UT5413 - It’s the “V” in “BIM”
A Vision for BIM for Electric & Gas Utility Engineering Design

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Transformation of an organization’s legacy engineering design systems first requires a vision. This class discusses the vision for transforming SDG&E’s Electric Transmission and Substation Engineering design and construction process using BIM for 3D intelligent design. The transformation includes the implementation of a number of Autodesk solutions in an integrated mosaic of engineering design workflows, starting with conceptual design using Infraworks, followed by detailed design and analysis with Civil3D, Inventor, ACAD Electrical and SDS (Substation Design Solution). A fundamental concept is the adoption of 3D model components for engineering design standardization and construction standards publishing and training. The transformation will be complete with the implementation of BIM 360 for construction QA/QC management. A strategic multi year plan will be discussed and visuals will be demonstrated that are being used to convey the vision and build consensus across the organization.
Key learning objectives

At the end of this class, you will be able to:

- Describe methodologies for gathering **requirements** and **strategic planning**
- Understand how Autodesk tools can be used to **collaborate**
- Understand how Vault can **improve workflows** and **data management**
- Develop a **vision** to develop requirements, solution design, implementation plan and business case
San Diego Gas & Electric – About US
A Sempra Energy Utility
SDG&E Geographically

- San Diego County
- Southern Orange County

http://www.energy.ca.gov/maps/serviceareas/Electric_Service_Areas_Detail.pdf
SDG&E Background

- Founded 1881
- Sempra Energy – Our Parent Company
- 5,000 SDG&E Employees
- Population Served = 3.4 M
  - Electric Meters = 1.4 M
  - 4,100 square-mile service area
- 2 Counties & 25 Communities
- Distribution Voltages = 12kV, 4kV, and 2.4kV
- Transmission Voltages = 69kV, 138kV, 230kV, and 500kV

Note - Numbers above are approximate

http://www.sdge.com/aboutus
Intelligent Model Design (IMD) – Possibilities of BIM At An Electric Utility
IMD Project

Today’s Challenges at an Electric Utility

- Old process built on traditional 2D technology & paper processes
- Resistance to change (Culture)
- Competition in the energy market (Solar Rooftops)
- Regulatory changes
- Doing more with less
- Communication between all stakeholders
  - Engineering, Regulatory, Environmental, Land, Consultants
- Risk Reduction
- Streamlining process & procedures (efficiency)
IMD Project

- **Business Objective**
  - Develop Intelligent 3D/2D Database to provide more accurate **drawings and standards** (BIM – Building Information Modeling) and leverage model & drawing database throughout the project lifecycle

- **Project Summary to Date**
  - Mapped As-Is & To-Be State
  - Gathered Requirements
  - Identified Autodesk products that can reduce risk and project cost, and accelerate project design by using off-the-shelf products
  - Define Implementation Strategy (Scope, Schedule & Costs)
Understanding who is Autodesk?

Software Offerings

- AutoCAD
  - Flagship Product, introduced in 1982)
  - 82 Other Software Products… and counting
- Civil 3D
- Map 3D
- Raster
- Inventor
- ReCAP
- Autodesk Utility Design (AUD)
- Infraworks
- Navisworks
- Vault
- …

Industries

- Manufacturing
- Automotive
- Architecture
- Engineering
- Construction
- Entertainment
IMD Requirements & Planning Schedule

November 2013
  • Kick-off
  • Design Workshops

December 2013
  • Interface Workshop
  • Architecture Workshop
  • Hi Level Spec/Tech Requirements

January – May 2014
  • Initial Findings Workshop
  • POC Development
  • Implementation Plan/Schedule
Requirements, Solution Design, Strategic Planning
Requirements Gathering Workshops

- Engineering
  - Distribution
  - Transmission
  - Substation
  - System Protection & Controls
  - Civil/Structural
- Construction & Maintenance
  - Transmission Construction & Maintenance
  - QA/QC Programs
- Major Projects Group
- IT
  - Technical Architecture and Interfaces

8 Workshops/ 40 interviews
Work Process Descriptions
What Did We Hear?
In Summary | “Pain Points”

- Need to “do more with less” is taxing current resources
- Dealing with a backlog of “as-built” drawings
- Backlog of construction standards
- Need for consistency and material standardization
- Need to improve design productivity of existing resources
- Need to attract and retain young talent
- Need to better share information and collaborate
- Better manage engineering revisions and engineering document control
- Need to improve ability to interpret drawings and design intent
- Need to improve accuracy of information
- Need to improve currency of information
Crafting a Vision – Building Information Models (BIM)

A unified workflow for the project lifecycle

OPERATIONAL EFFECTIVENESS
3D Digital Model v. 2D Drawing File
Business Process Improvement

COST CONTROL
Reduce construction waste
Increase confidence in cost estimates

SAFETY
Improved Data Quality
Validate Standards

WORKFLOW
- Site Design 2D/3D Modeling
- Physical Design 2D/3D Modeling
- Protection & Controls Schematics, panels, wiring diagrams, cable lists
- Constructability Design Review Model aggregation, clash detection, schedule
- Construction Package Drawings, BOMs
- 3D Parts and Assemblies SAPCU Alignment Technical Publications
- Construct and Commissioning Checklist, Validations, Project Dashboards
- Initial Design Permitting, estimating

ESTIMATING

CENTRAL DESIGN REPOSITORY
Disparate Design Disciplines Working in Silos

- PLAN
- DESIGN
- CONSTRUCT
- OPERATE
- MAINTAIN

Transmission Design
Substation Design
Distribution Design
Communications & Control Design
Construction
Operate and Maintain
BIM – A Unified Workflow Across Design Disciplines

PLAN ➔ DESIGN ➔ CONSTRUCT ➔ OPERATE ➔ MAINTAIN

BIM Unified Model

Engineering & Construction Service Providers ➔ Field / Mobile Workforce

Transmission Design ➔ Substation Design ➔ Distribution Design ➔ Communications & Control Design ➔ Construction ➔ Operate and Maintain

Autodesk Company Confidential - 2014
## COTS Products Considered | Technical Architecture

### Transmission Engineering
- Inventor
- Civil3D
- Infraworks
- ReCap
- Map3D
- Vault

### Substation Engineering
- Inventor
- Civil3D
- AutoCAD Electrical
- Substation Design Solution
- NavisWorks
- ReCap
- Vault

### Transmission Construction
- BIM360
- Vault

### Substation Construction
- BIM360
- NavisWorks
- Vault

### Distribution
- Inventor/Publisher
- Vault

### Major Projects
- BIM360
- NavisWorks
- Vault

“COTS” – Commercial Off The Shelf (no customization required)
Conveying the Vision – “Proof Of Concept” Vignettes

8 Vignettes
Approx. 57 Minutes Total
Approx. 6-8 Minutes Each
Strategic Plan (3 Years)

**Year 1**
- Database
- 3D Model Standards/Process
- Transmission Design & Standards

**Year 2**
- Substation Design & Standards
- Distribution Standards

**Year 3**
- Construction Rollout
- Major Projects Rollout

**CHANGE MANAGEMENT & TRAINING SUPPORT**
Integrated Approach

Change Management starts at the inception of the program to engage sponsors, develop overall change component plans and approaches:

- Leadership and Engagement
- Organization and Change Readiness
- Communications
- Learning and Enablement

Requirements and Plan Checkpoint
Design Checkpoint
Deployment Readiness Checkpoint
Post Deployment Checkpoint
Benefits Realization Checkpoint(s)
3D/2D Model Design – Cost Benefit Analysis Approach

- **Key Benefits Quantified in the Analysis:**
  - Productivity improvements for Transmission Engineering (~15%)
  - Productivity improvements for Substation Engineering (~15%)
  - Productivity improvements for As-Built creation (using Lidar/ReCap)
  - Cost avoidance benefits in construction by earlier detection of issues
  - Reduction in contingency and construction costs of ~1% on capital projects

- **Phase realization of benefits typically over three years**

- **Calculate Net Cash Flow and Financial Metrics**
  - Include all project costs: Hardware, Software, Services, SDG&E Business and IT
  - Calculate IRR and Payback Period
Key learning objectives

At the end of this class, you will be able to:

- Describe methodologies for business requirements gathering and strategic planning
- Understand how Infraworks, Civil3D, Inventor, SDS and Vault can be used to collaborate
- Understand how Vault can be used to improve engineering workflows and engineering data management
- Develop a vision to develop requirements, solution design, implementation plan and business case
Conclusion

- **BIM is right for an Electric Utility**
  - Central Design Database allows cross departmental sharing of information and direct access to the “truth”
  - Memorialization of tribal knowledge
  - Attracts new talent to an old industry
  - Allows engineers and designers to engage stakeholders more directly and collaboratively
  - Potential for 5D estimating (3D, Cost, Schedule)
  - Leverages existing partnerships and leaders in the industry