Make Your Case – Preparing a Business Justification and ROI for BIM in Utilities – Roundtable Discussion

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UT5414-R

Make Your Case – Roundtable Class Summary

Developing a sound **business case** and **securing funding** to implement new technology is **sometimes a difficult hurdle** to overcome. This class discusses an Autodesk Consulting engagement for a **major electric and gas utility** to develop a **strategic implementation plan and business case** for the **adoption of BIM** for both Transmission and Substation Design Engineering and Construction workflows. The solution will completely transform the current design and construction management processes, and includes InfraWorks, Civil3D, Inventor/Publisher, Substation Design Solution, Vault and BIM360. In this class we will **discuss the process** followed to **analyze the business requirements**, **develop a solution** and formulate an **implementation plan and cost estimate**. The class will highlight an approach to **benefit quantification**, preparing a **net cash flow analysis** and calculating the **financial metrics** required to present and **win funding approval** from senior management.

Key learning objectives

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

- Describe methodologies for **business requirements gathering** and strategic planning
- Develop a approach to **quantify benefits** for a technology solution
- **Calculate key financial metrics** for a business case including net cash flow, ROI and payback
- **Propose a study** to develop specifications, solution design, implementation plan and business case

Roundtable Agenda (90 min)

- Presentation (45 min)
  - Need for business case
  - Financial metrics defined
  - Major utility case study

- Roundtable Discussion / Questions (45 min)
  - What technology solution are you planning?
  - Have you identified the benefits?
  - Have you quantified the benefits?
  - What challenges are you facing to secure funding?

Why do we need a business case?

- Unlocking project funding typically requires executive sponsorship and a solid business case

- A business case can present *strategic benefits* but almost always requires a **financial benefit presentation**

- Financial means *quantification* and calculating ROI metrics

Financial Metrics – A Primer

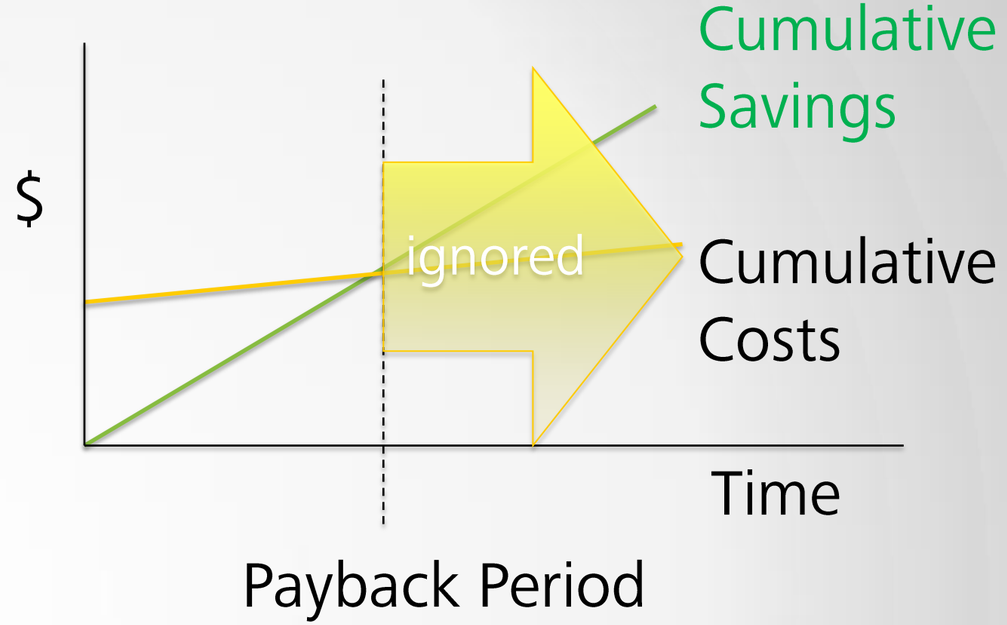
- **Payback Period** – sometimes called break even analysis. Represents the time required for the full investment to be recovered, typically in years.

- **Return on Investment (ROI)** - The calculated internal rate of return of a series of cash flows of investment and benefits realized over a period of time. An internal rate of return (IRR) is the same as an ROI.

- **Net Present Value (NPV)** – Considers a cash flow stream over time, similar to ROI, except the discount rate is assumed and all future cash flows are discounted for comparison in today's current dollars.

Financial Metrics

- **Payback Period**

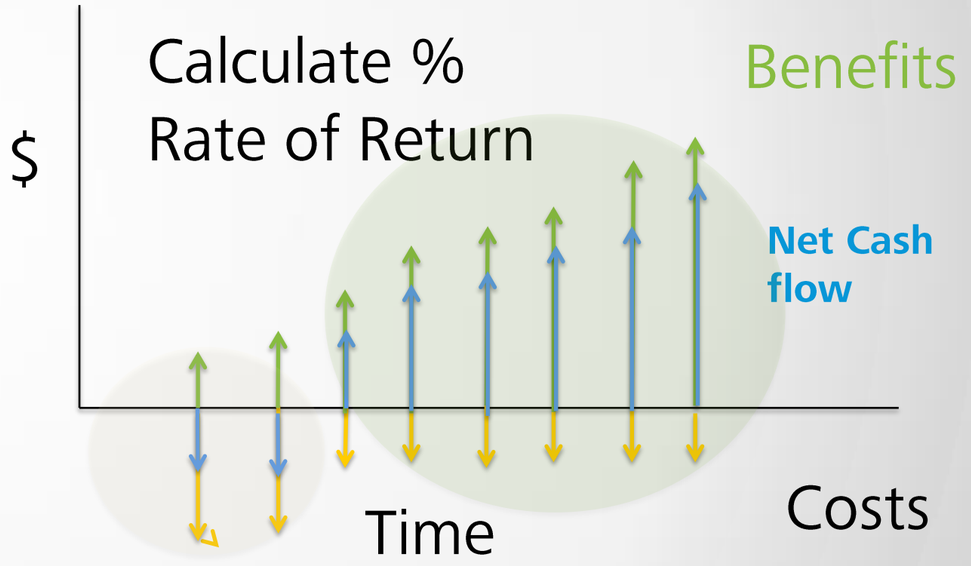


- Advantages
  - Simple, easy to understand
- Disadvantage
  - Favors projects with immediate benefits
  - Ignores benefits that continue to accrue after payback achieved

Financial Metrics

- **Return on Investment (ROI)** or Internal Rate of Return (IRR)

- Advantages
  - Includes benefits in future years after payback achieved
  - Better model of larger projects with multiple years of investment
  - Evaluate projects against threshold required % rate of return (hurdle rate)

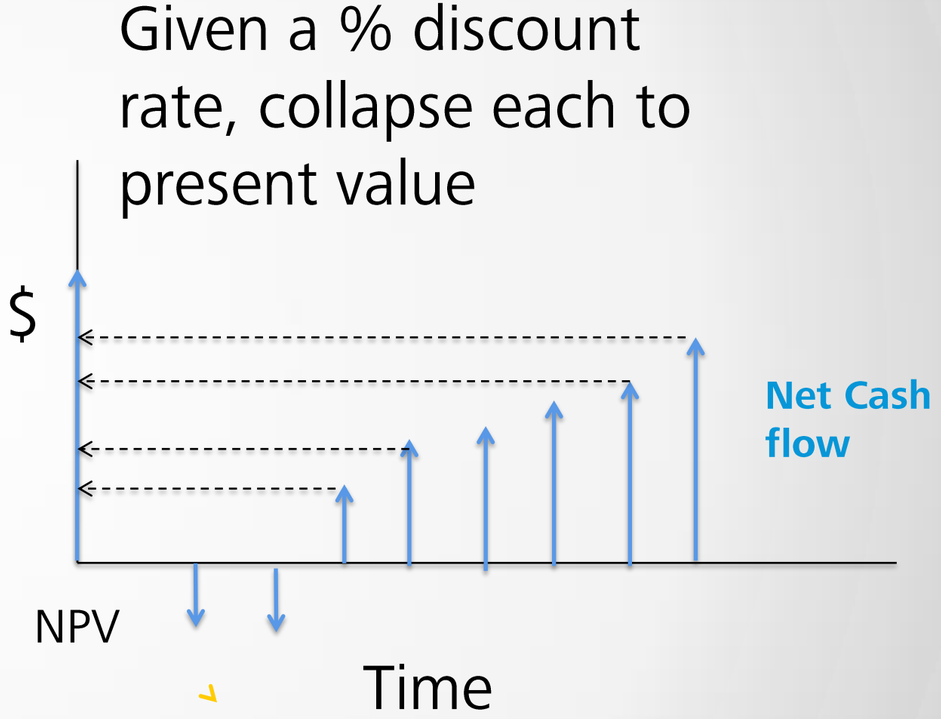


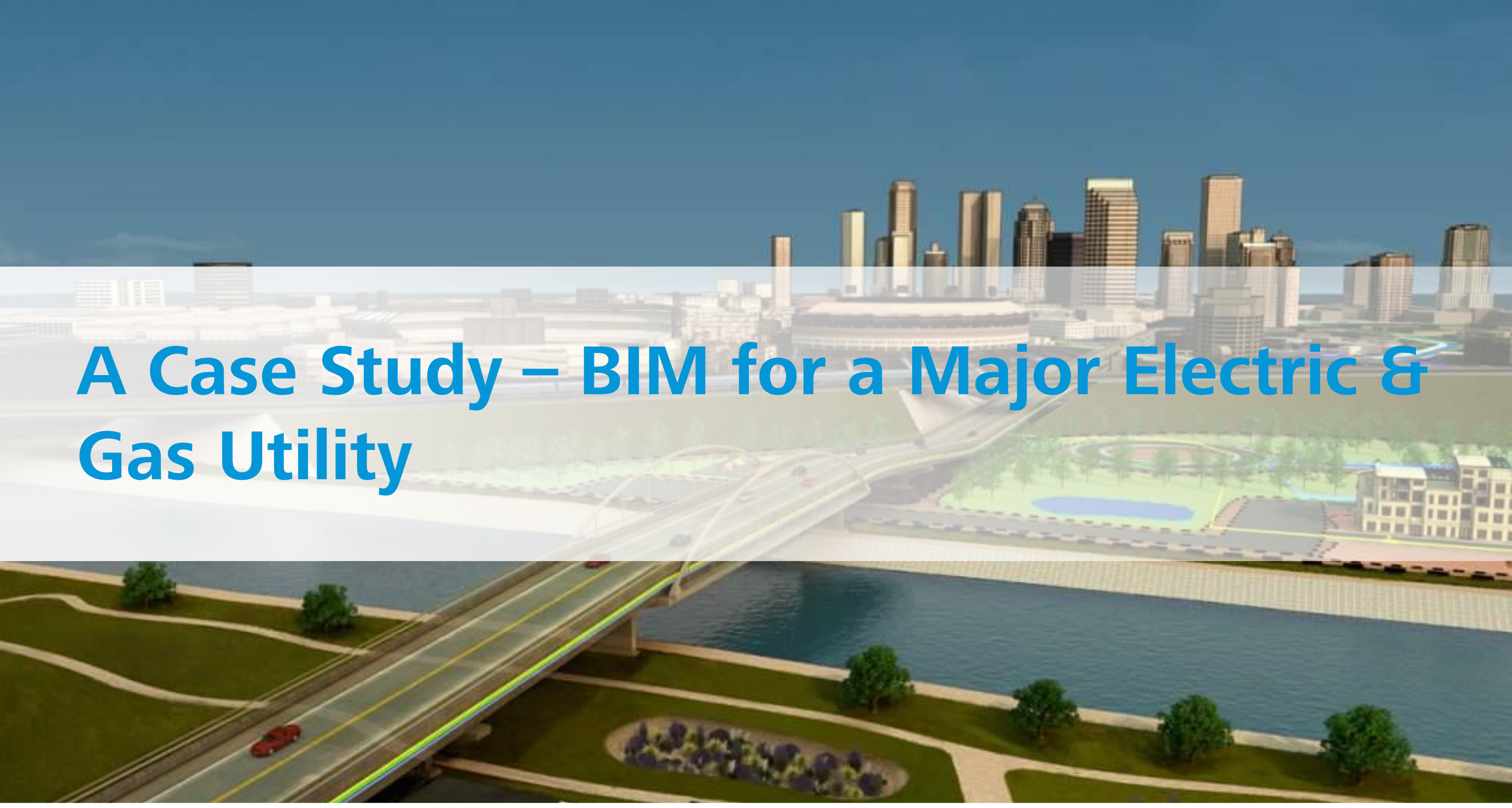
Financial Metrics

- **Net Present Value (NPV)**

- Advantages
  - Easy to compare projects in current constant dollars
  - Can rank unequal duration projects
  - NPV must be a positive number

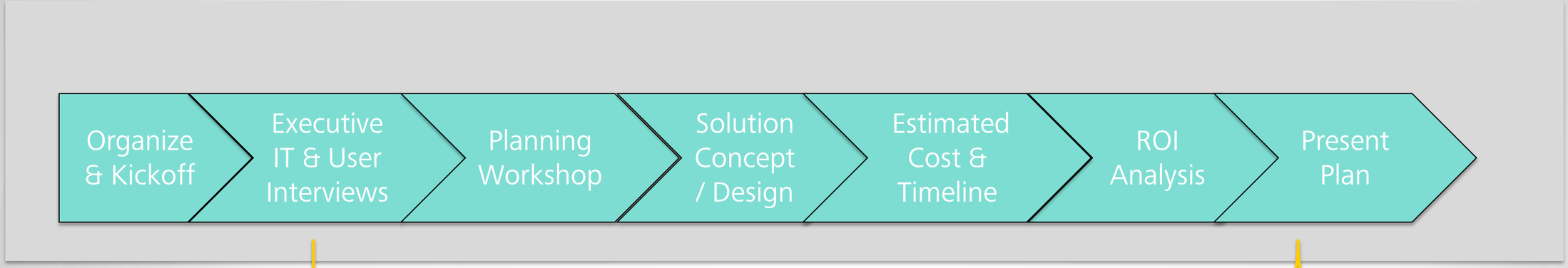
- Disadvantage
  - Requires pre-selection of a discount rate - % (firm's cost of capital)





A Case Study – BIM for a Major Electric & Gas Utility

Developing a Plan and Business Case – One Approach



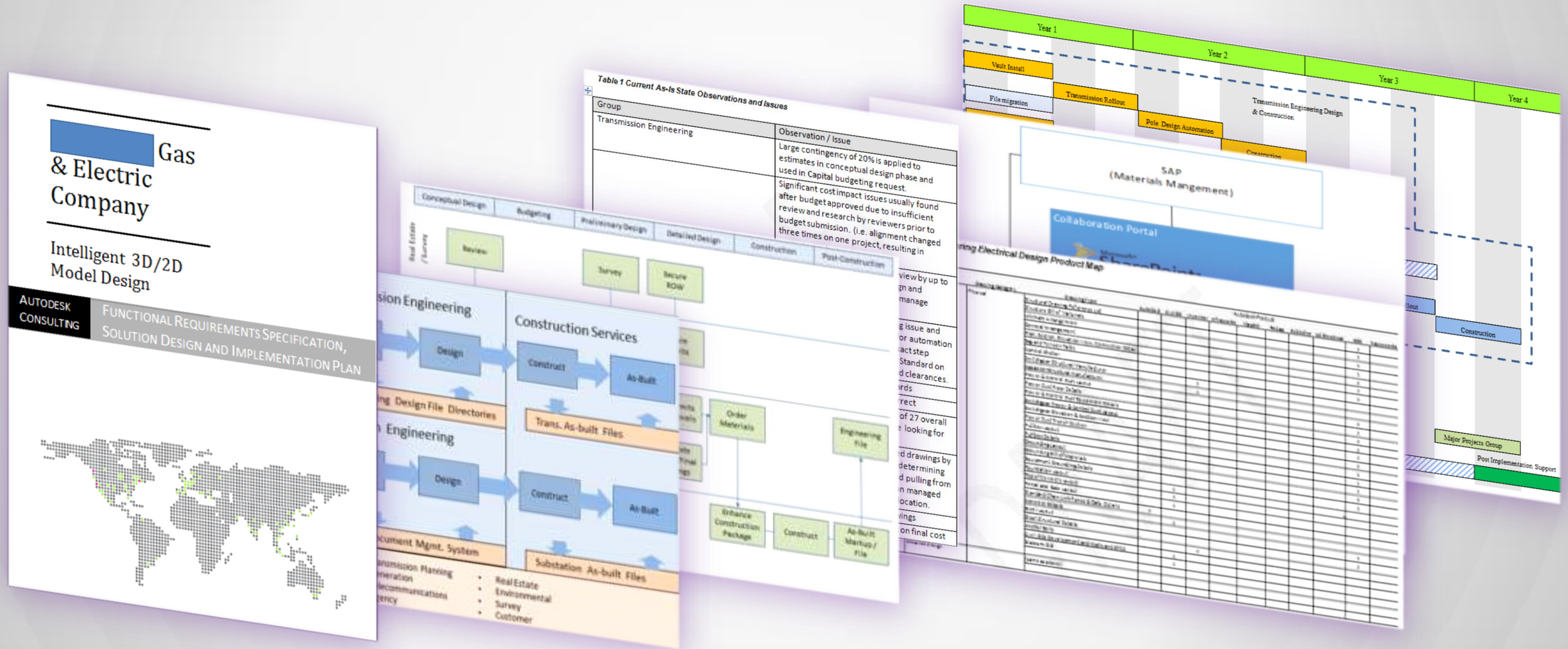
Business drivers
Current “as-is” workflows
Needs and opportunities
Current costs of doing business

Executive Summary
Requirements Analysis
- Current “as-is” workflows
- Needs analysis and opportunities

Solution Conceptual Design
- Proposed “to-be” workflows
- Proposed solution architecture

Implementation Plan
- Budgetary Estimates
- Schedule
- Cost/Benefit Analysis

A Major Electric & Gas Utility BIM Planning Example



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Project Schedule

November 2013

- Kick-off
- Design Workshops

December 2013

- Interface Workshop
- Architecture Workshop
- Hi Level Spec/Tech Requirements

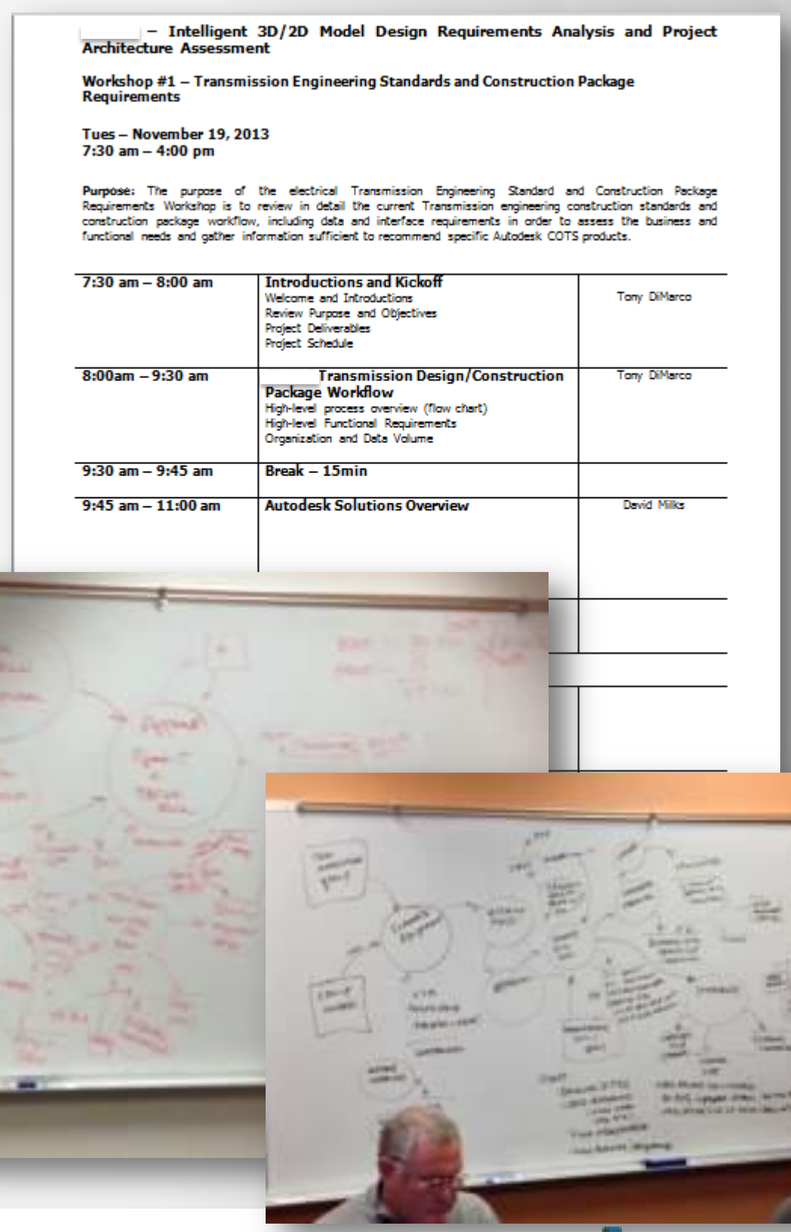
January – February 2014

- Initial Findings Workshop
- POC Development
- Implementation Plan/Schedule

Requirements Gathering Workshops

- Transmission Engineering and Construction Package Requirements
- Transmission Construction Maintenance and Construction Services
- Substation Engineering and System Protection
- Quality Programs
- Distribution Engineering and Construction Standards
- Civil/Structural Engineering and Standards
- IT Technical Architecture and Interfaces
- Major Projects Group

8 Workshops/ 40 interviews



– Intelligent 3D/2D Model Design Requirements Analysis and Project Architecture Assessment

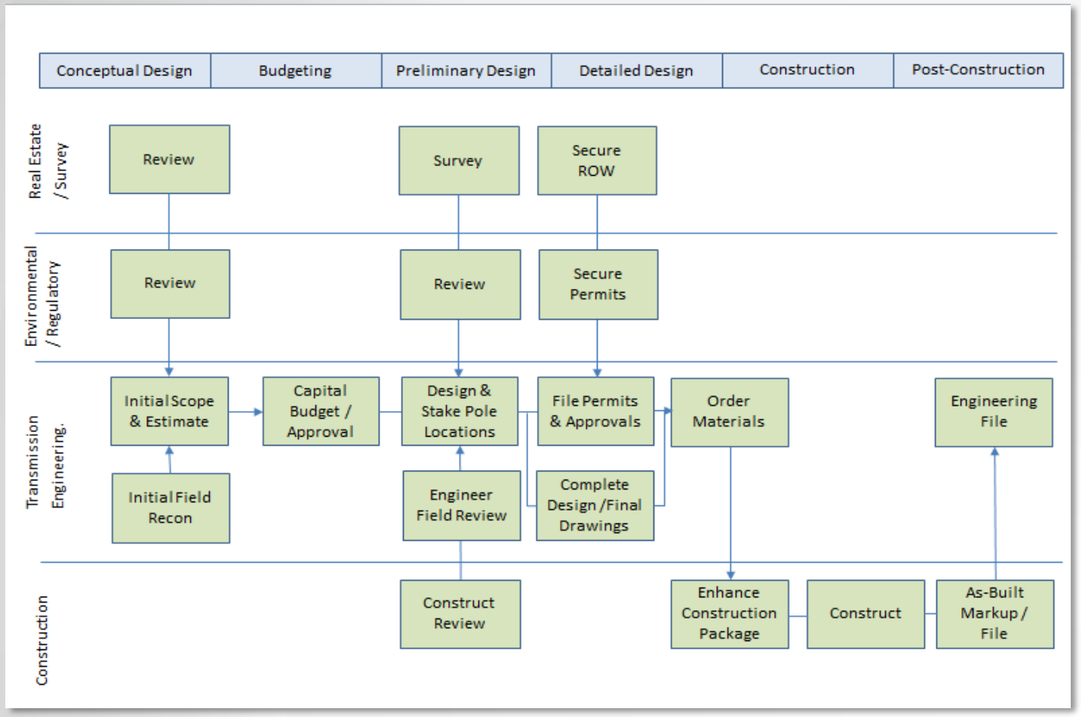
Workshop #1 – Transmission Engineering Standards and Construction Package Requirements

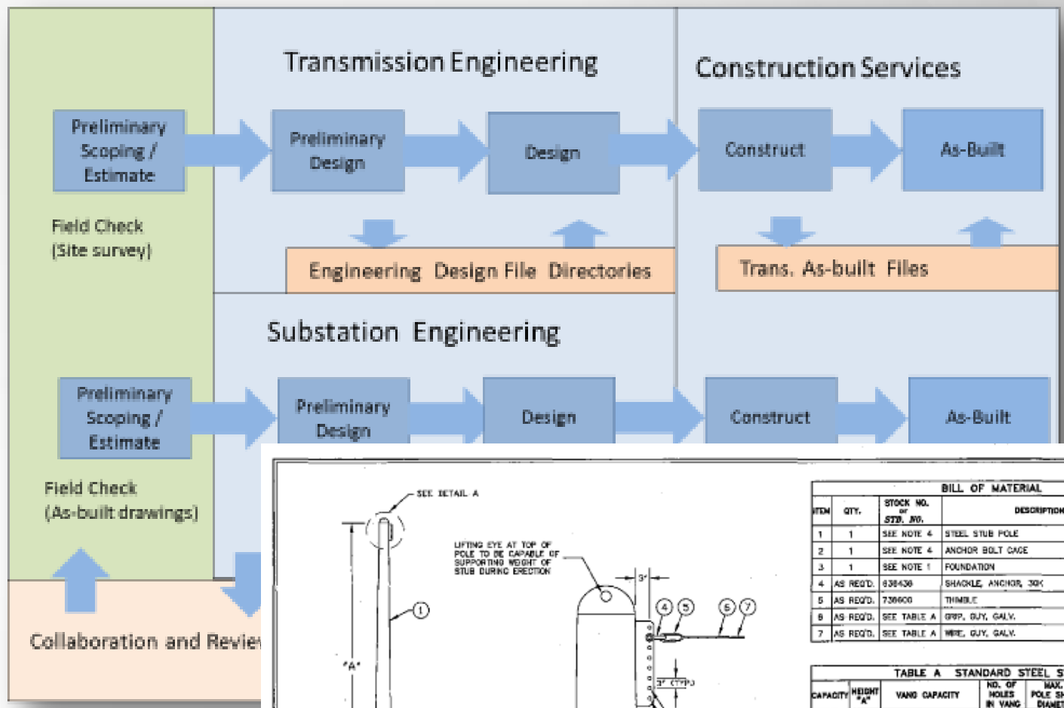
Tues – November 19, 2013
7:30 am – 4:00 pm

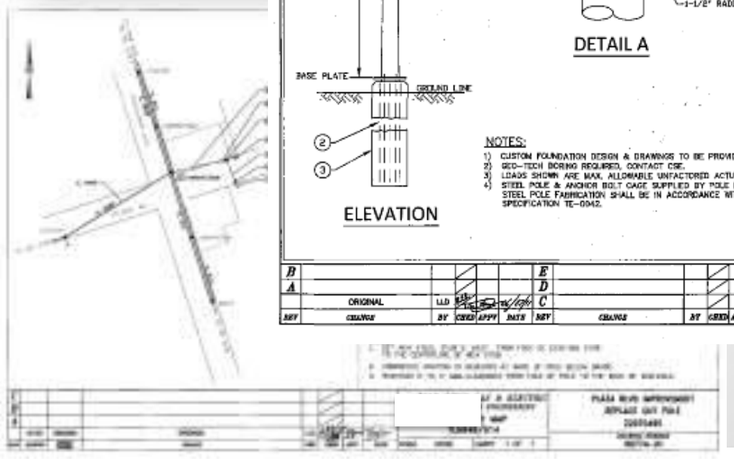
Purpose: The purpose of the electrical Transmission Engineering Standard and Construction Package Requirements Workshop is to review in detail the current Transmission engineering construction standards and construction package workflow, including data and interface requirements in order to assess the business and functional needs and gather information sufficient to recommend specific Autodesk COTS products.

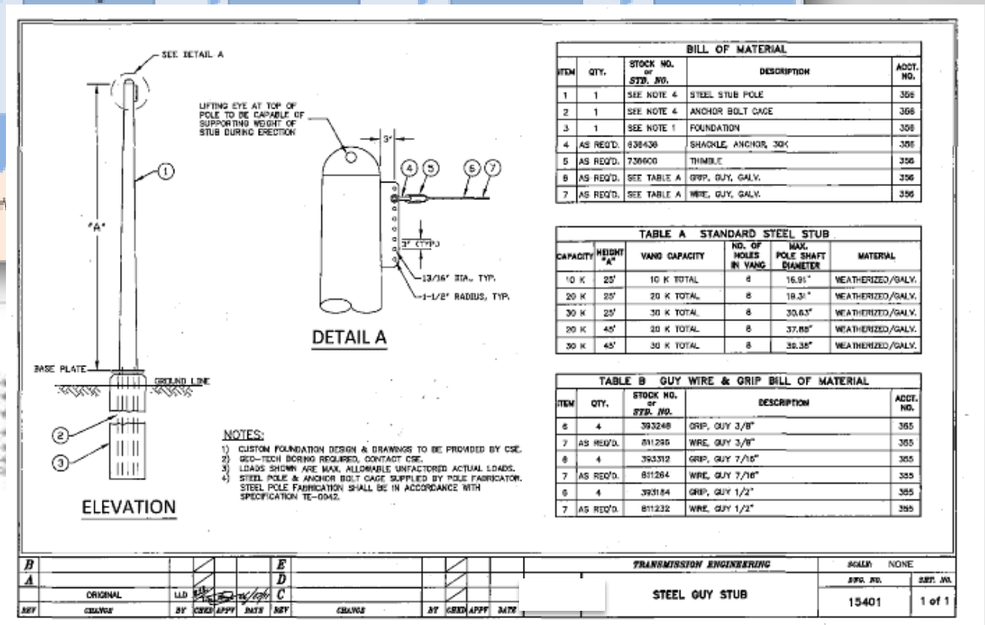
7:30 am – 8:00 am	**Introductions and Kickoff** Welcome and Introductions Review Purpose and Objectives Project Deliverables Project Schedule	Tony DiMarco
8:00am – 9:30 am	**Transmission Design/Construction Package Workflow** High-level process overview (flow chart) High-level Functional Requirements Organization and Data Volume	Tony DiMarco
9:30 am – 9:45 am	**Break – 15min**	
9:45 am – 11:00 am	**Autodesk Solutions Overview**	David Milks

Work Process Descriptions









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What Did We Hear? | “Pain Points”

Transmission Engineering Design (TED)

- Spend **50% of time** (for staff of 27) **looking for information**
- **Contingency of 20%** applied to estimates in used in capital budgeting request
- **Cost impact issues** usually found after budget approved due to **oversights in review**
- **Error prone and difficult design review process** with nine different groups participating
- No pole specific drawings by location results in **construction “fielding” hardware**
- **Steel pole** step and access requirements are **complex to design in 2D**
- **Lack of Engineering and Design Standards**

Transmission Construction Maintenance (TCM)

- **Materials are not always ordered in time** so unreasonable demands on schedule
- **Wrong bolt lengths**, **wire,** connector size can stop or **delay construction, contractors**
- **Need more understandable drawings** (i.e. grounding on steel poles was **confusing**)
- A challenge to find correct part # and stock # since **standards are not up to date**

What Did We Hear? | “Pain Points”

Substation Engineering Design

Need better way to **coordinate** between **physical and electrical** designers.
Labor intensive checking and coordination between all required **electrical drawings**.
Nearly **50% staff** time spent on **“as-built” checking** and researching.
Many senior people retiring over next few years
Three year backlog of “as-built” markups

Substation Construction and Maintenance

Biggest issue is **incomplete physical drawings**.
Delay in ordering materials creates a materials shortage and schedule delay
Drawing interpretation and **contractor discrepancies**
Excessive redline mark-up of control drawings due to “as-built” backlog issue.
Issues and engineering resolution tracking and general lack of documentation

What Did We Hear? | “Pain Points”

Distribution Standards

Large **backlog** of standards to be updated
Extensive **cross referencing** between standards manuals is **labor intensive** to maintain
Field has **difficulty interpreting** the 2D Standards drawings
Field does not readily **accept new equipment**, related to **lack of training**
Majority of equipment failures are **related to improper installation**

Major Projects

Need a **better way to share** information collaboratively through design process
Need **awareness of all active projects** in the same area to assess impacts
Issues with revision control preparing contractor packages and **approval grid-lock**

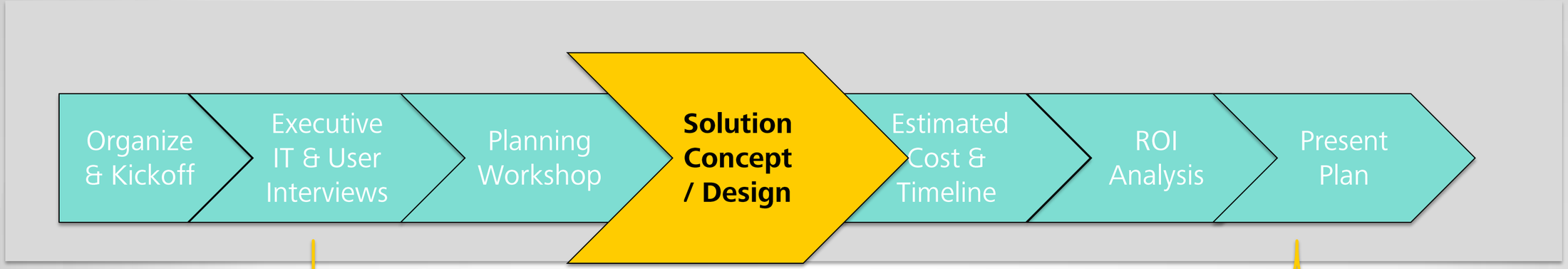
Civil and Quality Assurance

Need to get **“as-built” drawings**
Would like General Arrangement (GA) and foundation **drawings to scale**
Difficult to get dedicated resources to implement 3-4 year old **QA/QC program**

In Summary | “Pain Points”

- Need to **“do more with less”** is taxing current resources
- Dealing with an **overwhelming backlog of “as-built” drawings**
- Backlog of **out-of-date construction standards** / material stock numbers
- 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**

Strategic Planning – Conceptualize the Solution



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BIM Vision to Transform Engineering & Construction

Protection & Controls
Schematics, panels, wiring diagrams, cable lists

Physical Design
2D/3D Modeling

Constructability Design Review
Model aggregation, clash detection, schedule

WORKFLOW

CENTRAL DESIGN REPOSITORY

Site Design
2D/3D Modeling

Construction Package
Drawings, BOMs

3D Parts and Assemblies
SAP CU Alignment
Technical Publications

Conceptual Design
Permitting, estimating

ESTIMATING

Construct and Commissioning
Checklist, Validations, Project Dashboards

BIM – A Unified Workflow Across Design Disciplines

PLAN → DESIGN → CONSTRUCT → OPERATE → MAINTAIN

Engineering & Construction Service Providers

BIM Unified Model

Field / Mobile Workforce

Transmission Design

Substation Design

Distribution Design

Communications & Control Design

Construction

Operate and Maintain

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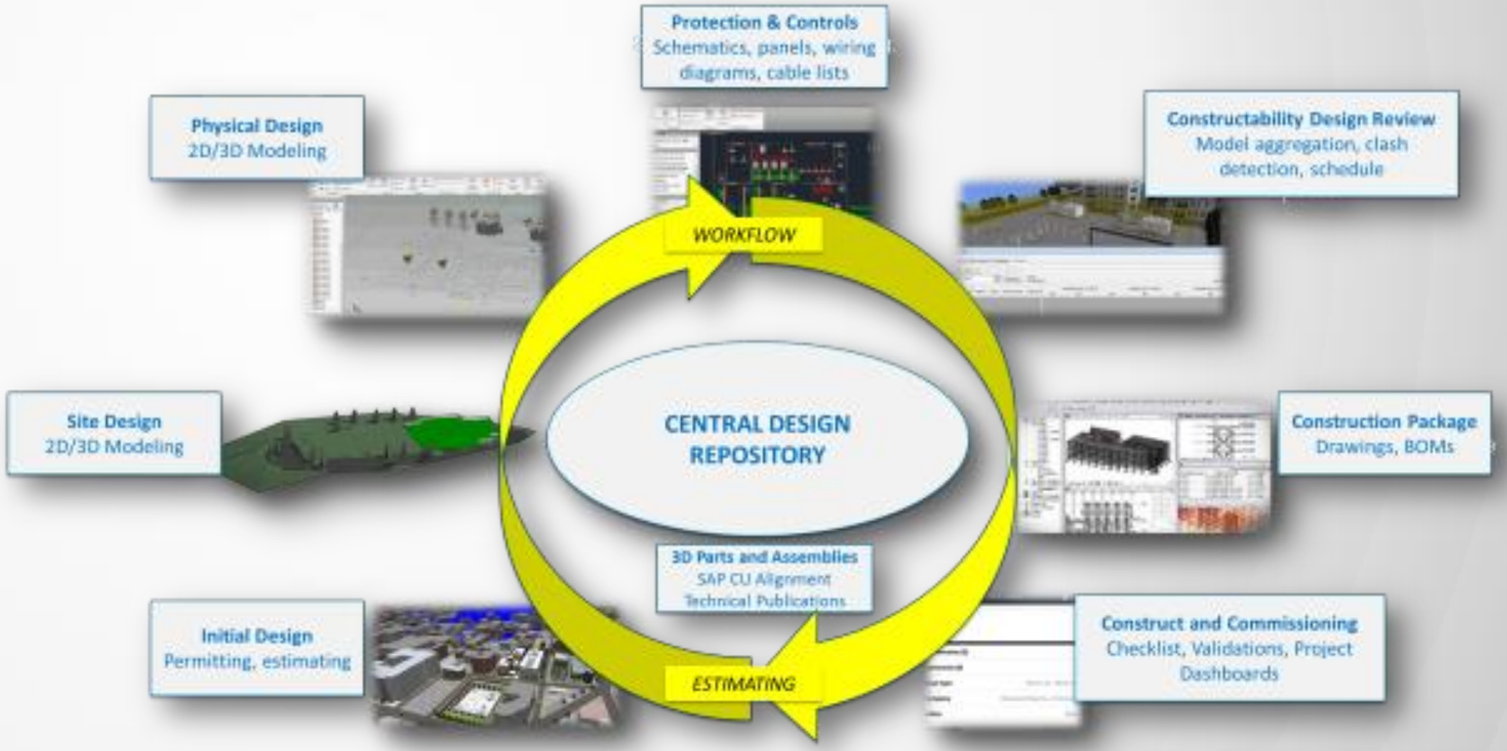
Crafting a Solution – Building Information Model (BIM)

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

COST CONTROL
Reduce construction waste
Increase confidence in cost estimates

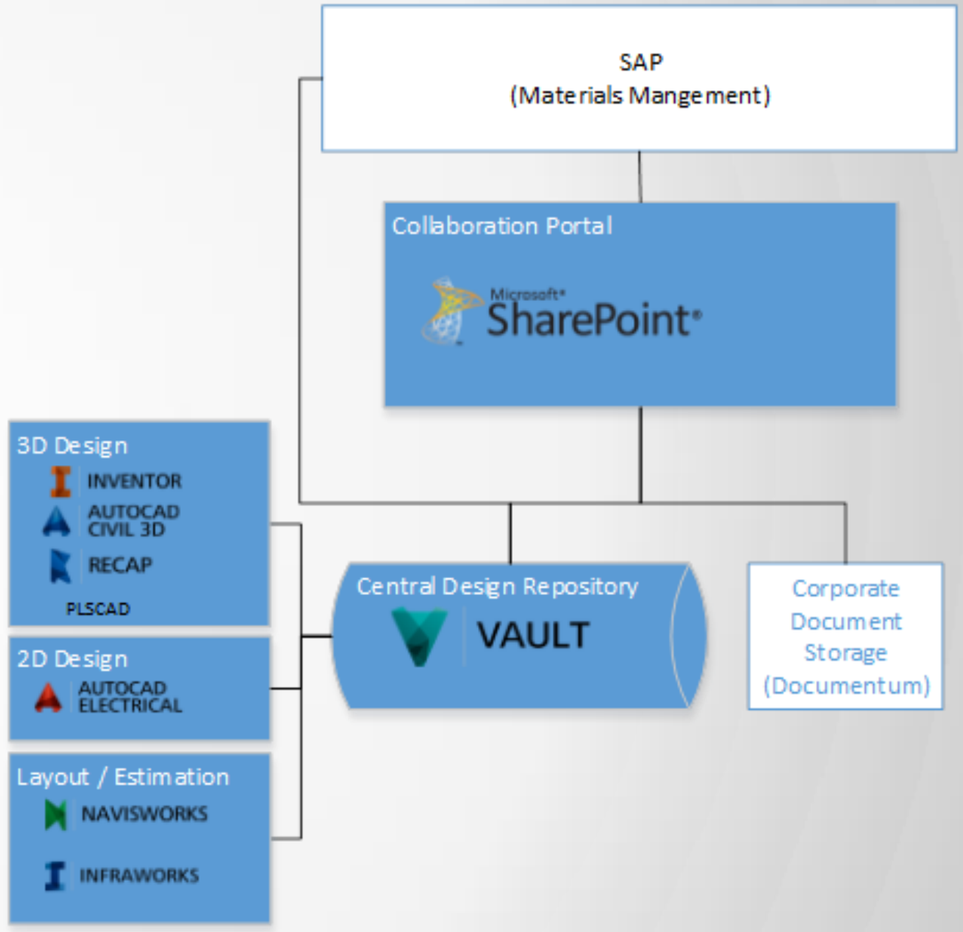
SAFETY
Improved Data Quality
Validate Standards

A unified workflow for the project lifecycle



COTS Products | 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



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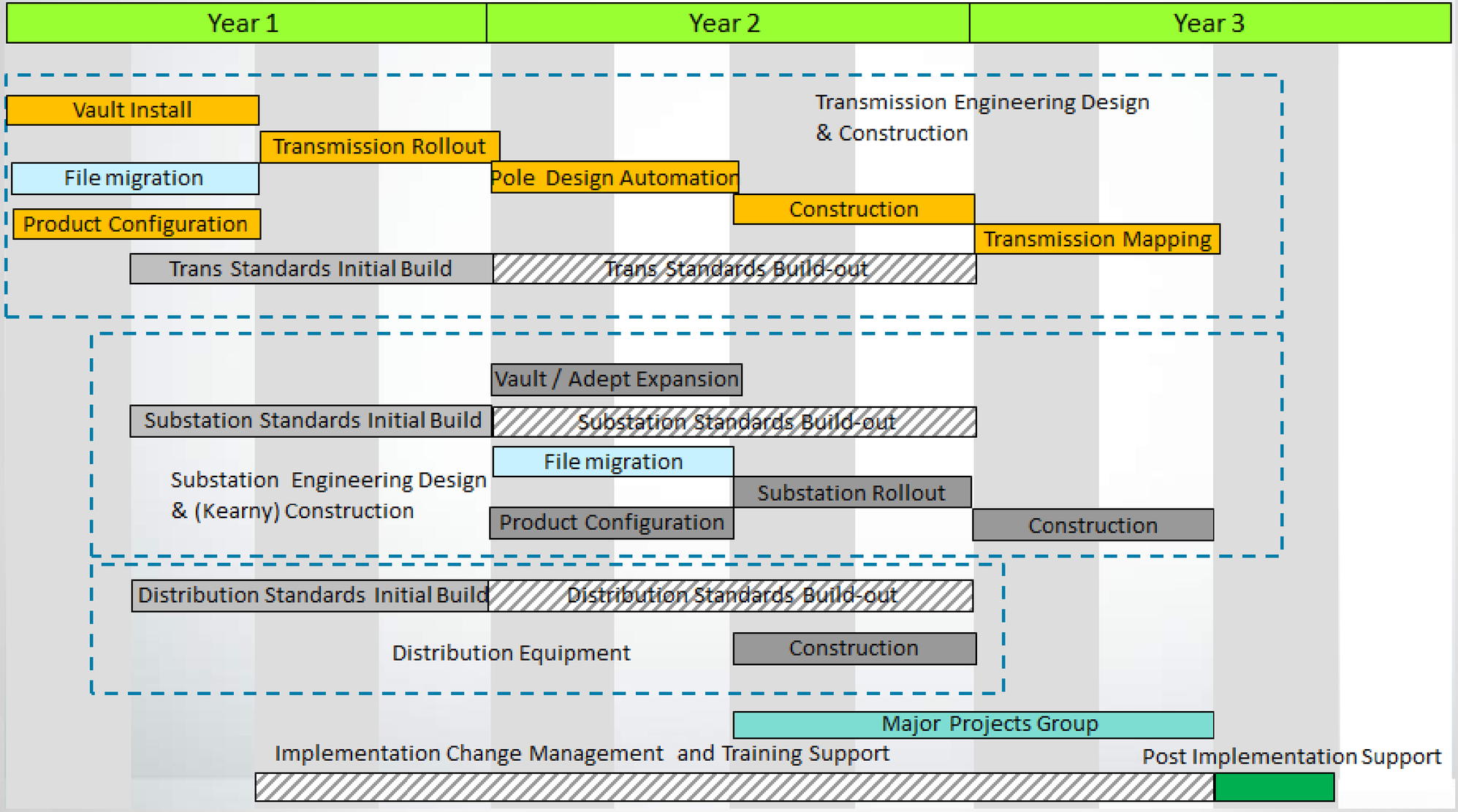
High Level Strategic Implementation Plan



Software Cost - Details by Group and Phase - sample

Transmission Engineering Design & Construction	PRD Unit Price	SUB Unit Price - EPS	Quantity	Total PRD	Annual SUB	Year		
						1	2	3
Infrastructure Design Suite - Premium	**$6,885.00**	**$1,292.00**	**25**	**$172,125.00**	**$32,300.00**	x		
Inventor Publisher	**$979.00**	**$184.00**	**5**	**$4,895.00**	**$920.00**	x		
Vault Professional	**$1,331.00**	**$312.00**	**30**	**$39,930.00**	**$9,360.00**	x		
BIM360	**$0.00**	**$850.00**	**50**	**$0.00**	**$42,500.00**		x	
Total Software (Autodesk)				**$216,950.00**	**$85,080.00**			

Substation Engineering Design & Construction	PRD Unit Price	SUB Unit Price - EPS	Quantity	Total PRD	Annual SUB	Year		
						1	2	3
Product Design Suite - Premium	**$7,028.00**	**$1,320.00**	**45**	**$316,260.00**	**$59,400.00**		x	
Inventor Publisher	**$979.00**	**$184.00**	**3**	**$2,937.00**	**$552.00**		x	
Substation Design Solution (SDS) - Elect	**$3,000.00**	**$600.00**	**30**	**$90,000.00**	**$18,000.00**		x	
Substation Design Solution (SDS) - Inventor	**$3,000.00**	**$600.00**	**15**	**$45,000.00**	**$9,000.00**		x	
Navisworks Manage	**$7,871.00**	**$1,476.00**	**1**	**$7,871.00**	**$1,476.00**			x
Vault Professional	**$1,331.00**	**$312.00**	**50**	**$66,550.00**	**$15,600.00**		x	
Buzzsaw								
BIM360	**$0.00**	**$850.00**	**50**	**$0.00**	**$42,500.00**			x
Total Software (Autodesk)				**$528,618.00**	**$146,528.00**			

Project Services Cost Summary by Year - sample

Project Services Budgetary Estimate				
Consulting Services	Y1	Y2	Y3	Total
Transmission Engineering	$980,000	$1,160,000	$465,000	$2,605,000
Substation Engineering	$390,000	$910,000	$345,000	$1,645,000
Distribution Engineering	$360,000	$310,000	$50,000	$720,000
Sub Total	**$1,730,000**	**$2,380,000**	**$860,000**	**$4,970,000**
Data Creation Services				
3D Model Creation - Trans.	$300,000			
3D Model Creation - Distrib.	$300,000			
3D Model Creation - Substn.	$300,000			
Other Services				
TSPI Integration Requirements	$150,000	$150,000		
Grand Total	**$2,780,000**	**$2,530,000**	**$860,000**	**$6,170,000**

Overall 3 Year Program Cost Summary:

- $6.2m in Autodesk Services
- $875k in Software
- $325k Annual Subscription

Notes:

- Software and Customer resource cost addressed in full ROI analysis, but not included here.

Cost Benefit Analysis Results

Cost Benefit Approach – Benefit Categories

- Productivity Benefits
- Cost Avoidance Benefits
- Reduction of External Costs
- Reduction in Capital Project Costs

Roundtable Discussion Point:

We continue to need customer testimonials to build our cost benefit quantification library of examples for % saved, costs eliminated, etc.

“BIM in Construction” Cost Benefit Studies *

Typical Savings we can extrapolate to BIM for Utility Infrastructure:

- “Reduction in rework 39%”
- “Reduction in change orders 39-47%”
- “Reduction in project time 7%”
- “40% reduction in unbudgeted changes”
- “ Reduced cost of MEP job by 8%”
- “Net savings of 5% on construction costs”
- “Productivity improvement by 30% for MEP”

* Research by Center for Integrated Facilities Engineering (CIFE) Stanford, Canadian National Research Council, Construction Industry Institute, Lean Construction Institute, publicly available case studies, 25 sources over 6 years..

3D/2D Model Design – Cost Benefit Analysis Approach

- **Key Benefits Estimated in the Analysis:**
  - Productivity improvements for Transmission Engineering (15%)
  - Productivity improvements for Substation Engineering (15%)
  - Productivity improvements for As-Built creation (50% using Lidar/ReCap)
  - Cost avoidance benefits in construction by earlier detection of issues
  - Reduction in contingency and construction costs of 1% on capital projects
- **Gradual phased realization of benefits over three years**
- **Calculate Net Cash Flow and Financial Metrics**
  - Include all project costs: HW,SW, Services and implementation team costs
  - Calculate IRR and Payback Period

Benefits Quantified

Productivity Savings:
Transmission Engineering: # designers x $X k annual loaded salary x 15% productivity improvement = $562,500 annual savings

Substation Engineering: # designers x $X k annual loaded salary x 15% productivity improvement = $1,462,500 annual savings

Substation Engineering: 80% of Substation work is "brownfield". If “X” physical designers, 50% of work is as-built, and LIDAR could save 50% then, = $450,000 annually

Avoided Costs:
Construction: Field consequences of wrong physical drawings. Cost of rework, both materials and delay. Scheduling, early clash detection, travel = $1.3M

External Costs:
Reduction of external contracted design resources, $250,000

Capital Projects:
Annual capital construction budget is $450 million. A reasonable extrapolation is expected savings of 1%, or $4,500,000 annually through improved design, coordination, construction management.

Cost Benefit – Benefit Quantification and Phasing

Benefit Category	Benefits Realization Implementation Phase-In 2014	2015	2016	2017	2018	2019	Annual Benefit
Productivity Savings							
Design productivity with 3D - Transmission	10%	25%	50%	100%	100%	100%	$562,500
Design Productivity with 3D - Substation		10%	25%	50%	100%	100%	$1,462,500
As-built Models creation from Lidar		25%	50%	100%	100%	100%	$450,000
Improved revision control data mgmnt	10%	25%	50%	100%	100%	100%	$100,000
Improved Supplier Collaboration		10%	25%	50%	100%	00%	$50,000
Cost Avoidance							
Layout Schedule Time			25%	50%	0%	00%	$300,000
Early Interference / Clash Checking		10%	50%	100%	1 %	100%	$1,000,000
Field Check Time and Travel		25%	50%	75%	100%	100%	$50,000
Reduction of External Costs							
Increased capacity for internal design		1 %	2 %	50%	100%	100%	$250,000
Reduction in Captial Projects Costs							
Reduction in Project Contingency		10%	25%	50%	75%	100%	$4,500,000
Improved Supplier Collaboration		25%	50%	75%	100%	100%	$50,000
						Estimated Annu	$8,775,000

% phase-in of benefit each year, until full 100% benefit achieved

Cost Benefit – Benefit Realization by Year Result

Autodesk Project Cash Flow Requirements Summary							
	2014	2015	2016	2017	2018	2019	Total
Benefits							
Productivity Savings							
Design productivity with 3D - Transmission	$56,250	$140,625	$281,250	$562,500	$562,500	$[illegible]2,500	$2,165,625
Design Productivity with 3D - Substation	$0	$146,250	$365,625	$731,250	$1,462,500	$1,4[illegible]50[illegible]	$4,168,125
As-built Models creation from Lidar	$0	$112,500	$225,000	$450,000	$450,000	$[illegible]50,[illegible]00	$1,687,500
Improved revision control data mgmnt	$10,000	$25,000	$50,000	$100,000	$1[illegible]	$1[illegible]0,0[illegible]0	$385,000
Improved Supplier Collaboration	$0	$5,000	$12,500	$25,000	[illegible]50,000	$50,000	$142,500
Cost Avoidance							
Layout Schedule Time	$0	$0	$75,000	$150,00[illegible]	$300,[illegible]00	$300,000	$825,000
Early Interference / Clash Checking	$0	$100,000	$500,000	$1,[illegible]00,[illegible]00	$1,000,000	$1,000,000	$3,600,000
Field Check Time and Travel	$0	$12,500	$25,000	$[illegible]5[illegible]	$50,000	$50,000	$175,000
0	$0	$0	$0	$0	$0	$0	$0
	$0	$0	$0	$0	$0	$0	$0
	$0	$0	$[illegible]	$0	$0	$0	$0
	$0	$[illegible]	$0	$0	$0	$0	$0
Reduction of External Costs							
Increased capacity for internal design	$[illegible]	$25,0[illegible]	$62,500	$125,000	$250,000	$250,000	$712,500
	$0	$0	$0	$0	$0	$0	$0
		$0	$0	$0	$0	$0	$0
	$[illegible]	$0	$0	$0	$0	$0	$0
	$0	$0	$0	$0	$0	$0	$0
Reduction in Captial Projects Costs							
Reduction in Project Contingency	$0	$450,000	$1,125,000	$2,250,000	$3,375,000	$4,500,000	$11,700,000
Improved Supplier Collaboration	$0	$12,500	$25,000	$37,500	$50,000	$50,000	$175,000
	$0	$0	$0	$0	$0	$0	$0
Net Benefits	$66,250	$1,029,375	$2,746,875	$5,468,750	$7,650,000	$8,775,000	$25,736,250

Cost Categories Considered

- Presented Capital Expenses (CAPEX)
  - Software License Costs
  - Implementation Services
  - Customer Implementation Team
  - Computing Hardware, Networking
- Presented Operating Expenses (OPEX)
  - Software Maintenance Subscription
  - Customer Support Team
  - External Support

Cost Benefit - Project Costs, Net Cash Flow and ROI

	2014	2015	2016	2017	2018	2019	Total
Implementation Cost							
Capital							
Autodesk Software	$240,050	$587,300	$47,250				$874,600
Autodesk Consulting Services	$2,780,000	$2,530,000	$860,000				$6,170,000
Customer Implementation Team Training	$100,000	$100,000					$200,000
Customer Implementation Team	$750,000	$750,000	$750,000				$2,250,000
Hardware	$125,000	$125,000	$0	$0	$0	$0	$250,000
							$0
Capital Cost Summary	$3,995,050	$4,092,300	$1,657,250		$0	$0	$9,744,600
Expense							$0
Software Subscription	$47,600	$272,000	$323,300	$323,300	$323,300	$323,300	$1,612,800
Sustaining AC Support				$100,000	$100,000	$100,000	$300,000
Customer Internal Support Team	$0	$0	$0	$150,000	$150,000	$150,000	$450,000
O&M Cost Summary	$47,600	$272,000	$323,300	$573,300	$573,300	$573,300	$2,362,800
Total Cost Summary	$4,042,650	$4,364,300	$1,980,550	$573,300	$573,300	$573,300	$12,107,400
ROI Analysis							
Net Cash Flow	($3,976,400)	($3,334,925)	$766,325	$4,895,450	$7,076,700	$8,201,700	
Cumulative Cash Flow	($3,976,400)	($7,311,325)	($6,545,000)	($1,649,550)	$5,427,150	$13,628,850	
Payback Period (yrs)	4.2						
Payback Year	2018						
IRR	35%						

Net Cash Flow (Benefit minus Cost) & Financial Metric Calculations

Cost Benefit Analysis Result

Presented a very attractive investment:

- Project Payback Period / Breakeven in 4.2 years
- Payback in 2018
- Internal Rate of Return (IRR) of 35% = (ROI)

Client Expressed Lessons Learned

- **O&M vs. Capital Expense for both FERC and State**
  - Collaborate with your accounting department early and often
  - Look to others who have tackled large IT or change mgmt. projects
  - It's a marathon…not a sprint

- **Ensure you have the right internal and external resources to fully support the project**
  - Or be prepared to extend timeline or reduce scope accordingly

- **Be sure you understand the hardware, software and development costs**

Roundtable Discussion Topics

- What technology solution are you planning next?
- Have you identified the benefits?
- Have you quantified the benefits?
- Can you sell a project based on strategic benefit alone?
- How are projects financially modeled in your firm?
- What challenges are you facing to secure funding?

Key learning objectives – Class Conclusion

You Should Now be Better Able to:

- Describe methodologies for **business requirements gathering** and strategic planning
- Develop a approach to **quantify benefits** for a technology solution
- **Calculate key financial metrics** for a business case including net cash flow, ROI and payback
- **Propose a study** to develop specifications, solution design, implementation plan and business case with ROI


Thank you for participating in the
"Make Your Case" Roundtable