



# Digital Twins & Lifecycle BIM

Igor Starkov, CEO  
EcoDomus, Inc.



## 为什么使用EcoDomus?

作为全球唯一的建筑生命周期的BIM公司，我们办公室遍布美国、欧洲、中东及亚太（悉尼、新加坡、香港），并且我们的合作伙伴也在世界各地支持着我们的项目。

1. 相比其他所有软件公司，EcoDomu成功地交付了基于物业管理以及COBie标准的数字化项目，在世界范围内未有其他公司有如此成功案例。
2. EcoDomus与世界顶级的业主、伙伴合作，并将行业的最佳实践案例应用到这些项目中。
3. EcoDomus的PM/FM软件相比其他BIM软件具有更多、更全面的功能 – 更高质量的数据整合，且占有较低的花费。
4. EcoDomus引领行业潮流，以及技术革新 – 以确保给业主、伙伴带来长期的经济效益。

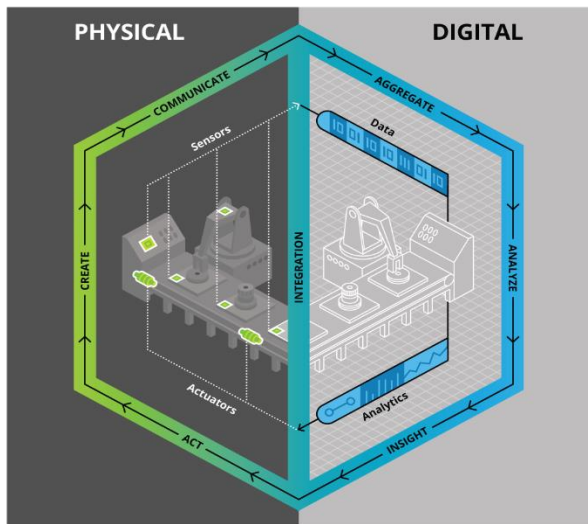


# Digital Twin

**Digital Twin** refers to a digital replica of physical assets, processes, people, places, systems and devices that can be used for various purposes. The digital representation provides both the elements and the dynamics of how an **Internet of Things** device operates and lives throughout its **life cycle**. (Wikipedia)

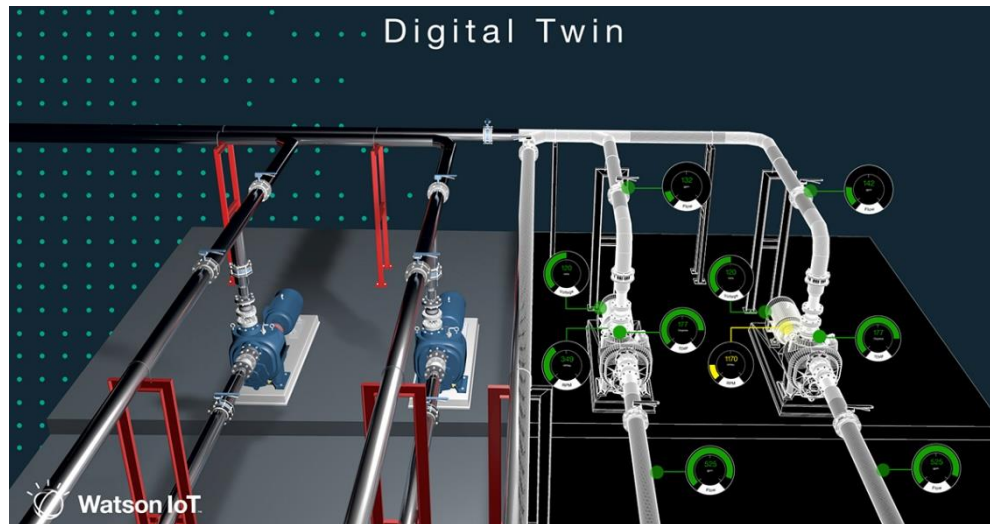
**Digital Twin = BIM + IoT + FM + GIS + ...**

Figure 1. Manufacturing process digital twin model

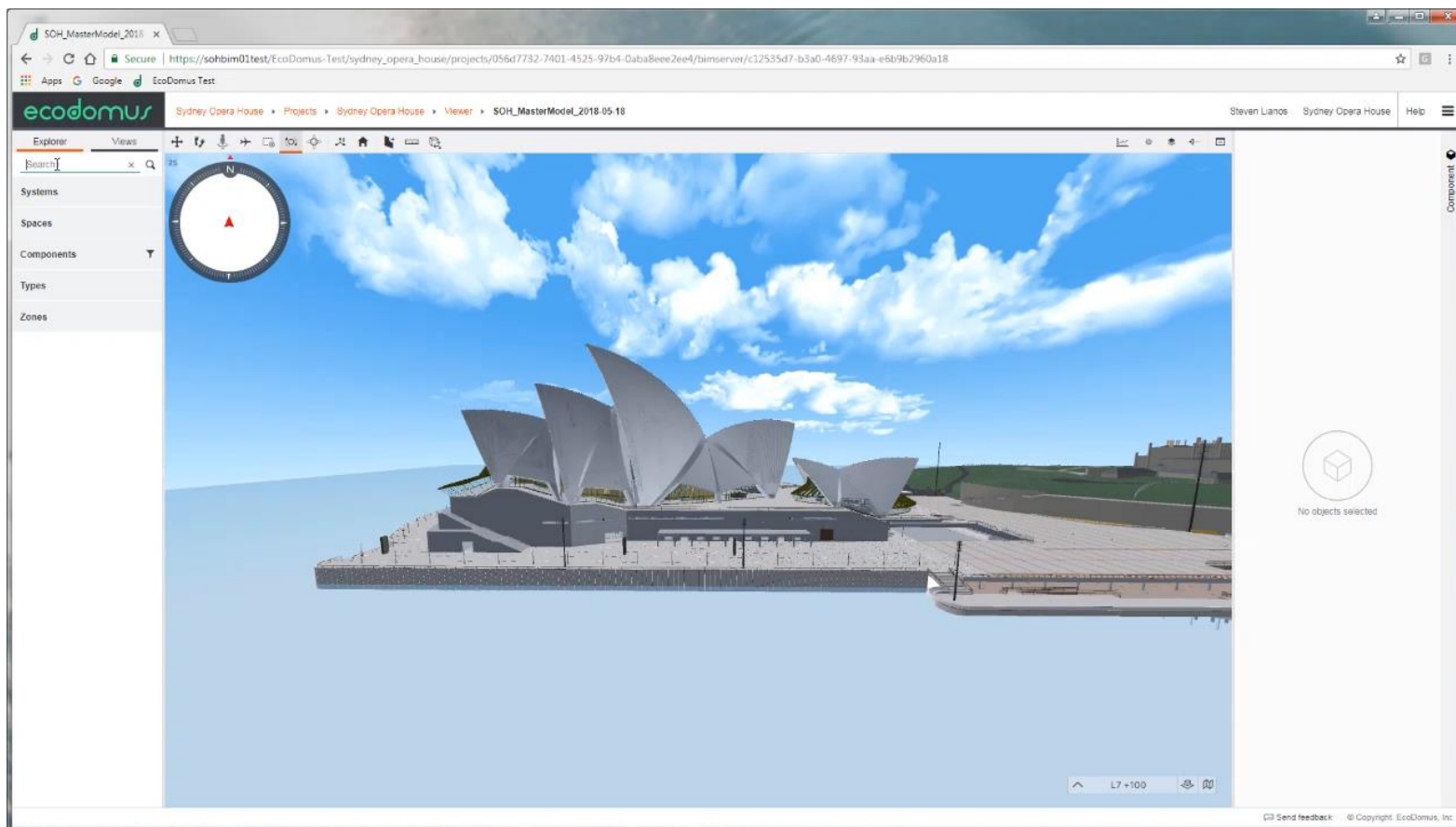


Source: Deloitte University Press.

Deloitte University Press | [dupress.deloitte.com](https://dupress.deloitte.com)



# EcoDomus Digital Twin for Sydney Opera House



# Digital Twin Benefits: Time Savings & Impact

## Comparison – Shutdown

### Major Plumbing Leak

BASILINE PROCESS	Time Spent	BIM MODEL PROCESS	Time Spent
<ol style="list-style-type: none"> <li>1. Work Order Submittal</li> <li>2. Staff Investigation and research</li> <li>3. Determining ladder and equipment access</li> </ol>	2.5 hours	<ol style="list-style-type: none"> <li>1. User access the BIM model and locates the room. Looks at systems above ceiling and finds optimal isolation valves.</li> <li>2. En route, staff discuss system with systems engineer and gets a link to access the BIM files in the room. The systems and valves are highlighted.</li> </ol>	0.75 hours

### BIM Process Key Distinctions

- Time Savings = 1.75hours per instance (70% less time)
- SCALE IMPACT
  - Number of Annual Events: 24
- Time Savings: 35 Hours per instance (62% less time)
- SCALE IMPACT
  - Number of Annual Events: 96
- Average savings/year = 3,402hrs

### Planned Utility Shutdown

BASILINE PROCESS	Time Spent	BIM MODEL PROCESS	Time Spent
<ol style="list-style-type: none"> <li>1. Utility shutdown request for an electrical panel.</li> <li>2. Contractor requests as-builts from facilities</li> <li>3. Contractor traces the system in the field</li> <li>4. Facilities receives shutdown request</li> <li>5. Utility Shutdown request review</li> <li>6. Utility shutdown request approved and</li> <li>7. Building occupants are notified of any impacts. Mitigation measures (back-up power, generator, etc.) are in place during shutdown.</li> </ol>	56 Hours	<ol style="list-style-type: none"> <li>1. Contractor submits utility shutdown request and reviews BIM model.</li> <li>2. Contractor traces system in the field and uses BIM model to verify the systems and view electrical panel data</li> <li>3. Facilities AND management reviews BIM Model.</li> <li>4. Utility shutdown request approved.</li> <li>5. Building occupants are notified of any impacts. Mitigation measures (back-up power, generator, etc.) are in place during shutdown.</li> </ol>	21 Hours

Use Case analysis from EcoDomus' project with the leading healthcare organization.

Benefits are related not just to time/cost savings but more importantly to the impact on operations.

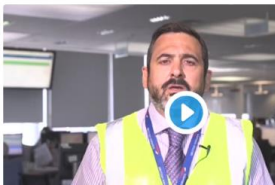


# Digital Twin for Risk Management (Not Just 3D!)

## A real case at London airport

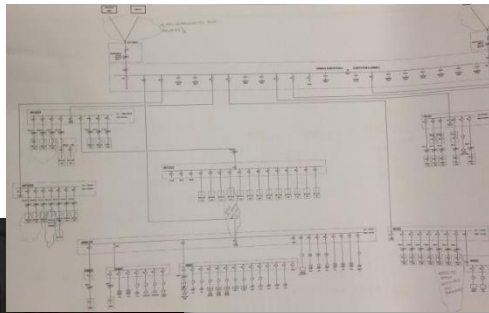
transportation tech. Even a relatively rare crash bug can become a serious headache if it tarnishes an airline's reputation and results in expensive payouts to angry travelers.

**Update:** British Airways chief Alex Cruz explained in a video apology (below) that the failure was likely caused by a "power supply issue." The airline is promising a full refund if you were affected and no longer want to fly (or just can't), so there's some consolation here. Still, the explanation makes the situation all the more outlandish: all it took was a power management problem to throw one of the world's largest airports into chaos.



## Chaos as LA airport is plunged into darkness

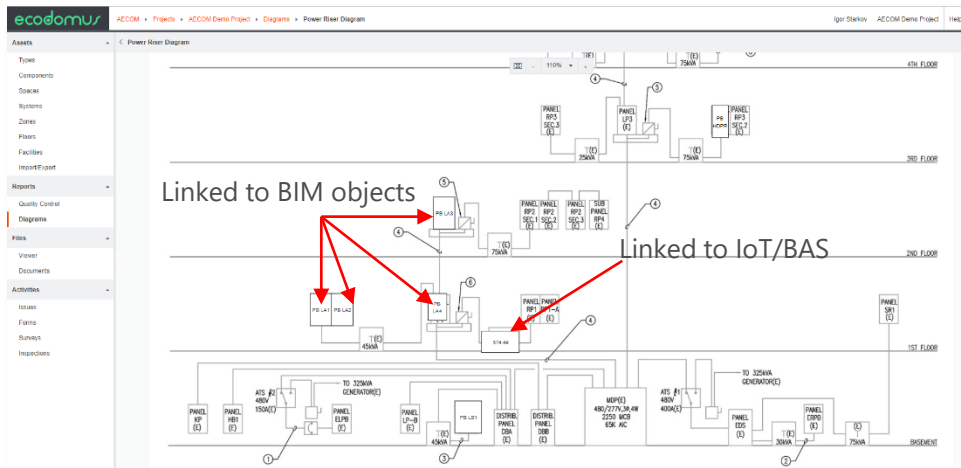
Passengers were stranded for nearly four hours in three terminals, causing delays and cancellations.



From paper & PDF to BIM systems integrated with sensors (BAS/BMS/SCADA) via EcoDomus.

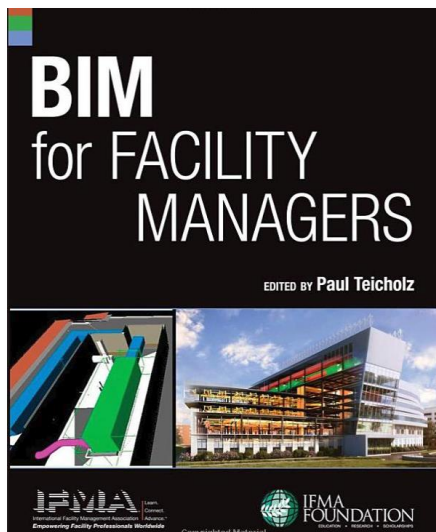
Every element of the 2D diagram below can be linked to a BIM object or show real-time data from a sensor. The "affects" schema below shows relationships between the elements of the electrical system.

Some issues can be prevented by establishing data-driven analysis and simulations of potential disruptions. This analysis requires structured data sets provided by intelligent BIMs.



# More About Digital Twin & BIM Benefits

Several books and articles are written on the benefits of BIM and Digital Twins of real assets:

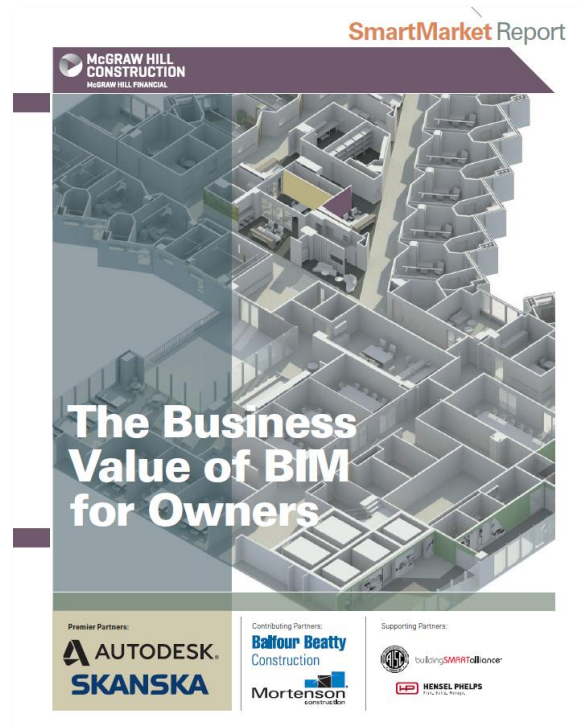


Final  
March 2018

## ***BIM Level 2 Benefits Measurement***

*Application of PwC's  
BIM Level 2 Benefits  
Measurement  
Methodology to Public  
Sector Capital Assets*

**pwc**



See more articles and case studies on EcoDomus website:

[www.ecodomus.com](http://www.ecodomus.com)

# Integration of All Data via BIM

*BIM as the “lowest common denominator” contains the information relevant to all other facility related systems, thus enabling integrations not available in the past.*

## Building Geometry Authoring (BIM\*)

Autodesk Revit, Bentley AECOsim, Graphisoft ArchiCAD, Tekla, IFCs

*\* mostly geometry, some data, so BIM is not the right word here*

## Space Management (CAFM/IWMS)

Oracle Unifier, TRIRIGA, ARCHIBUS, Planon, Manhattan, etc.

## Maintenance Management (CMMS)

IBM Maximo, Accruent, eMaint, FSI, TMA, AssetWorks, Corrigo, etc.



Augmented Reality,  
AI/ML, Predictive  
maintenance,  
Process simulation,  
energy analysis, etc.

## Enterprise Resource Planning (ERP)

SAP, Oracle Financials, IFS, Infor, etc.



Drones for  
indoor/outdoor  
navigation: space  
mapping, deliveries,  
video streaming,  
inspections, etc.

## Geographical Information System (GIS)

CityGML, IndoorGML, ESRI ArcGIS, Mapbox, Oracle Spatial

## Project Management (PM)

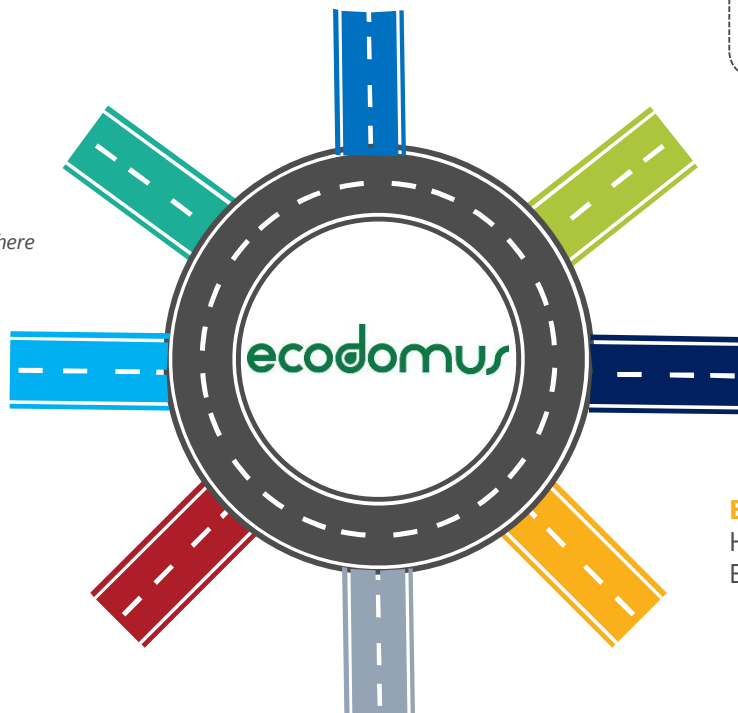
Procore, Primavera P6, Oracle Unifier, PMWeb, Prolog, e-Builder, etc.

## Building Automation System (BAS)

Honeywell EBI, Siemens Apogee, JCI, Schneider Electric StruxureWare, OPC, BACnet, etc.



QR/Barcodes, RFID,  
CCTV, vibration  
sensors, concrete  
sensors, etc.



## Electronic Document Management Systems (EDMS)

ProjectWise, Autodesk 360 Docs, Aconex, Alfresco, BlueCielo, etc.



# Example of Digital Twin Integrations at Sydney Opera House



Mainpac  
maintenance systems



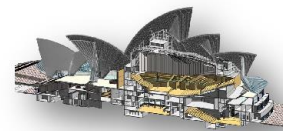
Mainpac  
building assets



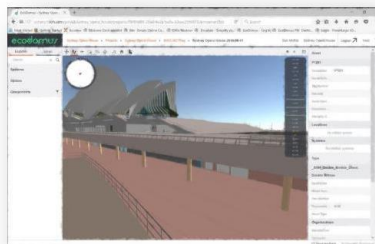
BIM-SQL  
drawings / plans



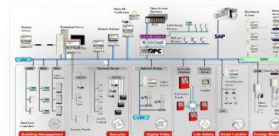
BIM-CD  
rooms & doors



Revit  
models / point clouds



EcoDomus - BIM4FAM

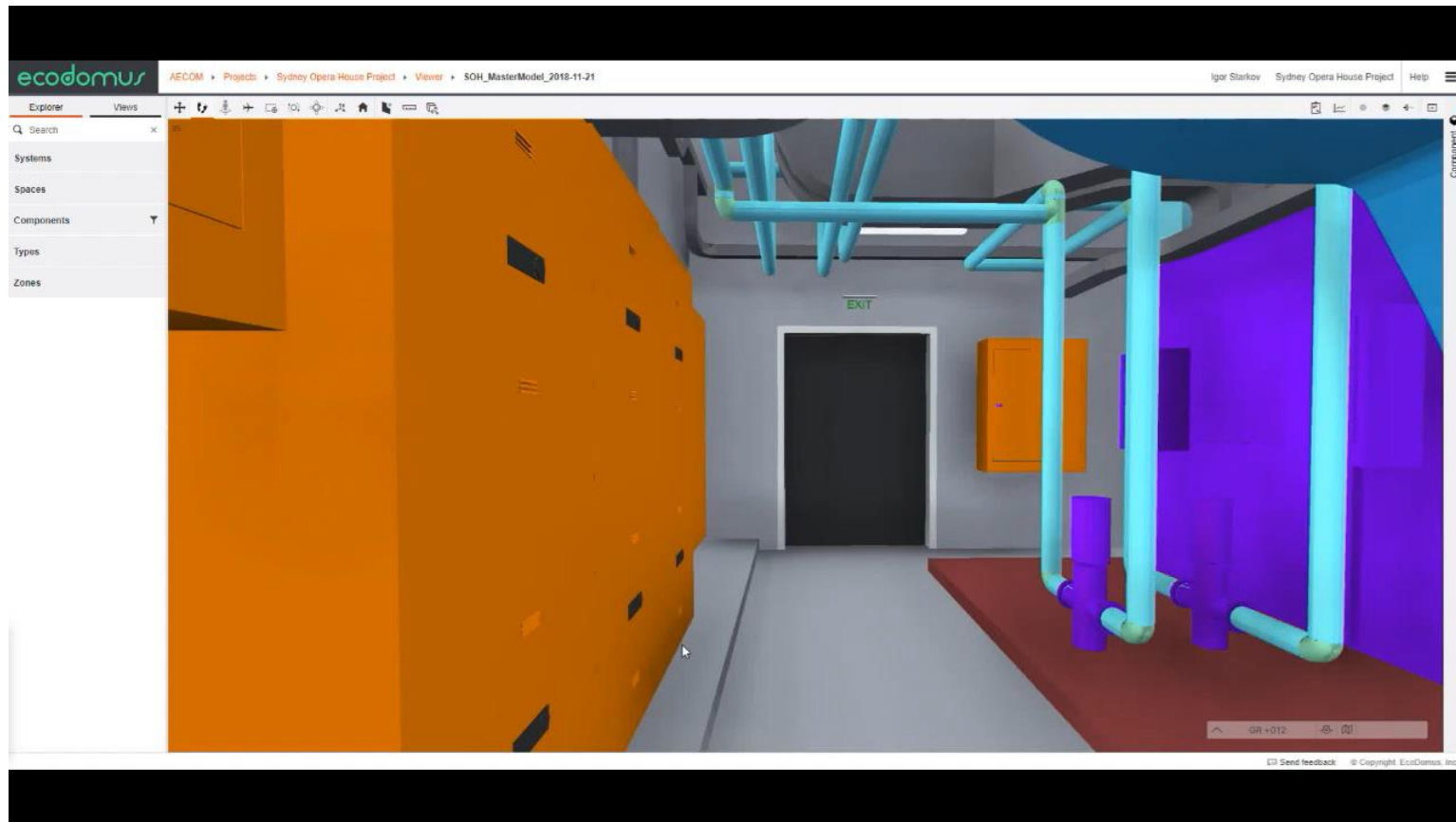


Honeywell - BMCS



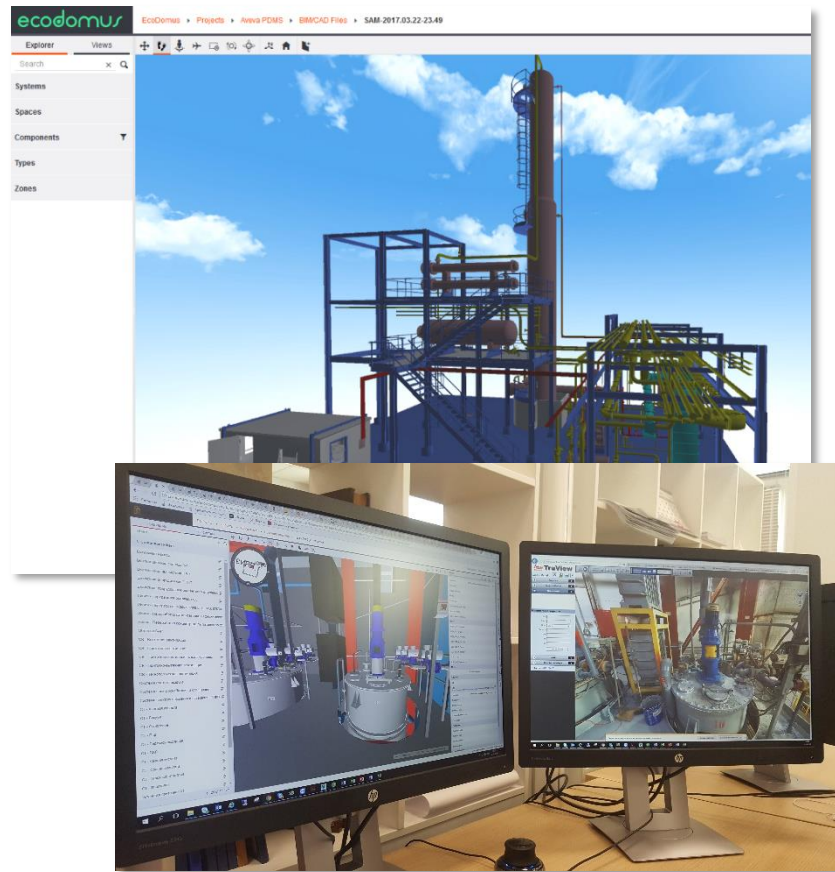
RM8  
document system

# Digital Twin: BIM + IoT

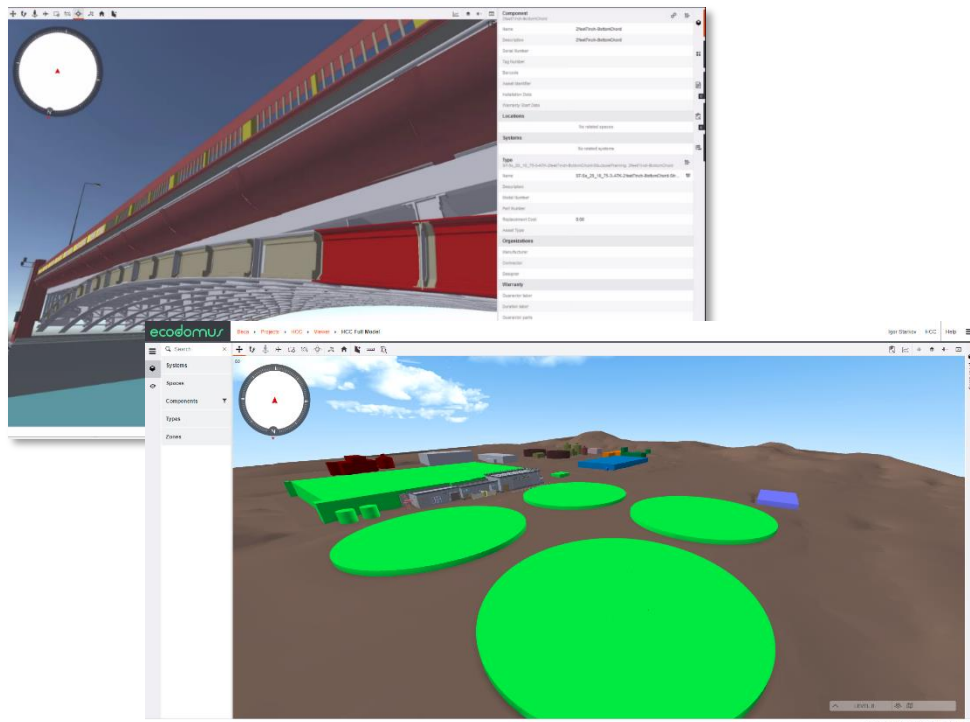


[www.ecodomus.com](http://www.ecodomus.com)

# All Built Structures Supported

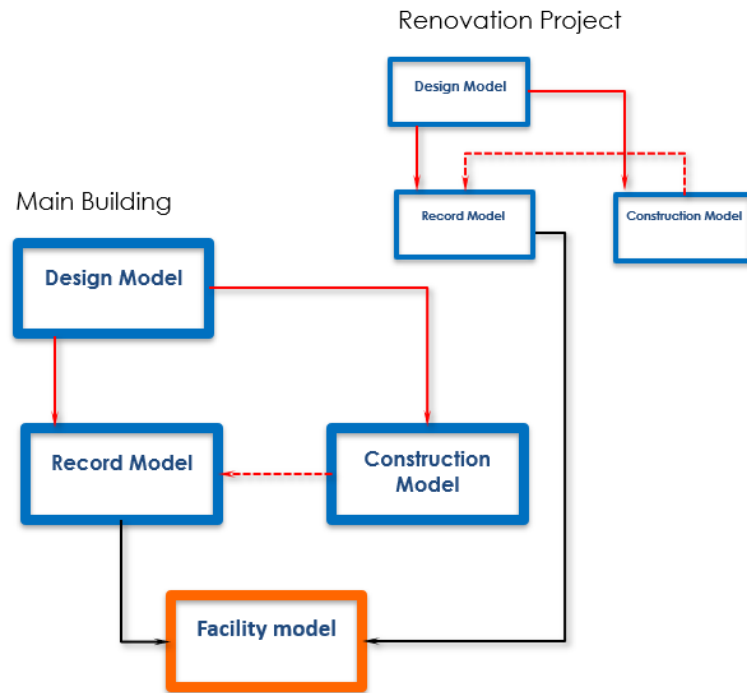
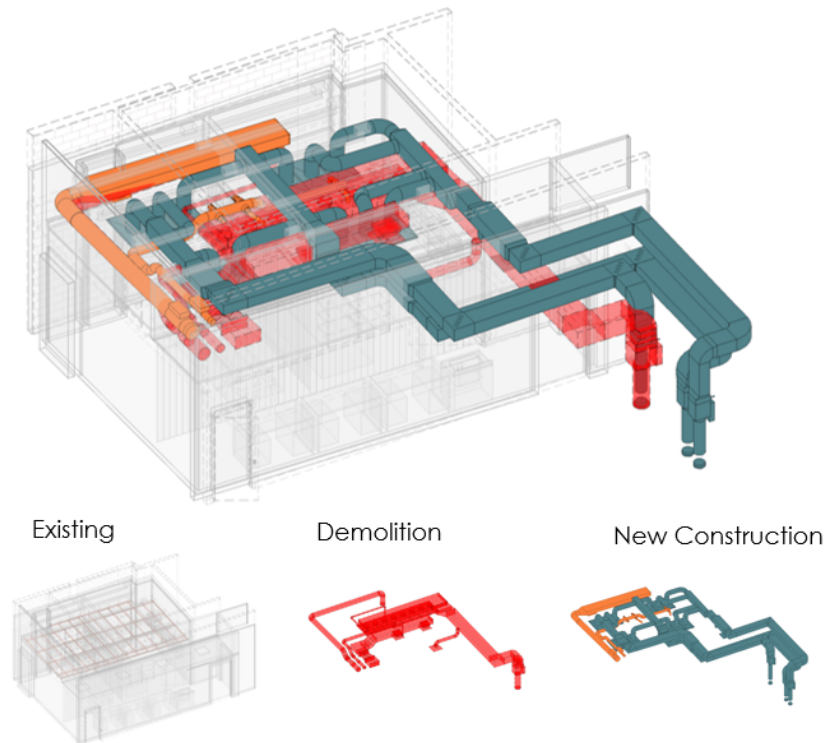


Structures of different type are supported, not only buildings: including linear (roads and bridges), industrial (oil & gas, factories).



# How to Create Facility Model for Digital Twin

Integrating Fitout, Reconstruction, Addition Projects





# EcoDomus是什么?

EcoDomus是一个为管理资产信息模型和项目信息模型而开发的通用数据环境（CDE）。

## 设计

- BIM的作用是为设计提供可视化和协同，同时也是施工的辅助工具
- 同时满足设计意图的属性也在不断被创建

### EcoDomus的角色:

1. 检查模型数据与软件的兼容性，并交付给施工阶段
2. 将设计意图在3维浏览器中可视化，为施工方及物业服务
3. 收集BIM以外的信息，并进行输入整合

## 装修及翻新

- 在3维BIM中进行翻新的规划
- 对于翻新在增强的环境中进行评估

### EcoDomus的角色:

1. 为重新设计提供精确的竣工信息
2. 与其他软件程序（用户管理，能源管理等）进行竣工信息的同步



## 施工

- BIM将会以3维形式反映现场的竣工情况
- 整合安装信息等属性
- 将资产信息与项目文档与BIM进行整合

### EcoDomus的角色:

1. 检查模型数据，并为验收交付做准
2. 为总包与分包提供基于3维浏览器的可视化协同
3. 将BIM以外的信息进行编辑整合，将文档与BIM进行链接

## 运营及管理

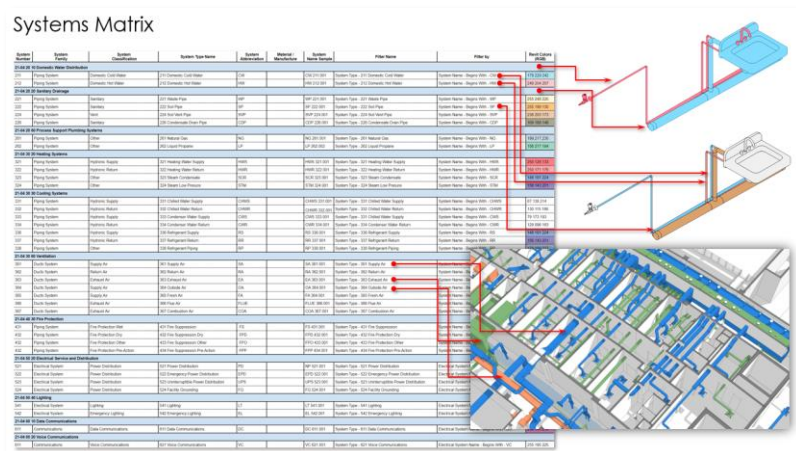
- 3维可视化派工单
- 闭馆安排
- 快速应急响应
- 基于BIM的能源分析

### EcoDomus的角色:

1. 在3维浏览器中将模型可视化，并整合楼宇自控信息，为物业运维服务
2. 生成报表（巡查报告、采购报表、能源管理报告，等等）

## Useful BIM for Digital Twin

- Focuses on 3D + Data
- Asset names meet owner requirements
- Properties are verified
- Building systems (MEPF) show actual connections
- Geometry issues are resolved – easy to navigate and get data



# Customized Analytics & 3D Reports

16

ecodomus

AECOM > Projects > AECOM Demo Project > Components

Igor Starikov AECOM Demo Project Help

Assets

Types

Components

Spaces

Systems

Zones

Floors

Facilities

Import/Export

Reports

Quality Control

Diagrams

Files

Viewer

Documents

Activities

Issues

Forms

Surveys

Inspections

Components

+ Add + Rename + Remove + Edit + Get barcode in PDF

Export Display Columns Custom Filters Hide ducts

Search

DISCIPLINE

☐ <Unknown category>

☒ Architecture

☒ Civil

☒ Electrical

☒ Mechanical

☐ Piping

☐ Structural

<input type="checkbox"/>	Name	Description	Location	Type	Category	Purchased Cost	Installed Cost	Maintenance Cost
<input type="checkbox"/>	1/2" (1)			Pressure Regulating Valve - ...	Pipe Accessories			
<input type="checkbox"/>	2 1/2" (4)			Butterfly Valve - 2-12 Inch 2 ...	Pipe Accessories	50	10	35
<input type="checkbox"/>	2 1/2" (5)			Butterfly Valve - 2-12 Inch 2 ...	Pipe Accessories	50	10	35
<input type="checkbox"/>	2 1/2" (6)			Butterfly Valve - 2-12 Inch 2 ...	Pipe Accessories	50	10	35
<input type="checkbox"/>	2 1/2" (7)			Butterfly Valve - 2-12 Inch 2 ...	Pipe Accessories	50	10	35
<input type="checkbox"/>	2 Inch (2)			Valve-Mixing-Apollo-Lead_Fr...	Pipe Accessories			
<input type="checkbox"/>	2 Inch (3)			Valve-Mixing-Apollo-Lead_Fr...	Pipe Accessories			
<input type="checkbox"/>	4 - 20 mA / Metal Housing (2)			Sensor-Temperature_Pipe-Si...	Pipe Accessories			
<input type="checkbox"/>	4 - 20 mA / Metal Housing (3)			Sensor-Temperature_Pipe-Si...	Pipe Accessories			
<input type="checkbox"/>	5" Drain Pipe (10)		120 - A S R	Roof Drain Pipe: 5" Drain Pipe	Plumbing Fixtures	100		
<input type="checkbox"/>	5" Drain Pipe (11)		1C5 - Electrical	Roof Drain Pipe: 5" Drain Pipe	Plumbing Fixtures	100		
<input type="checkbox"/>	5" Drain Pipe (12)			Roof Drain Pipe: 5" Drain Pipe	Plumbing Fixtures	100		
<input type="checkbox"/>	5" Drain Pipe (13)		1VA8 - Void Area	Roof Drain Pipe: 5" Drain Pipe	Plumbing Fixtures	100		
<input type="checkbox"/>	5" Drain Pipe (14)			Roof Drain Pipe: 5" Drain Pipe	Plumbing Fixtures	100		
<input type="checkbox"/>	5" Drain Pipe (15)		1VA5 - Void Area	Roof Drain Pipe: 5" Drain Pipe	Plumbing Fixtures	100		
<input type="checkbox"/>	5" Drain Pipe (8)			Roof Drain Pipe: 5" Drain Pipe	Plumbing Fixtures	100		
<input type="checkbox"/>	5" Drain Pipe (9)		1VA2 - Void Area	Roof Drain Pipe: 5" Drain Pipe	Plumbing Fixtures			
<input type="checkbox"/>	85 gal Wessel		2XS1 - Roof	Boiler Expansion Tank	Mechanical Equipment	1000	50	
<input type="checkbox"/>	AC Motor 1		2XS1 - Roof	AC Motor	Electrical Equipment			
<input type="checkbox"/>	AC-1		2XS1 - Roof	AC Rooftop Unit 75 ton	Air Handling Units	100	20	30
<input type="checkbox"/>	AC-2	AC-2	2XS1 - Roof	AC Rooftop Unit 70 ton	Air Handling Units	45000		
<input type="checkbox"/>	AC-3	AC-3	2XS1 - Roof	AC Rooftop Unit 3 ton	Air Handling Units	1000		
<input type="checkbox"/>	Air_Vent-Metraflex-Metraven...	Test edit1		Air Vent Automatic (1)	Pipe Accessories			

1 - 50 of 3418 items

# EcoDomus Document Management System



Each file has metadata associated with it: category, custom tags, version (revision), date updated, size, etc. Metadata fields are editable. Documents can be filtered by metadata fields. Custom queries can be saved for reuse. Docs are linked to BIM objects. Markups are stored.

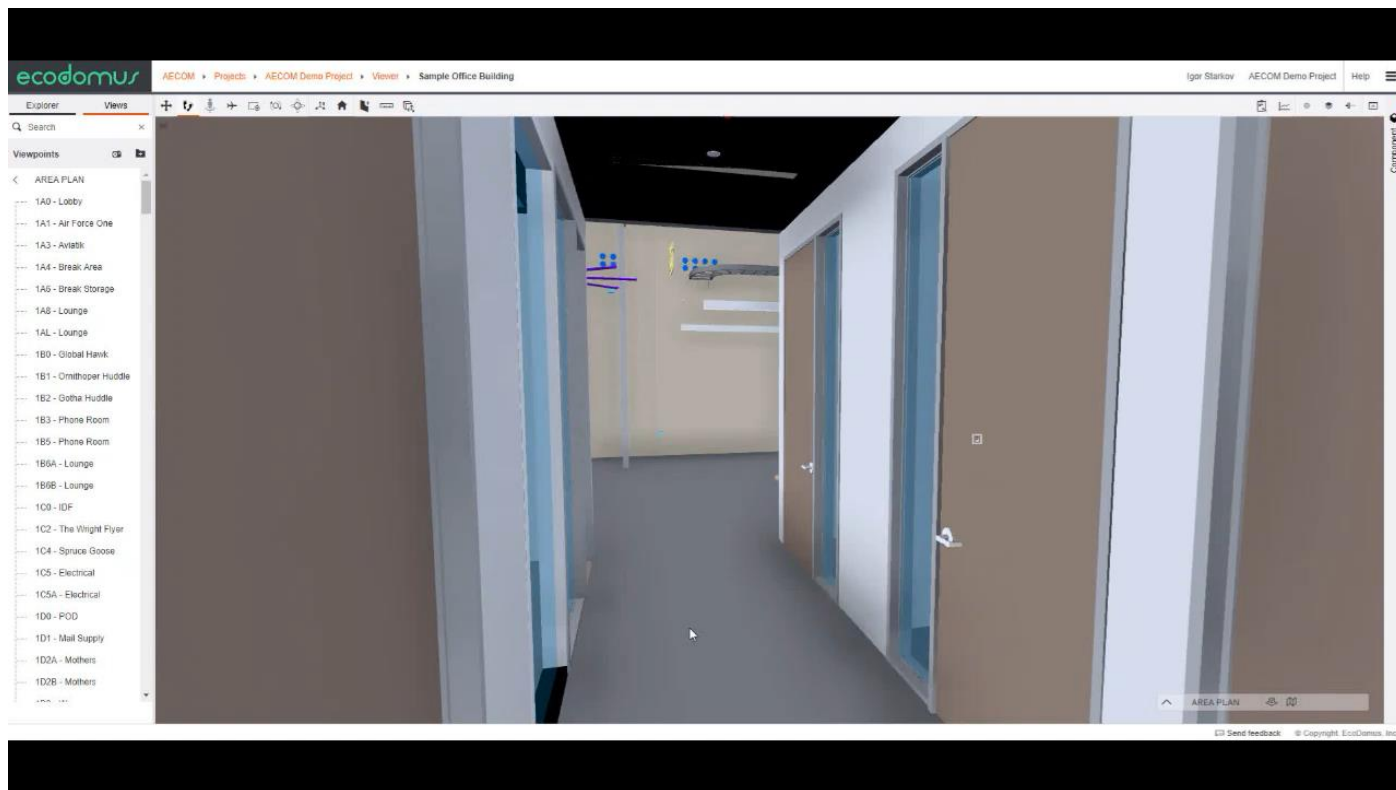
The screenshot displays the EcoDomus Document Management System interface. The top section shows a sidebar with navigation options: Assets, Reports, Files, Viewer, Documents, Activities, and Issue Management. The main area displays a list of documents with columns for Name, Version, Category, Linked objects, Tags, and File Size. The documents are categorized under 'Client Requirements', 'Operation and Maintenance', and 'Closeout Submittals'.

Below the document list, there is a detailed view of a document titled 'AC-3 Filter'. This view includes a 'Name' field, 'Status', 'Category', 'Discipline', and 'Tags' (with a 'Filters' tag). The 'Linked objects' section lists various BIM objects such as 'AC Rooftop Unit 3 ton', 'Hand Dryer', 'Air Separator', 'Air\_Vent-Metraflex-Metavent\_Autom...', 'FA Strobe Speaker', 'HV Fire Department Hose Valve 1 1/2...', 'Countertop Stone 9ft 5in', 'Countertop Stone 6ft', and 'Countertop P Lam 9ft 5in'.

On the right side of the detailed view, there is a 'Markup' section showing a technical drawing of a Rinnai water heater. The drawing includes various annotations and a 'Markup Objects' table at the bottom. The table lists the following objects:

Figure	Author	Date of create	Color	Comment
Rectangle	John Doe	5/7/2019, 1:00am	0080FF	okay
Cloud	John Doe	5/7/2019, 1:00am	52FF00	123
Triangle	John Doe	5/7/2019, 1:00am	0080FF	
Arrow	John Doe	5/7/2019, 1:00am	0080FF	
Text	John Doe	5/7/2019, 1:00am	52FF00	

# Issues Management in 3D BIM





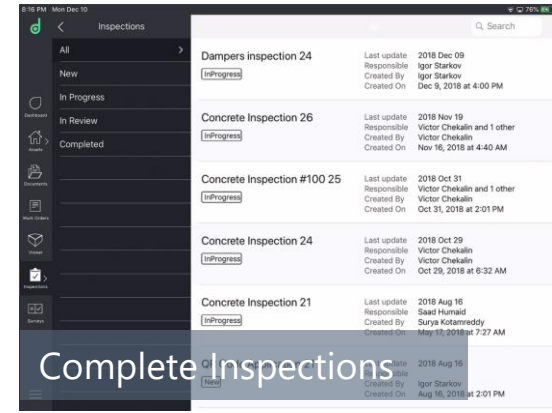
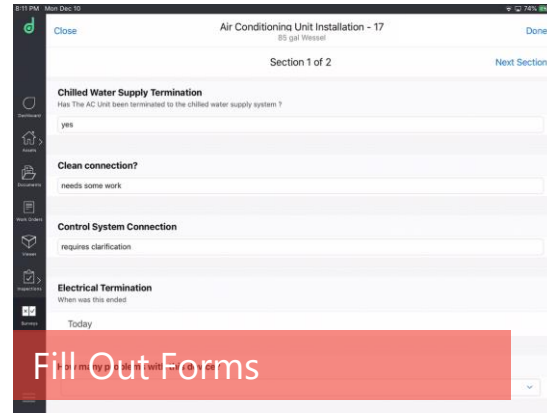
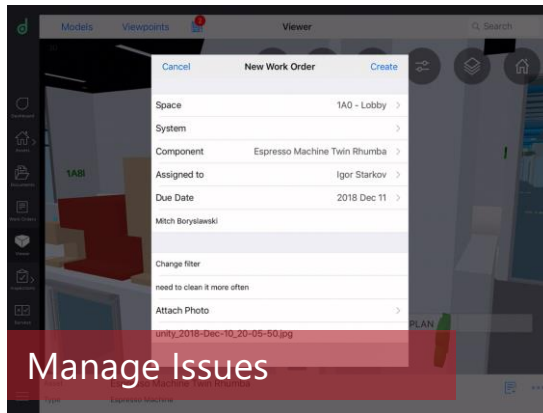
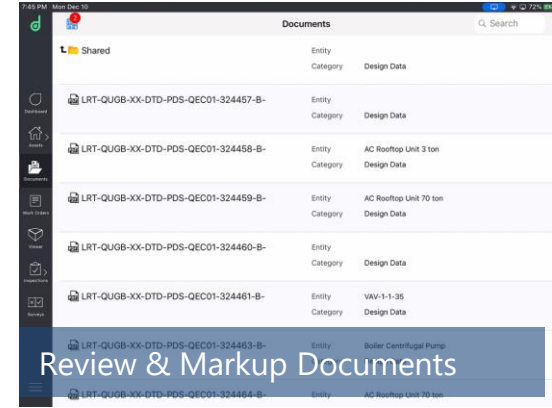
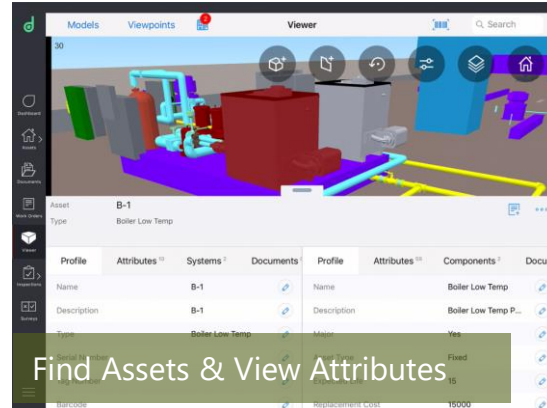
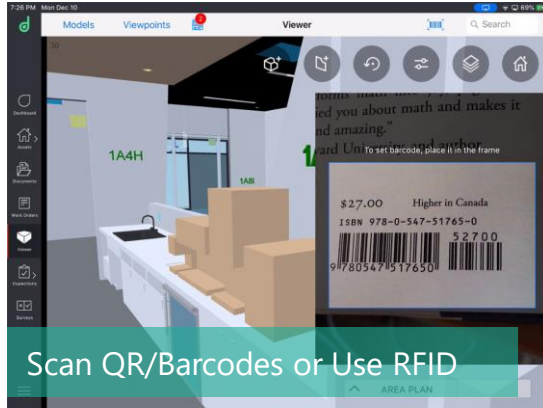
# 3D GIS and Macro BIM to Micro BIM

19

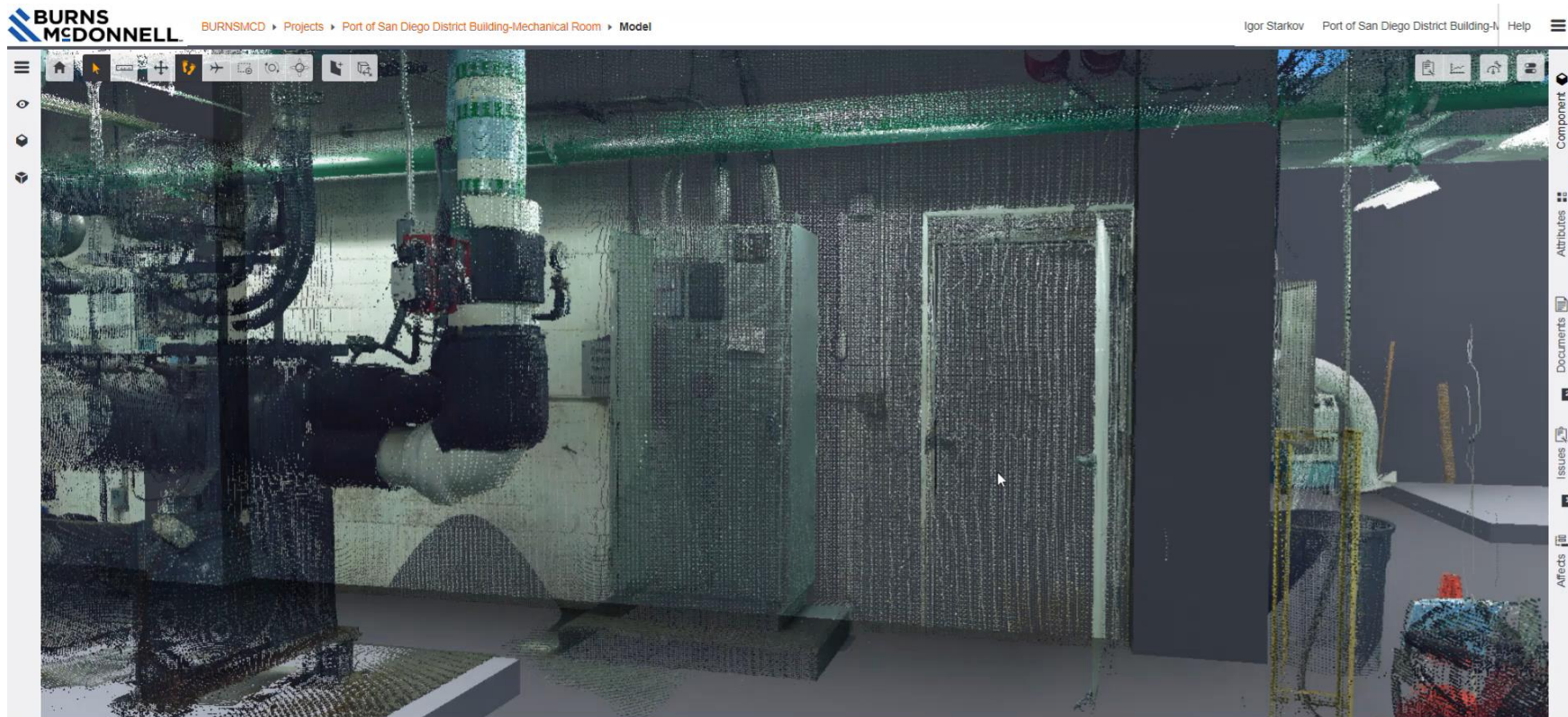


# Mobile BIM & Quality Control on iPad

20



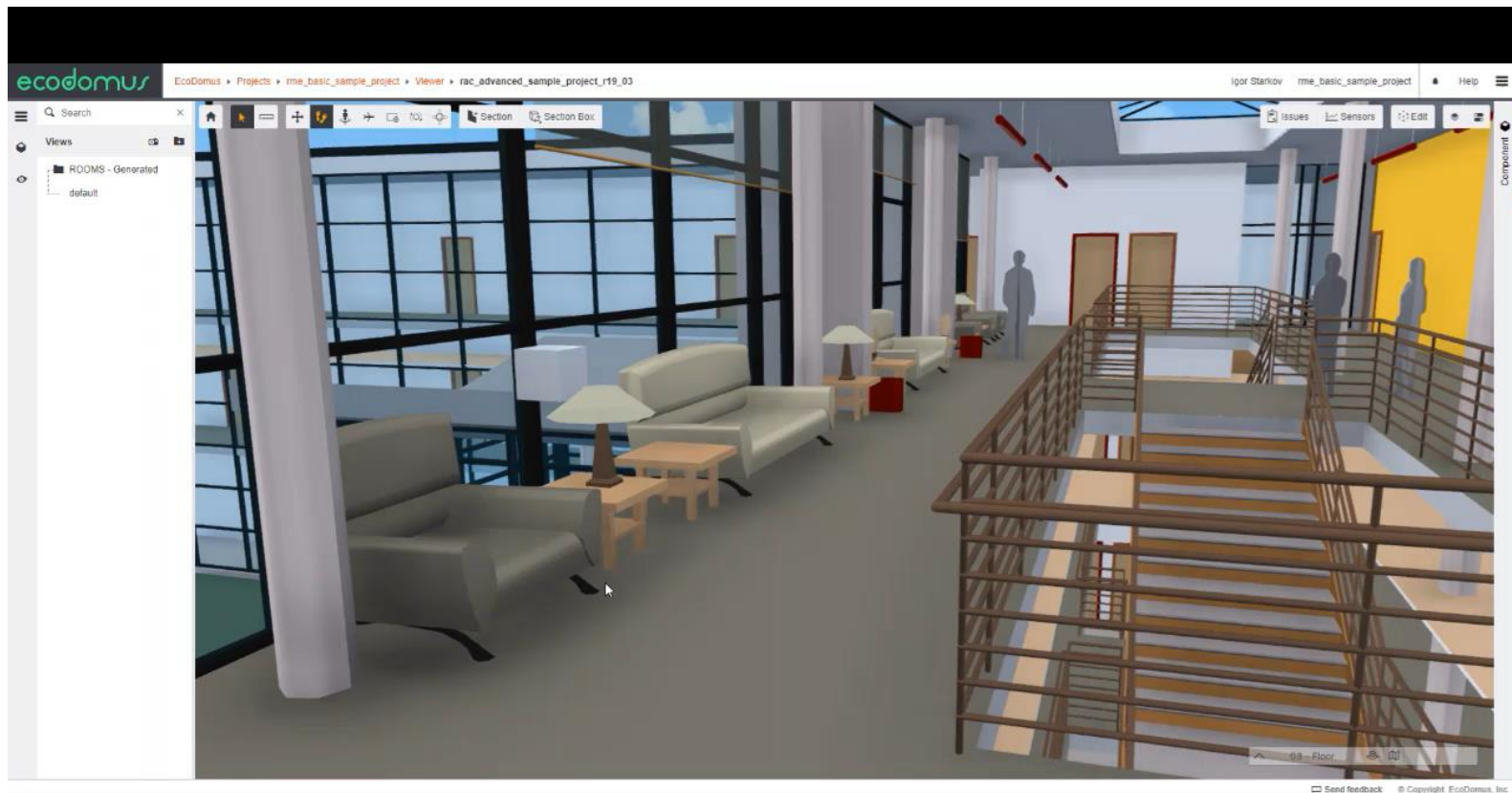
# Merging Point Clouds with BIM





# 3D BIM Modeling in Browser – Moveable & Intelligent Objects

22

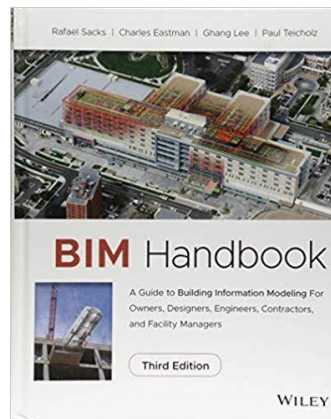


# Contact Us

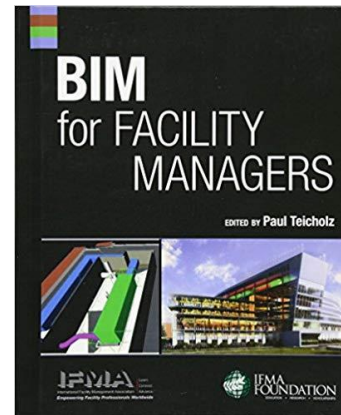
Read about EcoDomus:



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+1-571-277-6617  
igor@ecodomus.com



#1 book on BIM in the industry.  
3 out of 11 case studies are  
from EcoDomus projects:  
*Howard Hughes Medical,  
Stanford,  
Medina Airport*



EcoDomus is the only  
software with a dedicated  
chapter. The image on the  
cover is from our USC project.