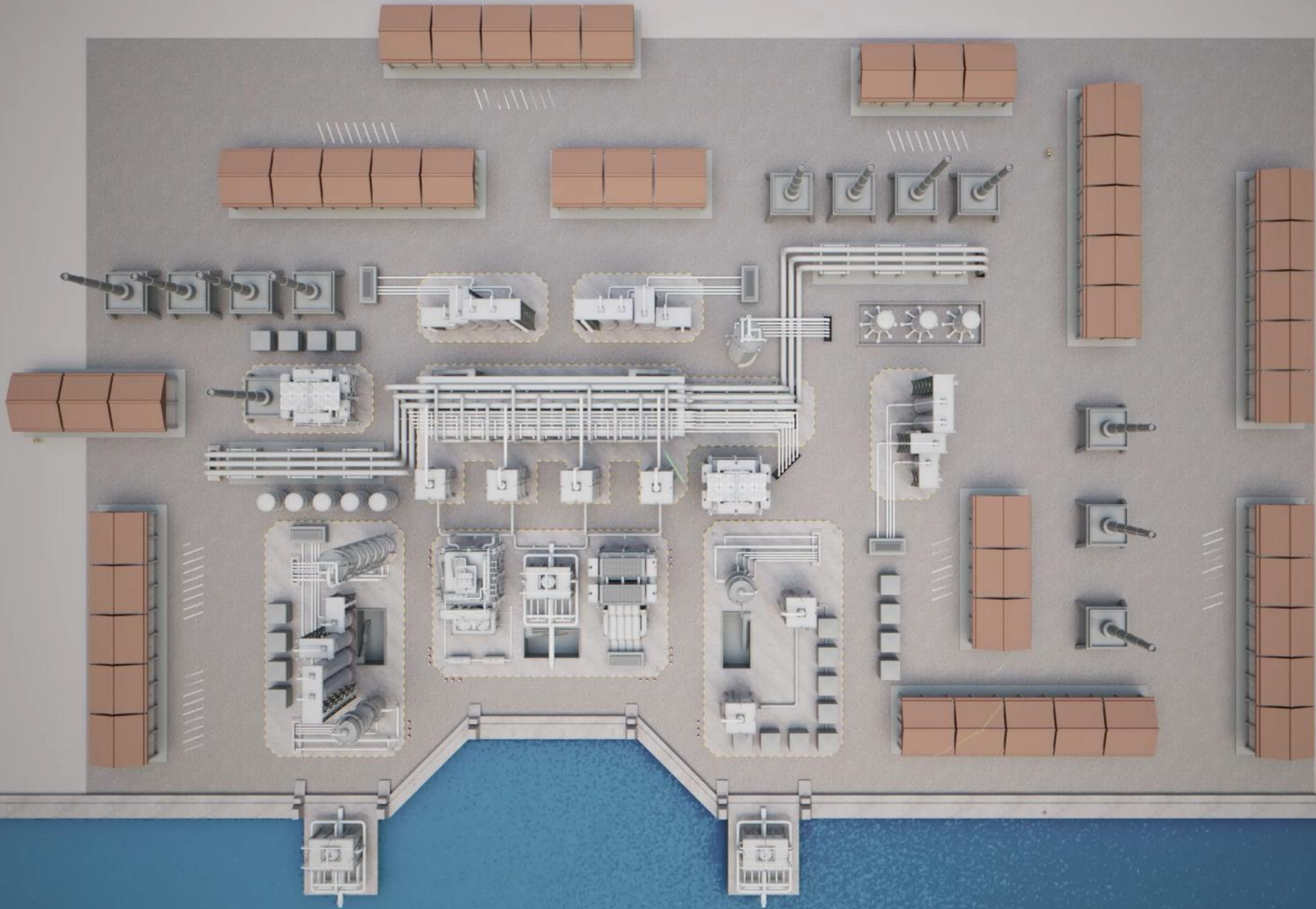
## Digital Backbone

Interoperability Connectors 	Common Data Environment 	Reality Capture 	Digitization 	Visualization 	Analytics 
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## Autonomy Enablers

Connected Worker 	Integration Middleware 	Cloud / SaaS 	Artificial Intelligence 	IIoT / Sensors 	Robots & Scanners 
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¿Que datos necesito?

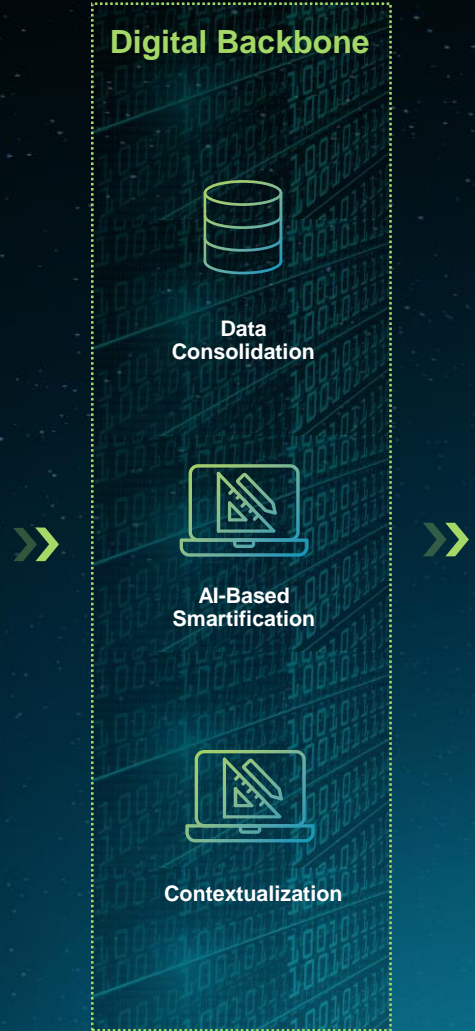
¿Que tengo que hacer hoy?

¿Que decisiones necesito tomar?

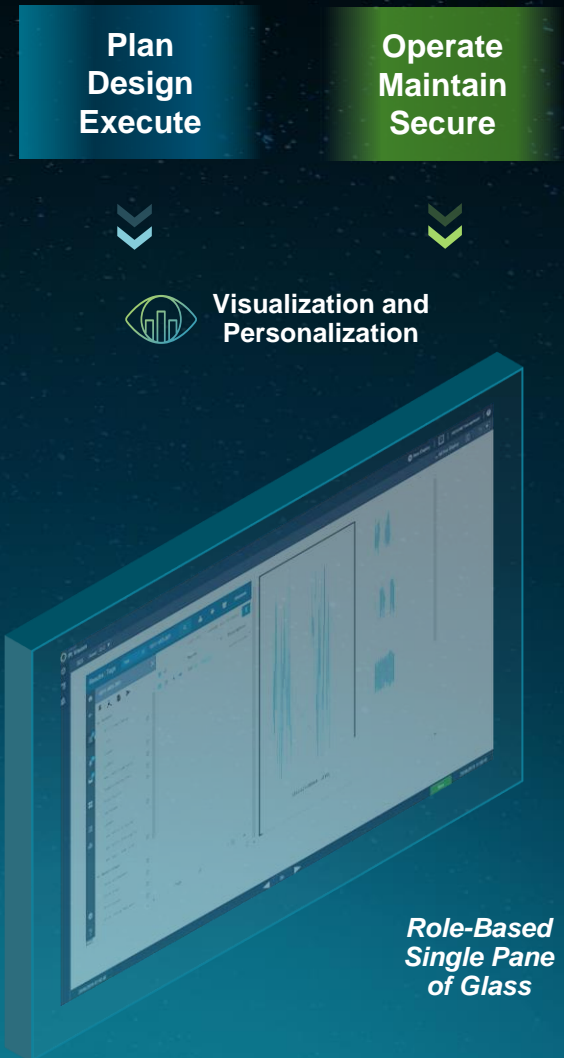
### Data Inputs

- Reality Capture Data
- Design & Engineering Data
- IIoT and Sensor Data
- Operational Data

### Digital Backbone



### Embedded Work Processes



### Decision Support Analytics



### Outcomes

- SAFETY
- EFFICIENCY
- QUALITY
- PRODUCTIVITY

# Presiones de la Industria que impactan a la Gestión de Activos



# Casos de Aplicación



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# Casos de aplicación, del modelo digital a la gestión de mantenimiento edilicio



# Casos de aplicación, interacción con el modelo digital de una planta



# Casos de Aplicación – Permisos de Trabajo en modelo Digital

Assets
WATER (ITSGDNA054\_DEM) Org: USCAE Group/User: 2020/JBARWICK

00067333 Pump, centrifugal

Record View Comments Structure Details Events Costs PM Schedules LOTO Safety Permits Reliability Calculations Documents OC BIM

OpenCAD BIM 11.71.1

IFC models

Tree view

Class View

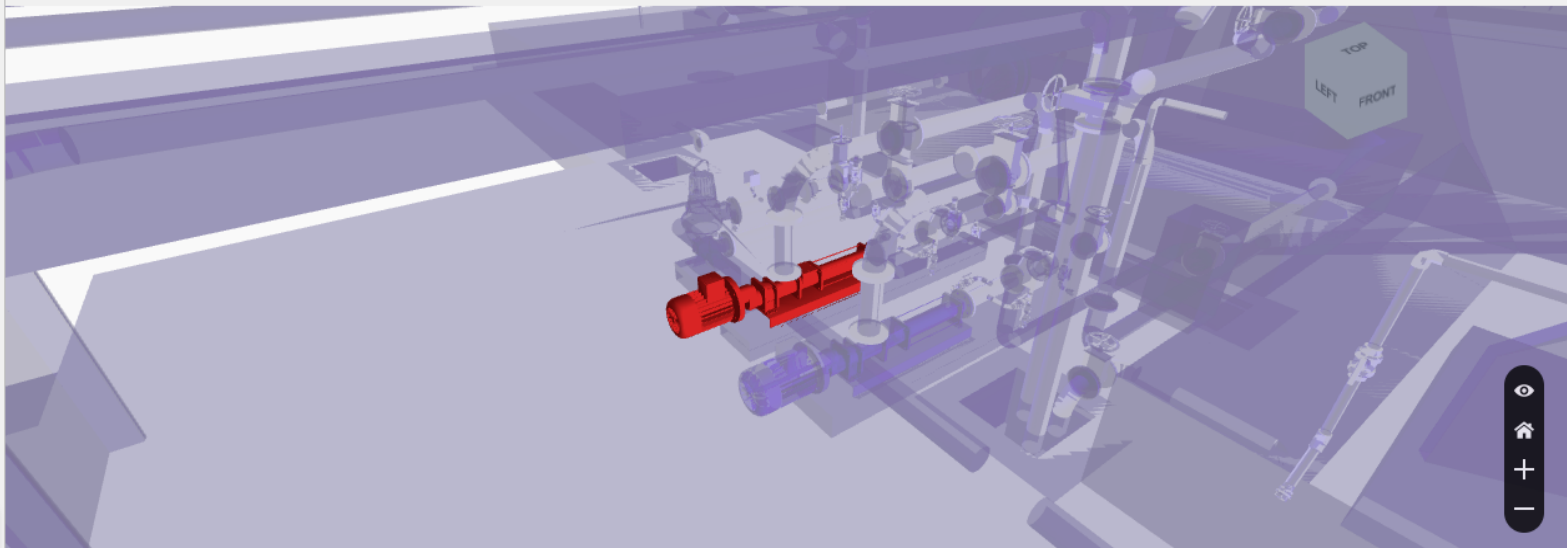
- ▶ EDC 4
- ▶ EDC 3
- ▶ EDC 2
- ▶ BPR-201-123
- ▶ APR-203-101
- ▶ EDR 5
- ▶ APR-203-131
- ▶ APR-203-121
- ▶ APR-203-111

HxGN EAM code:: # 00067333

Parent object

Element details

Attribute	Value
▼ p_set:	
AssetName	203-BPR-PV-120



Equipment

ExtId 1048490

00067333 Pump, centrifugal:

Status: Installed

Type: Asset

Department: Columbia Water Plant

Category: Centrifugal Pump

Safety:

Out of Service:

Asset details

Create work order

View Non-conformity

Work order list

Permit to work

8 Work Orders

AM Code	Description	Class	Criticality	Department	Type	
067333	Pump, centrifugal	001270	03	Columbia Water Plant	A	<input type="checkbox"/>
067334	Pump, centrifugal	001270	03	Columbia Water Plant	A	<input type="checkbox"/>
167347	C-Valve, isolation	P00012	03	Columbia Water Plant	A	<input type="checkbox"/>
1049150	USCAE Valve, isolation	00167399	03	Columbia Water Plant	A	<input type="checkbox"/>
127	USCAE The Water Treatment Plant	001-00167037		Columbia Water Plant	S	<input type="checkbox"/>

Page 1 of 1

Displaying topics 1 - 5 of 5

Start Center
Assets
PM Schedules
Parts
Standard WOs
Systems
Work Orders

# Casos de Aplicación – Permisos de Trabajo Digitales

Work Materials Equipment Purchasing Operations Administration PTW Dashboard

PTW - DATA ANALYSIS

PTW Type

- Cold
- Hot

PTW - Data Analysis

Screen Map: STO-DT-0007-08\_PLOT\_PLAN-STO\_GENERAL.SVG

PTW	PTW description	Status	Permit Type	Data required	Equipment	Equipment description	LOTO certificate	LOTO cert. description	Loto Type	Isolation Point	Isp Desc	Isp Method	Isp Type	Type	JSA
10000	Tank cleaning	Unfinished	Cold		TK-101-01	Tanque 101-01	M-LOTO: 10015 - E-LOTO: 10014	-	-	-	-	-	-	PTW	
10000	-	-	-		ADI-300-3	ADI-300-3	10015	Example M-LOTO Certificate (10001)	M-LOTO	ISO-000003	Aditivacion y Solplado, ...	M-SPADED	Clamp	ISO	
10000	-	-	-		ADI-300-1	ADI-300-1	10015	Example M-LOTO Certificate (10001)	M-LOTO	ISO-000001	Aditivacion y Solplado, ...	M-BLIND-INSTAL	Switch	ISO	
10000	-	-	-		M-931-01-02	Motor 01, MOV 02, Tank Slops,STO	10014	Example E-LOTO Certificate (10023)	E-LOTO	ISO_006174	Motor 01, MOV 02, Ta...	E-ISOLATED	Switch	ISO	
10000	-	-	-		LI-931-01-02	Indicador de Nivel 02, Tank Slops,STO	10014	Example E-LOTO Certificate (10023)	E-LOTO	ISO-005446	Indicador de Nivel 02, ...	E-ISOLATED	Switch	ISO	
10004	Cambiar el aceite de lubricac...	Ready for Auth...	Hot	25-May-2018	TK-101-08	TK-101-08	M-LOTO: - E-LOTO: 10014	-	-	-	-	-	-	PTW	
10004	-	-	-		M-931-01-02	Motor 01, MOV 02, Tank Slops,STO	10014	Example E-LOTO Certificate (10023)	E-LOTO	ISO_006174	Motor 01, MOV 02, Ta...	E-ISOLATED	Switch	ISO	
10004	-	-	-		LI-931-01-02	Indicador de Nivel 02, Tank Slops,STO	10014	Example E-LOTO Certificate (10023)	E-LOTO	ISO-005446	Indicador de Nivel 02, ...	E-ISOLATED	Switch	ISO	



# Casos de Aplicación – Permisos de Trabajo Digitales

Work Materials Equipment Purchasing Operations Administration PTW Dashboard

PTW - DATA ANALYSIS

PTW Type

- Cold
- Hot

ISOLATION

- M-LOTO (hot)
- E-LOTO (hot)
- M-LOTO (hot)
- E-LOTO (hot)

PTW - Data Analysis

Screen Map: STO-DT-0007-08\_PLOT\_PLAN-STO\_GENERAL.SVG

Refresh Clear Filter

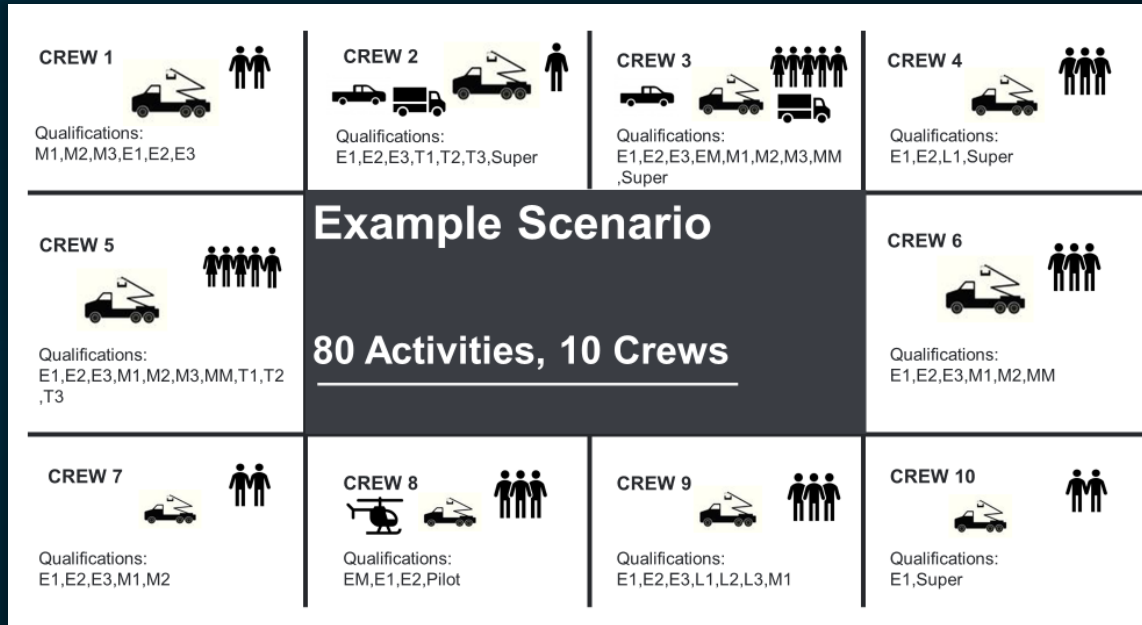
PTW	PTW description	Status	Permit Type	Data required	Equipment	Equipment description	LOTO certificate	LOTO cert. description	Loto Type	Isolation Point	Isp Desc	Isp Method	Isp Type	Type	JSA
10000	Tank cleaning	Unfinished	Cold		TK-101-01	Tanque 101-01	M-LOTO: 10015 - E-LOTO: 10014	-	-	-	-	-	-	PTW	
10000	-	-	-		ADI-300-3	ADI-300-3	10015	Example M-LOTO Certificate (10001)	M-LOTO	ISO-000003	Adivivacion y Solplado, ...	M-SPADED	Clamp	ISO	
10000	-	-	-		ADI-300-1	ADI-300-1	10015	Example M-LOTO Certificate (10001)	M-LOTO	ISO-000001	Adivivacion y Solplado, ...	M-BLIND-INSTAL...	Switch	ISO	
10000	-	-	-		M-931-01-02	Motor 01, MOV 02, Tank Slops,STO	10014	Example E-LOTO Certificate (10023)	E-LOTO	ISO_006174	Motor 01, MOV 02, Ta...	E-ISOLATED	Switch	ISO	
10000	-	-	-		LI-931-01-02	Indicador de Nivel 02, Tank Slops,STO	10014	Example E-LOTO Certificate (10023)	E-LOTO	ISO-005446	Indicador de Nivel 02, ...	E-ISOLATED	Switch	ISO	
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10004	-	-	-		M-931-01-02	Motor 01, MOV 02, Tank Slops,STO	10014	Example E-LOTO Certificate (10023)	E-LOTO	ISO_006174	Motor 01, MOV 02, Ta...	E-ISOLATED	Switch	ISO	
10004	-	-	-		LI-931-01-02	Indicador de Nivel 02, Tank Slops,STO	10014	Example E-LOTO Certificate (10023)	E-LOTO	ISO-005446	Indicador de Nivel 02, ...	E-ISOLATED	Switch	ISO	

# Casos de Aplicación : Modelo Digital de Optimización de Recursos

Setup (HxGN EAM)

Optimize

Results (EAM)



Optimized Scheduler

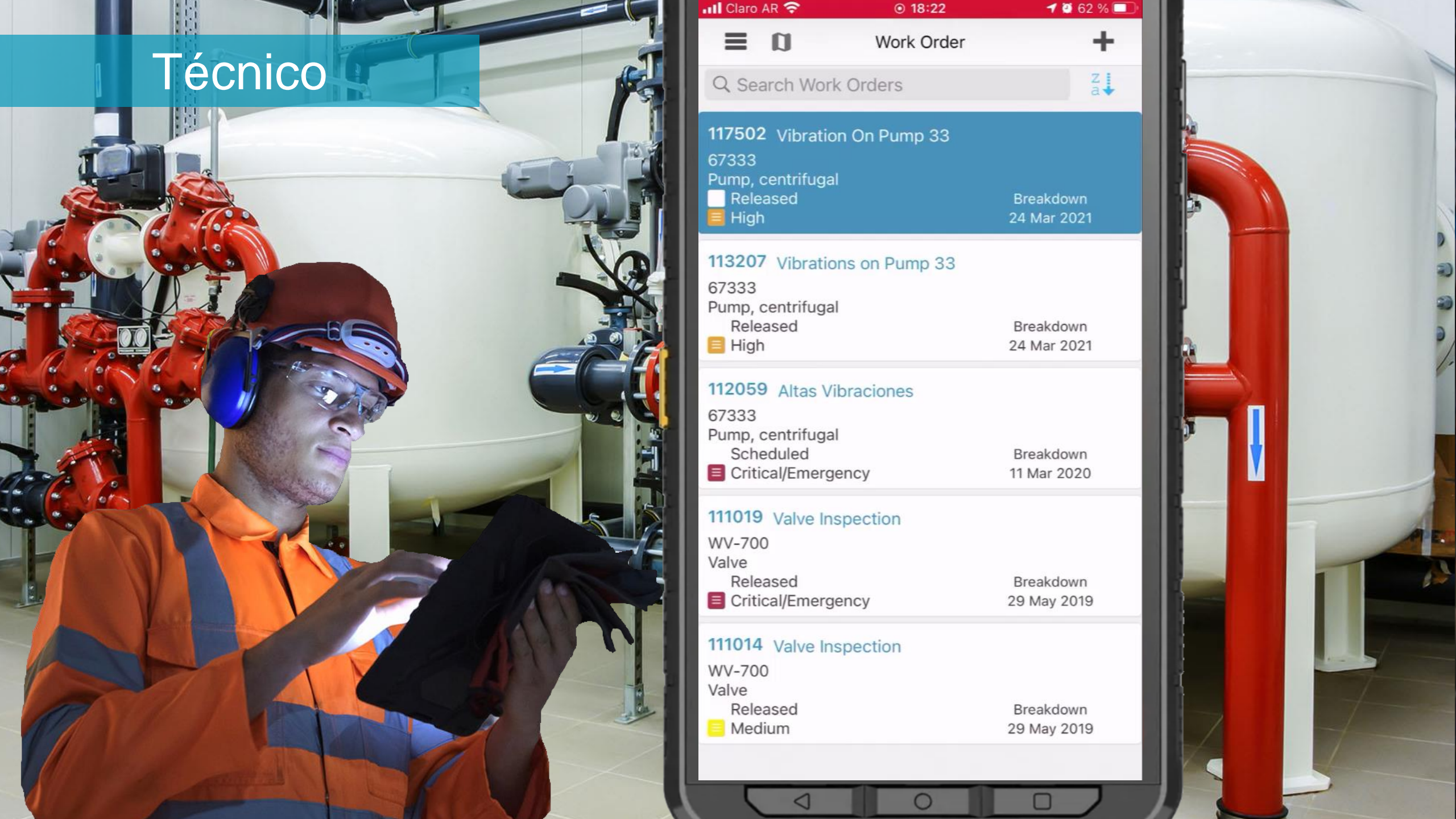
## Schedule

- Crew 1
  - Activity A
  - Activity B
- Crew 2
  - Activity C
  - Activity B

## Unassigned Activities

- Activity X
- Activity Y

# Técnico



Claro AR 18:22 62 %

Work Order

Search Work Orders

<b>117502</b> Vibration On Pump 33 67333 Pump, centrifugal Released High	Breakdown 24 Mar 2021
<b>113207</b> Vibrations on Pump 33 67333 Pump, centrifugal Released High	Breakdown 24 Mar 2021
<b>112059</b> Altas Vibraciones 67333 Pump, centrifugal Scheduled Critical/Emergency	Breakdown 11 Mar 2020
<b>111019</b> Valve Inspection WV-700 Valve Released Critical/Emergency	Breakdown 29 May 2019
<b>111014</b> Valve Inspection WV-700 Valve Released Medium	Breakdown 29 May 2019

# Caso de Aplicación: Modelo Digital de Activos Lineales

Assets

Assets

WATER (ITSGDENA054\_DEM) Org: USCAE Group/User: 3010/CSAUNDERS

672579 Water Main from WN-756 to WN-703

Search within All Assets

Record View Comments Events **Linear Overview** PM Schedules Work Order Checklists Rankings Impacted Connections Documents

672579 - Water Main from WN-...  
Status: Installed  
Department: WTR01  
Assigned To:

672580 - Water Main from WV-...  
Status: Installed  
Department: WTR01  
Assigned To:

672581 - Water Main from WN-...  
Status: Installed  
Department: WTR01  
Assigned To:

672582 - Water Main from WV-...  
Status: Installed  
Department: WTR01  
Assigned To:

672596 - Water Main from WV-...  
Status: Installed  
Department: WTR01  
Assigned To:

672603 - Water Main from WV-...  
Status: Installed  
Department: WTR01  
Assigned To:

672605 - Water Main from WN-...  
Status: Installed  
Department: WTR01  
Assigned To:

672606 - Water Main from WN-...  
Status: Installed  
Department: WTR01  
Assigned To:

Work Orders Open Work Orders Edit Effective: 06/10/2022

Reference	0	12.9591	25.9182	38.8773	51.8364	64.7955	77.7546	90.7137	103.6728	116.6319
Linear References										
Points of Interest										
Condition Index				(4) Good/3.9					(5) Excellent/4.98	
Criticality Index				Low/122					Low/122	
Risk Priority Index				Low /5					Low /5	
Related Equipment										
Water Service Line		🏠							🏠	
Related Parts										
Work Orders										
118614										Planned Pipe Repair

Start Center Assets Call Center GIS Map Search Optimized Scheduler Setup Parts Systems Work Orders

# Caso de Aplicación: Modelo Digital de Activos Lineales

The screenshot displays the Infor EAM (Enterprise Asset Management) software interface. The main window shows the details for an asset named 'Track-GEO-508B' with ID '7811-312'. The interface is organized into several sections:

- Header:** 'infor EAM' logo and 'Assets' menu. Search bar with 'Start Typing' and user profile 'Aline Johnston'.
- Asset Identification:** Asset ID: 7811-312, Track-GEO-508B. Department: YVR02, Organization: CAYVR, Class: 400-7811.
- Record View:** A horizontal menu with tabs for Record View, Tech Details, Events, Structure Details, Costs, Statistical Failure Data, Reliability Calculations, RCM, Rankings, Ranking Survey, and Documents.
- Equipment Details:** Fields for Class (400-7811), Category (LR), Cost Code, and Manufacturer (SFTTR). Includes 'Est Replace Value' (10,000.00) and 'Replacement Value'.
- GIS Details:** Location information including GIS ID (100,001,170), Map (CAYVR), Map Org. (CAYVR), Profile (400-7811-YVR), Layer (SpoorProRail), Location X (189,511.218491), and Location Y (444,331.239639).
- Other Sections:** Tracking Details, Part Association, Risk and Reliability - RCM Details, and Documents.

# Caso de Aplicación: Digitalización de Manuales de Fabricantes

Assets

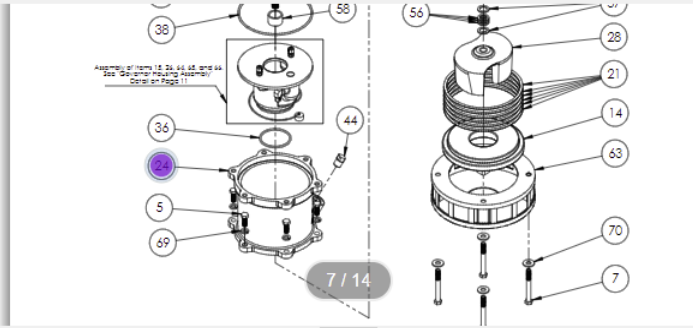
Work Orders

36102 Sludge Pump PM

36102 - Sludge Pump PM  
Equip/Location: T101-PMP-SLD-01  
Equipment Descri... Sludge Pump #102  
Status: Assigned

Record View Activities x Material x Schedule Labor x Cost Summary x Permits x Book Labor x Closing x Safety x Checklist x **OpenCAD XBrowser x** More v

7 / 14



Material List

...	Item ID	Part number	Part description	Page	UM	Activity	Store	Bin	Lot	Available Qty	QTY	Plan. Qty	Res. Qty
	1	070.002.000	Bearing, Ball	7	EA	10	MA-1	B5	*	7	0	0	0
	9	180.002.155	Volute	7	EA	10	MA-1	B1	*	9	0	0	0
	10	200.004.330	Clamp, Muffler	7	EA	10	MA-1	B6	*	15	0	0	0
	11	200.005.115	Clamp, Hose	7	EA	10	MA-1	B2	*	11	0	0	0
	13	255.001.000	Coupling, Flexible	7	EA	10	MA-1	B7	*	14	0	0	0
	24	430.007.155	Housing, Intern...	7	EA	10	MA-1	B3	*	5	0	0	0
	26	430.009.155	Housing, Governor	7	EA	10	MA-1	B8	*	19	0	0	0
	27	430.010.150	Housing, Bearing	7	EA	10	MA-1	B4	*	2	0	0	0
	28	444.002.010	Impeller	7	EA	10	MA-1	B9	*	3	0	0	0

WO activity: 10 Check out

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Drawings List

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# Caso de Aplicación: Digitalización de Manuales de Fabricantes

Assets

Work Orders

36102 Sludge Pump PM

Record View Activities x Material x Schedule Labor x Cost Summary x Permits x Book Labor x Closing x Safety x Checklist x OpenCAD XBrowser x

Search within All Open Work

36102 - Sludge Pump PM  
Equip/Location: T101-PMP-SLD-01  
Equipment Descri... Sludge Pump #102  
Status: Assigned

Material List

Item ID	Part number	Part description	Page	UM	Lot	Available Qty	QTY	Plan. Qty	Res. Qty
1	070.002.000	Bearing, Ball	7	EA	*	7	0	0	0
9	180.002.155	Volute	7	EA	*	9	0	0	0
10	200.004.330	Clamp, Muffler	7	EA	*	15	0	0	0
11	200.005.115	Clamp, Hose	7	EA	*	11	0	0	0
13	255.001.000	Coupling, Flexible	7	EA	*	14	0	0	0
24	430.007.155	Housing, Intern...	7	EA	*	5	0	0	0
26	430.009.155	Housing, Governor	7	EA	*	19	0	0	0
27	430.010.150	Housing, Bearing	7	EA	*	2	0	0	0
28	444.002.010	Impeller	7	EA	*	3	0	0	0

Material List - Issue / Plann... X

Part number: 430.007.155  
Part description: Housing, Intermediate  
Store: MA-1  
Bin: B3  
Lot: \*  
Available QTY: 5  
WO activity: 10

Issue  Planning

Issue Quantity: 0

Cancel Continue

WO activity: 10 Check out

Page 1 of 1

Displaying topics 1 - 9 of 9

Start Center Assets Calibrated Equipment PM Schedules Parts Positions Projects Systems Work Orders

# Foco en la Sustentabilidad



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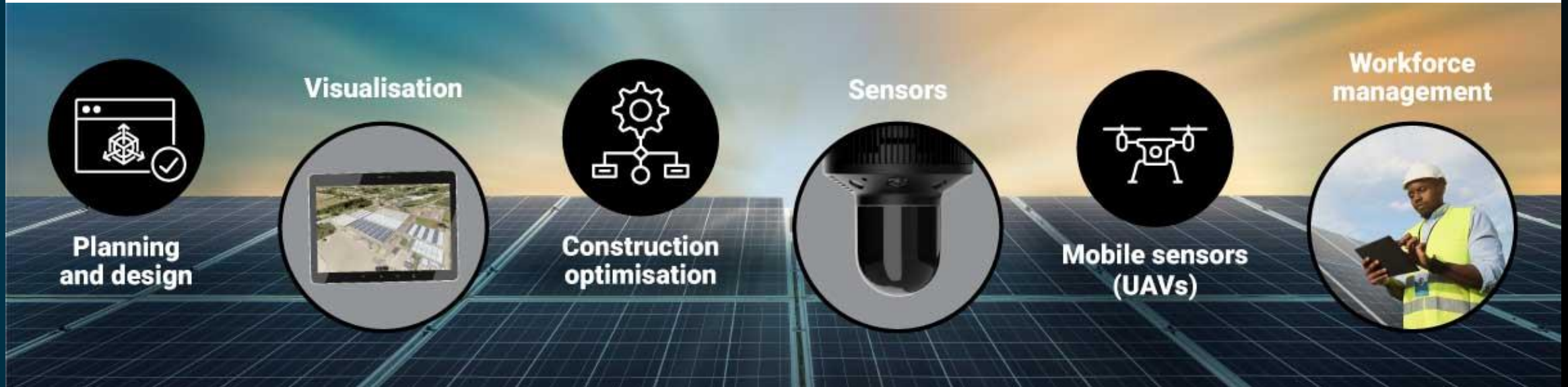


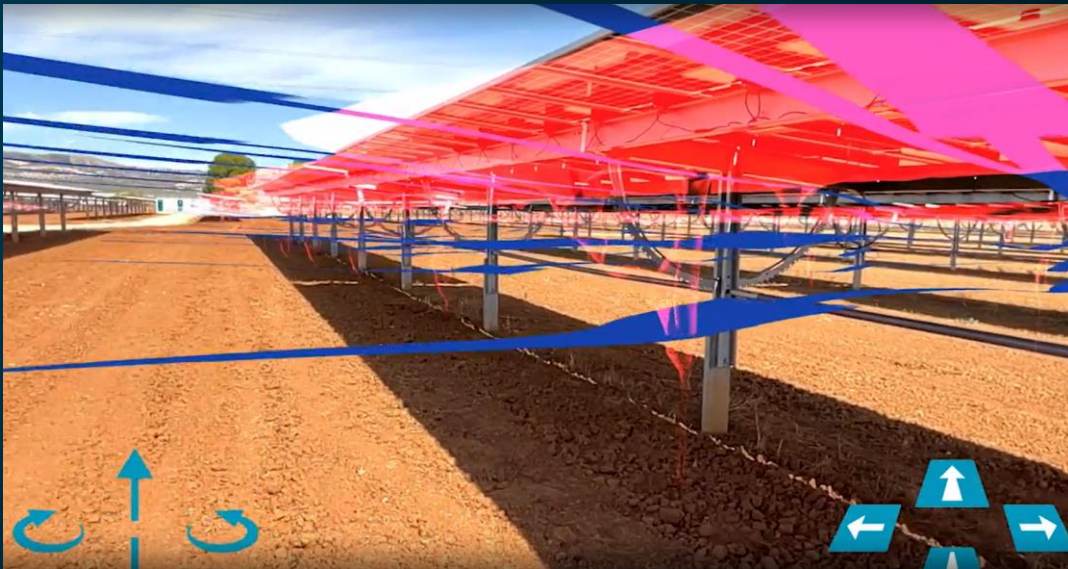
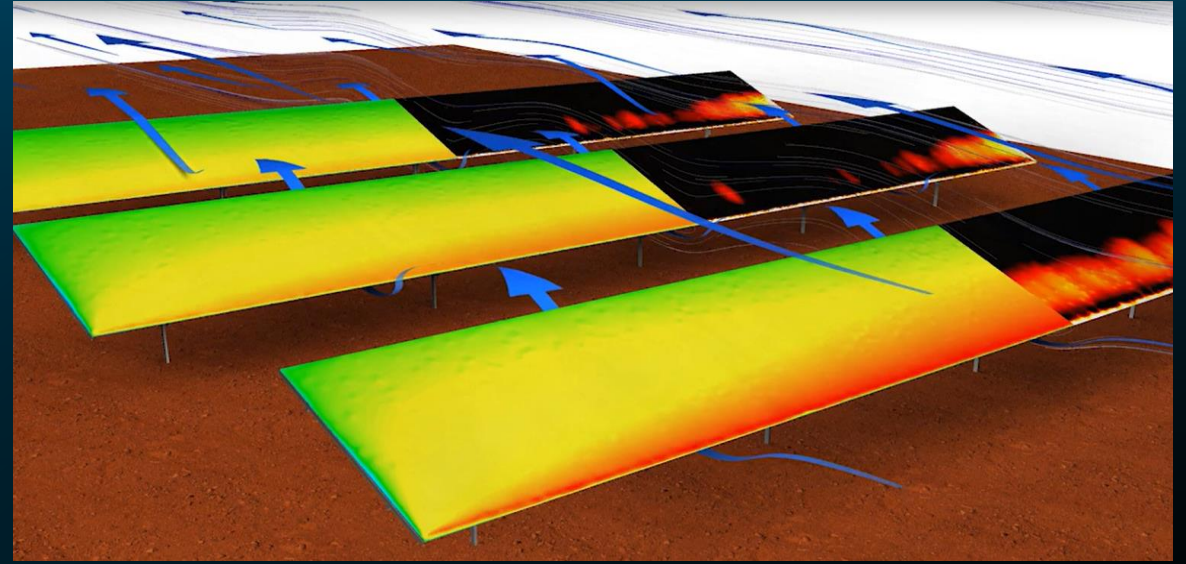
**R-evolution**

Powered by Hexagon

## R-evolution in progress: Digitalising solar energy production

On the front lines of R-evolution







## Facilitating Hexagon and H2U's strategic partnership

Unleashing digital reality technologies to  
accelerate and scale green hydrogen plant  
design and performance

## The time is now

R-initiatives are steady waves of innovation driving a more sustainable future

**LEARN MORE** →



## R-evolution enables blue carbon credits

Blue carbon ecosystem discovered by sharks, validated with Bathymetric LiDAR enable the world's first blue carbon credits

**LEARN MORE →**

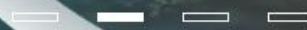




## R-evolution launches venture capital arm

The programme aims to help green-tech startups accelerate their next breakthroughs through seed funding or in-kind technology

**LEARN MORE →**



# Hexagon, hacia una gestión de activos autónoma y sustentable

## GRACIAS

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