



***CRITICAL THINKING.
SOLUTIONS DELIVERED.***

The Dynamic Economic Model:

A flexible approach to investment analysis with Analytica

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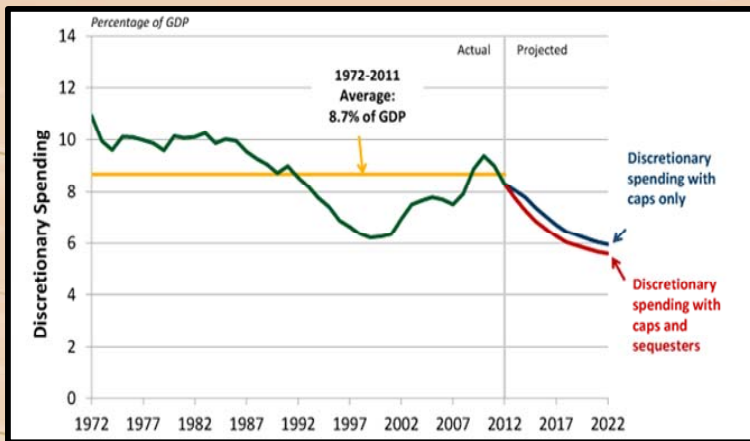
ICEAA TRIBUNE

no.203.078

Number One in Cost Estimation

- Since 1990

CBO projects \$845 billion budget deficit for 2013



Discretionary Spending Cut Indiscretion

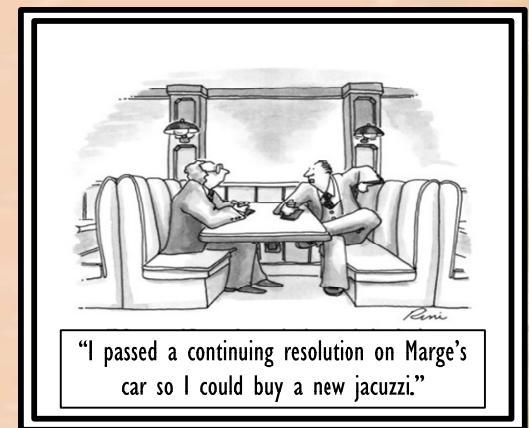
In libris graecis appetere mea. At vim odio lorem omnes, pri id iuvaret partiendo. Vivendo menandri et sed. Lorem volumus blandit cu has.Sit cu alia porro fuisset.

Continued Resolution Continues

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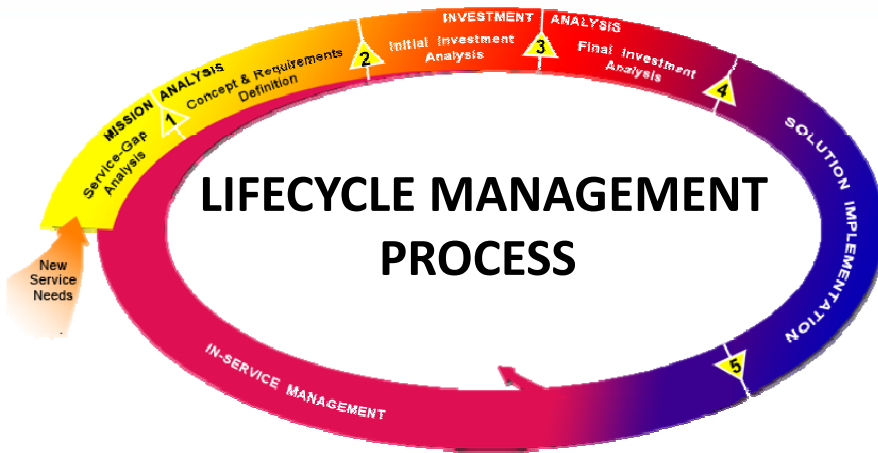
Ea pro natum invidunt repudiandae, his et facilisis vituperatoribus. Mei eu ubique altera senserit.

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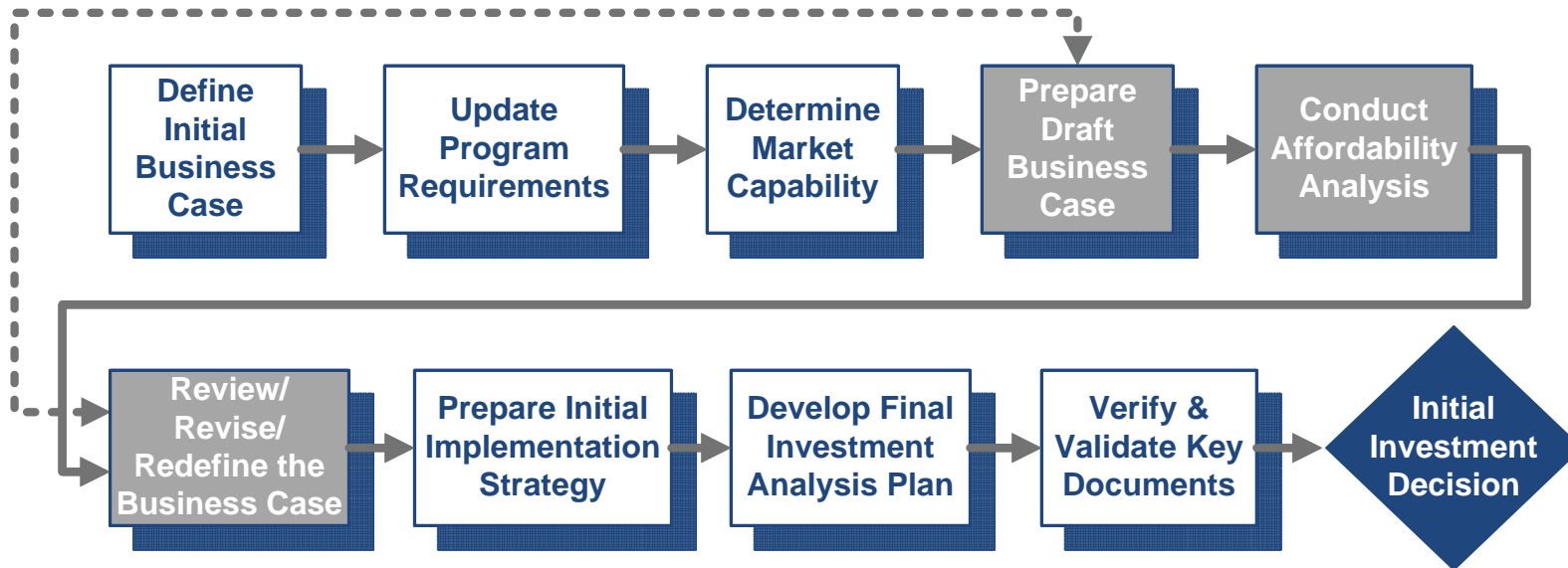


Start Early



Business Case Development

- Concept Requirements Definition
- Initial Investment Analysis

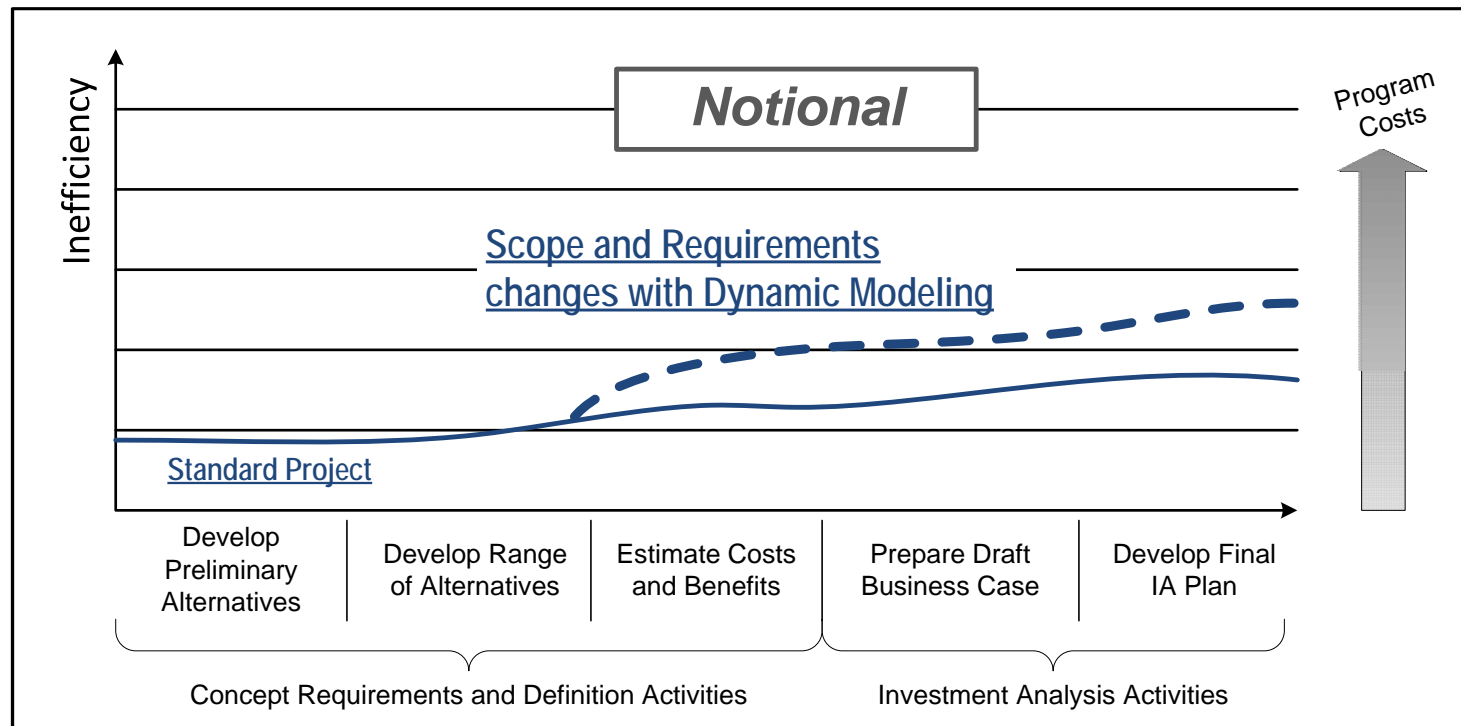




A new way of thinking

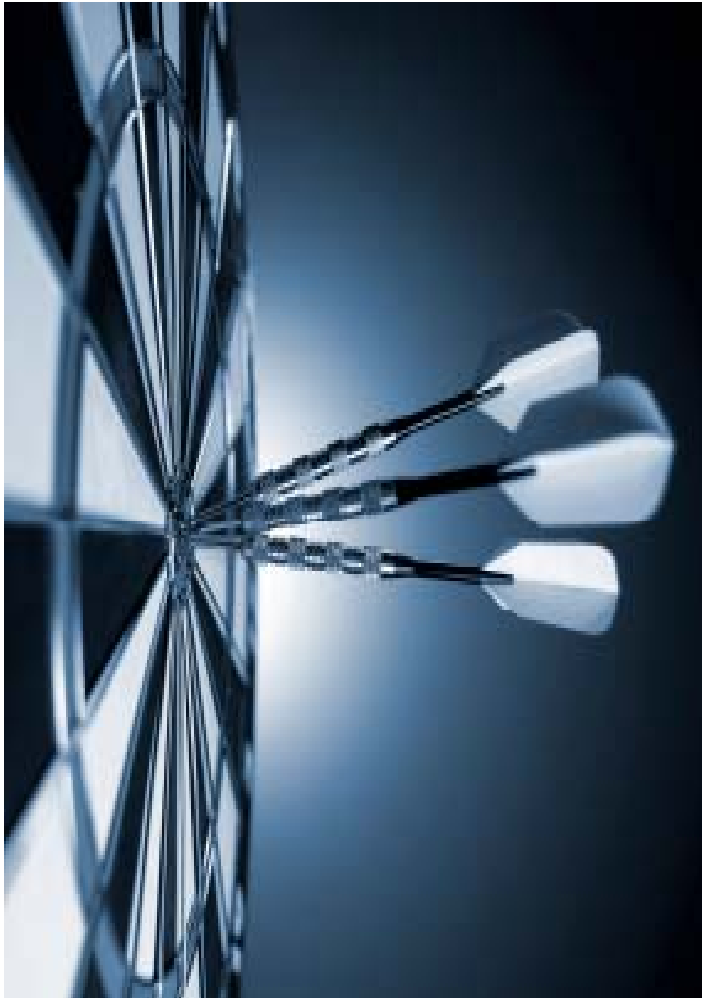
- Limited flexibility to deal with requirement and scope adjustments increases LOE needed to remain on schedule.
- Too many changes will eventually lead to schedule slip.

So how do we accommodate this uncertainty?





Federal Facility Consolidation Example



Objective

Reduce overall facility footprint & optimize operations

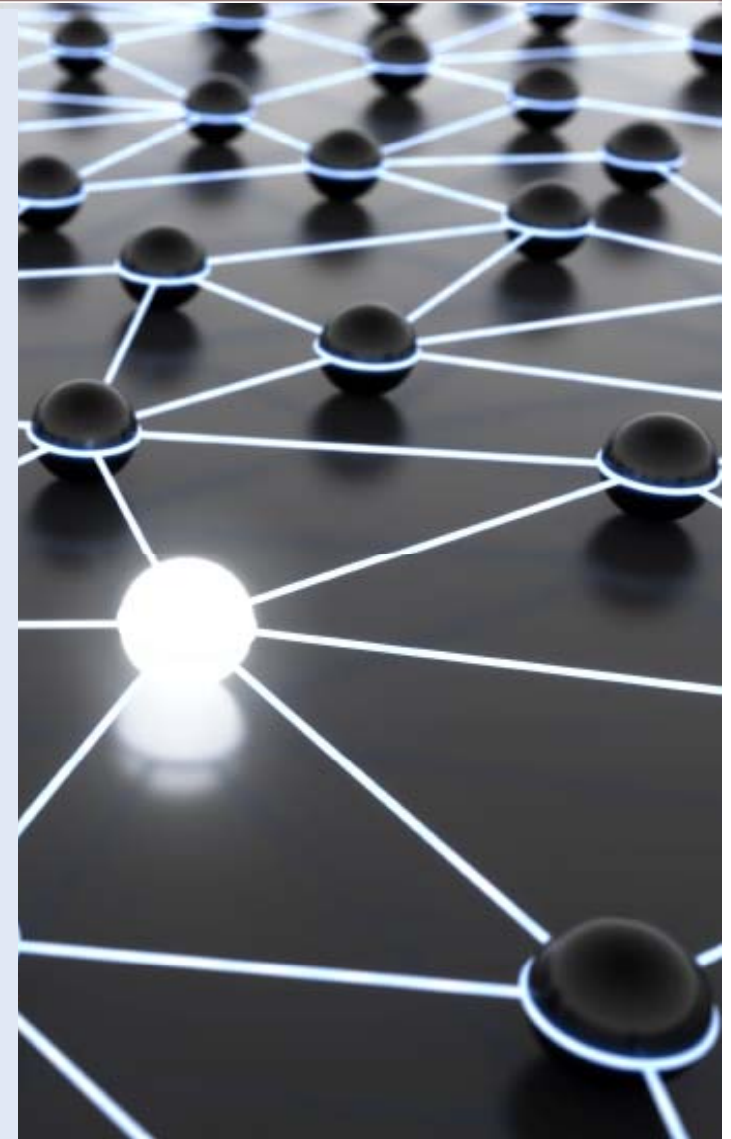
Scope

49 existing facilities re-aligned into between 1 and 7 future facilities



A Dynamic Business Case

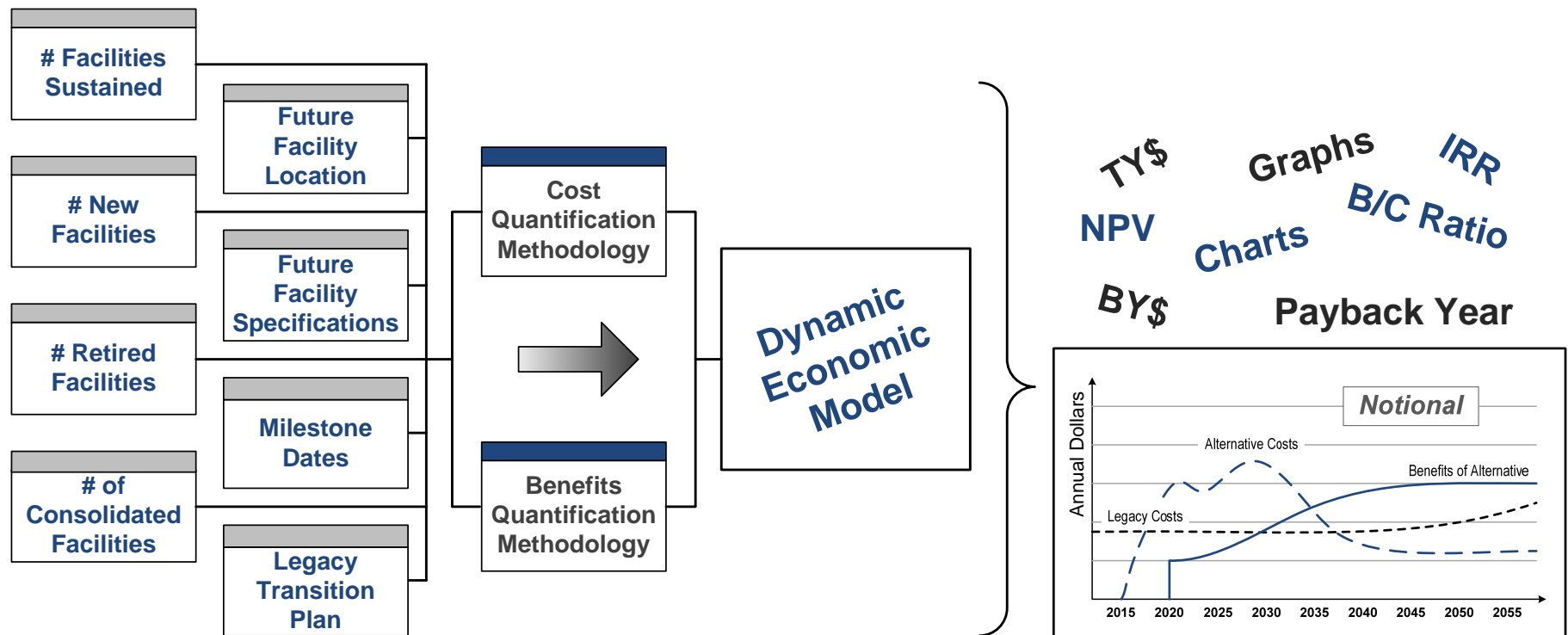
- **Business Case Factors**
 - Facilities
 - People
 - Equipment
- **Alternative Definition**
- **Donor/Receiver Matrix**
- **Key Schedule Milestones**





Solution Framework

- Interchangeable inputs and methodologies magnifies the advantages achieved from automated model creation



- Analytica© software tool was a perfect fit!



Why Analytica?

- **Quick GUI Development**
- **Influence Diagrams**
- **Monte Carlo**
- **Dynamic Arrays**
- **OLE Linking**



User Interface

NextGen Facilities Dynamic Eco -- Analytica® Enterprise -- C:\Users\kming\Documents\Projects\Facilities\DEM\Release 14\NGF_DEM_R14.ana

File Edit Object Definition Result Diagram Window Help

Diagram - NextGen Facilities Dynamic Economic Model (DEM)

NextGen Facilities Dynamic Economic Model (DEM)

The Dynamic Economic Model:
A flexible approach to investment analysis with Analytica

Scenario: **Scen 2** **The Dynamic Economic Model** Risk Adjusted: **Yes** Dollars: **TY** WBS Ver.: **4.2**

Legacy Improvement Case

Legacy 1st Level WBS (5.0 Only) **Calc** mid
 Legacy 2nd Level WBS (5.0 Only) **Calc** mid

Alternative

Scenario 1st Level WBS (5.0 Only) **Calc** mid
 Scenario 2nd Level WBS (5.0 Only) **Calc** mid
 Scenario WBS by Project **Result** mid

Economic Analysis

ICF NPV Over Time **Result** mid
 ICF NPV 2.51G mid
 Economic Analysis Summary **Result** mid

Mid Value - Scenario WBS by Project

Value of Scenario WBS by Project

	Time					
	2013	2014	2015	2016	2017	2018
...	0	0	0	0	0	0
...	0	0	0	0	0	0
...	0	0	0	0	0	0
...	0	0	0	0	0	0
...	8.75M	8.768M	0	0	0	0
...	2.5M	2.54M	0	0	0	0
...	0	0	0	0	0	0
...	783.3K	782.2K	807.2K	810.8K	832.7K	847
...	0	0	0	22.7M	23.11M	
...	0	0	0	0	0	
...	0	0	0	2.43M	2.473M	
...	5.606M	5.696M	805K	384.8K	401.9K	405
...	0	0	0	0	0	

Mid Value - ICF NPV Over Time

Mid Value of ICF NPV Over Time

Horizontal Axis: Time

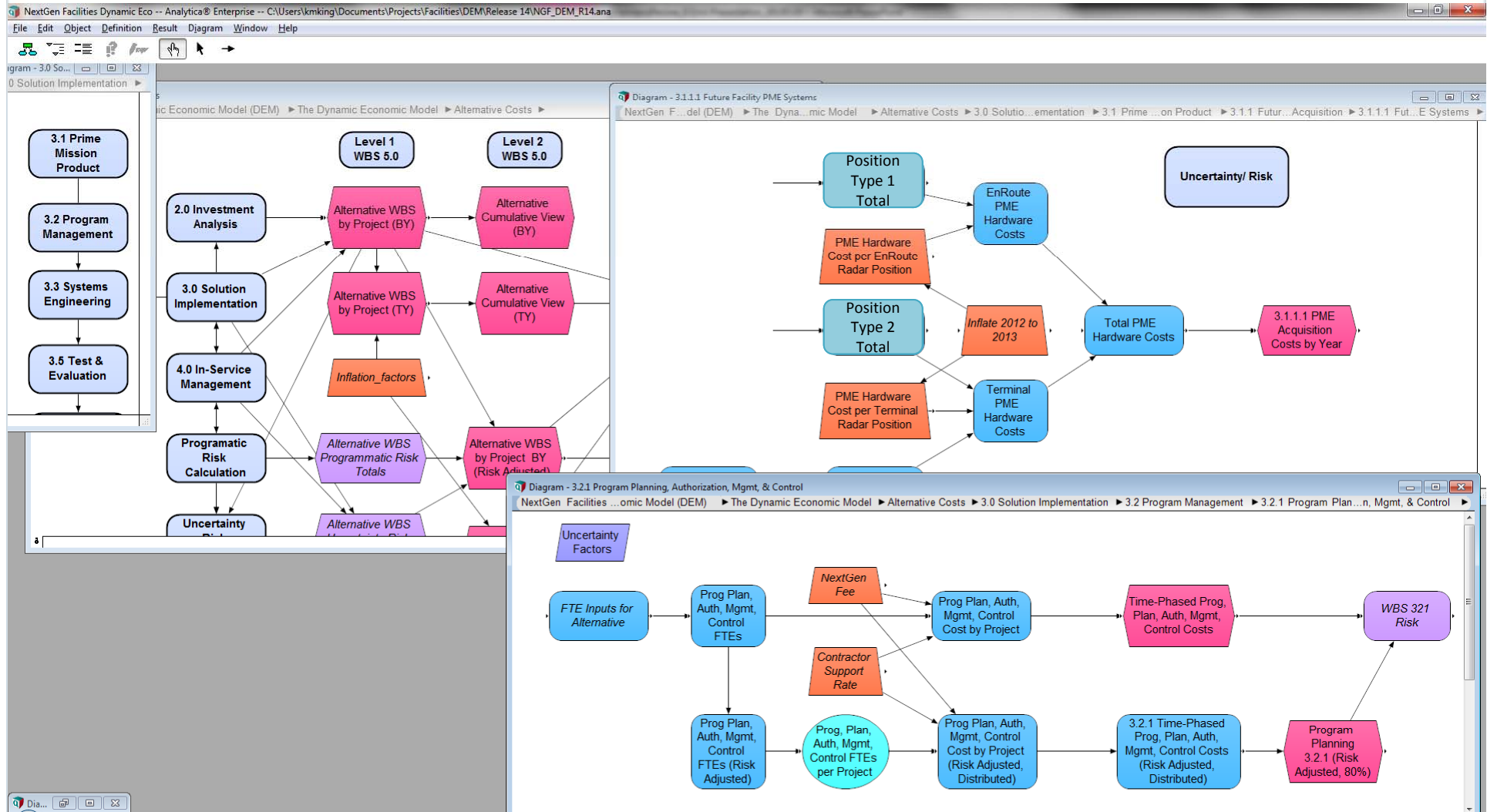
Square Feet Over Time

Charts and Graphs

- Savings by Area (BY) **Calc** mid
- Savings by Area (TY) **Calc** mid
- Savings by Area (NPV) **Calc** mid
- ... v1 2 Comparison (BY) **Calc** mid
- ... v1 1 Comparison (BY) **Calc** mid
- ... Level Comparison (BY) **Calc** mid
- ... Summary Comparison **Calc** mid
- ... Cost Comparison (TY) **Calc** mid
- ... Minutes of Delay Saved **Calc** mid



Influence Diagrams





Monte Carlo

The screenshot displays a software interface for a Monte Carlo simulation. The main window shows a flowchart with the following components:

- Position Type 1 Total**, **Position Type 2 Total**, and **Position Type 3 Total** (blue rounded rectangles) all point to **Terminal PME Hardware Costs** (blue rounded rectangle).
- PME Hardware Cost per Terminal Radar Position** (blue oval) and **EnRoute PME Hardware Costs** (blue rounded rectangle) both point to **PME Hardware Costs (Risk Adjusted, Distributed)** (blue rounded rectangle).
- An orange box labeled **Inflate 2012 to 2013** has arrows pointing to the two PME Hardware Cost ovals.
- The **PME Hardware Costs (Risk Adjusted, Distributed)** box points to the final output: **3.1.1.1 PME Acquisition Costs (Time Phased, Risk Adjusted, Distributed)** (blue rounded rectangle).

Two parameter definition windows are visible:

- Object - PME Hardware Cost per Terminal Radar Position**:
Title: PME Hardware Cost per Terminal Radar Position
Description: $expr$
Definition: $Randomseed=Dem_Random_Seed; Triangular(315K, 348K, 385K) * Inflate_{2012_to_2013}$
Value: 354.9K
Inputs: DEM_Random_Seed (DEM Random Seed), Inflate_2012_to_2013 (Inflate 2012 to 2013)
- Object - PME Hardware Cost per EnRoute Radar Position**:
Title: PME Hardware Cost per EnRoute Radar Position
Description: $expr$
Definition: $Randomseed=Dem_Random_Seed; Triangular(720K, 800K, 880K) * Inflate_{2012_to_2013}$
Value: Calc
Inputs: DEM_Random_Seed (DEM Random Seed), Inflate_2012_to_2013 (Inflate 2012 to 2013)

Two data visualization plots are shown:

- Probability Density - PME Hardware Cost per Terminal Radar Position**: A histogram showing the probability density of the terminal hardware costs. The x-axis is labeled "PME Hardware Cost per Terminal Radar Position" and ranges from 320K to 400K. The y-axis is labeled "Probability Density" and ranges from 0 to 40. The distribution is roughly bell-shaped and centered around 350K.
- EnRoute PME Hardware Cost per EnRoute Radar Position**: A scatter plot showing the results of 2000 iterations. The x-axis is labeled "Iteration (Run)" and ranges from 0 to 2000. The y-axis is labeled "PME Hardware Cost per EnRoute Radar Position" and ranges from 720K to 880K. The data points are scattered across the entire range, indicating a wide distribution of values.



Dynamic Methodologies

- **Assists in providing accurate cost estimates across the range of potential input values**
 - Examples
 - 11-point construction estimate
 - Equipment Acquisition Parametric Equation
 - Transition schedule framework



Dynamic Methodologies

- **11-Point Construction Cost Estimate**

- Developed by Architecture and Engineering firm
- Provides construction related cost estimates for all possible future facility sizes

Cost Category	<u>Point 1</u> (51 to 75 pos.)	<u>Point 2</u> (76 to 100 pos.)	<u>Points</u> 3 - 10	<u>Point 11</u> (301 – 325 pos.)
Site Selection	\$780,000	\$999,000	\$2,940,000
Main Building Construction	\$45,600,000	\$56,500,000	\$122,800,000
Supporting Facilities	\$6,200,000	\$6,860,000	\$7,240,000
Parking Garage	\$9,800,000	\$10,760,000	\$29,140,000
.....

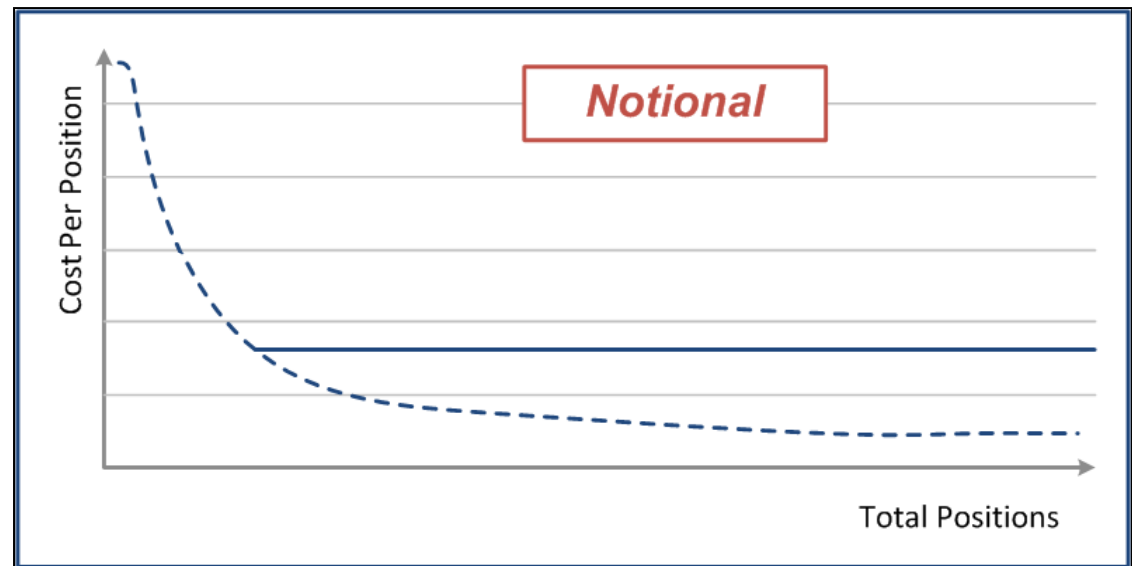


Dynamic Methodologies

- **Equipment Procurement Parametric**
 - Created using historical comparative analysis
 - Provides equipment cost estimates given full range of potential radar positions

Limitations

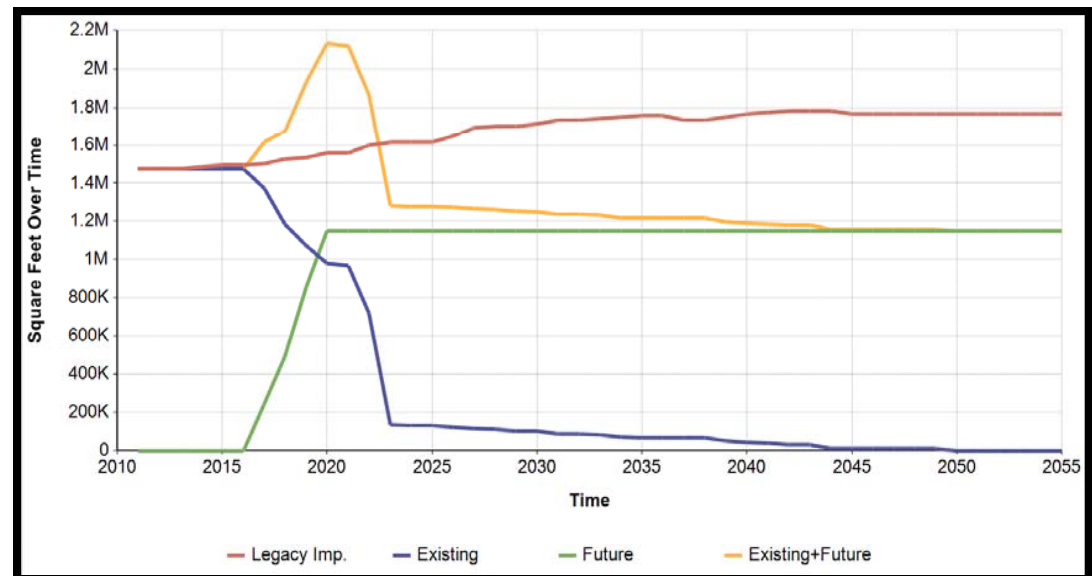
Unknown equipment types and future personnel counts





Dynamic Methodologies

- Transition schedule controls the time-phasing for all costs and benefits
- Given the uncertainty of the project the model needed to be capable of handling changes to project schedule and total facility counts.





OLE Linking

Mid Value - Alternative WBS by Project (BY)

Project Index: A
WBS Dimensions Update: Program
Appropriation: «Totals»
Program WBS 50

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
3.1.1.1.4 Enterprise Systems PME Acquisition	0	0	0	0	0	0	0	0	0	0	0	0
3.1.1.1.5 Weather PME Acquisition	0	0	0	0	0	0	0	0	0	0	0	0
3.1.1.1.6 Other PME Acquisition	0	0	0	0	0	0	0	0	0	0	0	0
3.1.1.2 Supplemental Training PME	0	0	0	2,308M	2,308M	0	0	0	0	0	0	0
3.1.1.3 Technical Refresh	0	0	0	0	0	0	0	0	0	0	0	0
3.1.4 Prime Mission Product Integration, Assembly, Test, and Checkout	0	0	0	0	2,154M	2,154M	2,154M	0	0	0	0	0
3.2.1 Planning, Authorization, and Control	4M	4M	0	0	0	0	0	0	0	0	0	0
3.2.2 NextGen Fee	4.75M	4.63M	4.79M	5.05M	3.35M	1.5M	0	0	0	0	0	0
3.3.2 Requirements and Architecture Engineering	2.5M	2.5M	0	0	0	0	0	0	0	0	0	0
3.3.3 Design Engineering	5,608M	5,608M	875K	375K	375K	375K	375K	0	0	0	0	0
3.3.8 Human Factors	750K	750K	750K	750K	750K	750K	333.3K	333.3K	0	0	0	0
3.5.2 Operational Test and Evaluation	0	0	0	0	1,348M	1,348M	0	0	0	0	0	0
3.6 Integrated Logistics Support	0	0	325K	325K	1,125M	1,338M	1,013M	212.5K	0	0	0	0
3.6.9 Training, Training Support, and Personnel Skills	0	0	0	0	508.5K	508.5K	508.5K	0	0	0	0	0
3.7.1 Implementation Planning, Management, and Control	0	0	3M	3M	3,640M	3,640M	3,640M	4M	0	0	0	0
3.7.1.1 Human Resources Planning and Staffing	0	0	750K	750K	1.75M	1.75M	2.5M	0	0	0	0	0

DEM Release 12 Summary 20121206

	A	C	D	E	F	G
1	FOR INTERNAL USE ONLY	ZZZZZ	ZZZZZ	ZZZZZ	ZZZZZ	
2		XXX	XXX	XXX	XXX	
3	Scenario Attributes					
4	Facility Size	85,000		145,000		
5	Locality	ZXY		YYY		
6	Locality Rate	14.6%		14.6%		
7	Operating Positions	??		??		
8	IOC/Replacement Year	2027		2019		
9	Life Cycle Cost (Risk Adjusted TY-SM)					
10	Program F&E					
11	Program Mgmt, Planning, Inv. Analysis	\$ 42.00	\$ 32.00	\$ 36.00	\$ (4.00)	
12	Solution Development & Design	\$ 12.00	\$ 11.00	\$ 14.00	\$ (3.00)	
13	Implementation Support & Oversight	\$ 11.00	\$ 7.00	\$ 14.00	\$ (7.00)	
14	Construction Contract	\$ 67.00	\$ 49.00	\$ 70.00	\$ (21.00)	
15	PME Acquisition, Install & Test	\$ 31.00	\$ 32.00	\$ 45.00	\$ (13.00)	
16	Site Acquisition, Eval., & Prep	\$ 12.00	\$ 14.00	\$ 18.00	\$ (4.00)	
17	Facility JAI/Commissioning/Closeout	\$ 6.00	\$ 5.00	\$ 8.00	\$ (3.00)	
18	Training & Overtime	\$ 1.00	\$ 2.00	\$ 3.00	\$ (1.00)	
19	Disposition	\$ 10.00	\$ 15.00	\$ 14.00	\$ 1.00	
20	Program F&E Total	\$ 192.00	\$ 167.00	\$ 222.00	\$ (55.00)	\$350
21	Program F&E Grand Total					\$300
22	Indirect F&E					

FutureFac-BOE-v12.0 - Microsoft Word

5 COST AND BENEFITS ESTIMATE SUMMARY

The following tables, charts and graphs represent the full suite of cost and economic analysis results generated by the Dynamic Economic model for use in the Business Case Analysis (BCA) report.

	2013	2014	2015	2016	2017	2018	2019	2020-2029	2030-2039	Grand Total
2.0 Investment Review	\$ -	\$ -	\$ 0.75	\$ -	\$ 1.25	\$ -	\$ -	\$ -	\$ 2.00	\$ 4.00
2.1 Solution Implementation (Inv/Inst)	\$ -	\$ -	\$ -	\$ 10.98	\$ 12.21	\$ -	\$ -	\$ -	\$ -	\$ 23.19
2.2 Solution Implementation (O&M)	\$ -	\$ -	\$ -	\$ -	\$ 14.01	\$ -	\$ -	\$ -	\$ -	\$ 14.01
4.0 Service Management	\$ -	\$ -	\$ -	\$ -	\$ 5.81	\$ 5.81	\$ 5.81	\$ 5.81	\$ 5.81	\$ 34.56
5.0 IT Program P&E	\$ -	\$ -	\$ 0.75	\$ 10.98	\$ 12.21	\$ 5.81	\$ 5.81	\$ 5.81	\$ 5.81	\$ 74.44
Indirect *	\$ 7.46	\$ 7.46	\$ 7.5	\$ 7.52	\$ 8.01	\$ 8.02	\$ 8.03	\$ 8.04	\$ 8.05	\$ 84.08
FCIS Costs	\$ -	\$ -	\$ -	\$ -	\$ 15.94	\$ -	\$ -	\$ -	\$ -	\$ 15.94
Activity 3	\$ -	\$ -	\$ 2.0	\$ -	\$ -	\$ -	\$ -	\$ 0.14	\$ -	\$ 2.14
Non-Workforce (21%)	\$ 8.28	\$ 8.28	\$ 8.28	\$ 8.28	\$ 8.28	\$ 8.28	\$ 8.28	\$ 8.28	\$ 8.28	\$ 82.80
Control/FCIS	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 55.8	\$ 55.8	\$ 111.6
Tech Ops (CAS)	\$ 16.27	\$ 16.27	\$ 16.27	\$ 16.27	\$ 16.27	\$ 16.27	\$ 16.27	\$ 16.27	\$ 16.27	\$ 162.70
1.0M Program P&E	\$ 28.05	\$ 28.05	\$ 28.05	\$ 28.05	\$ 28.05	\$ 28.05	\$ 28.05	\$ 28.05	\$ 28.05	\$ 280.50

Total Life-Cycle OPS Cost: \$1.241M

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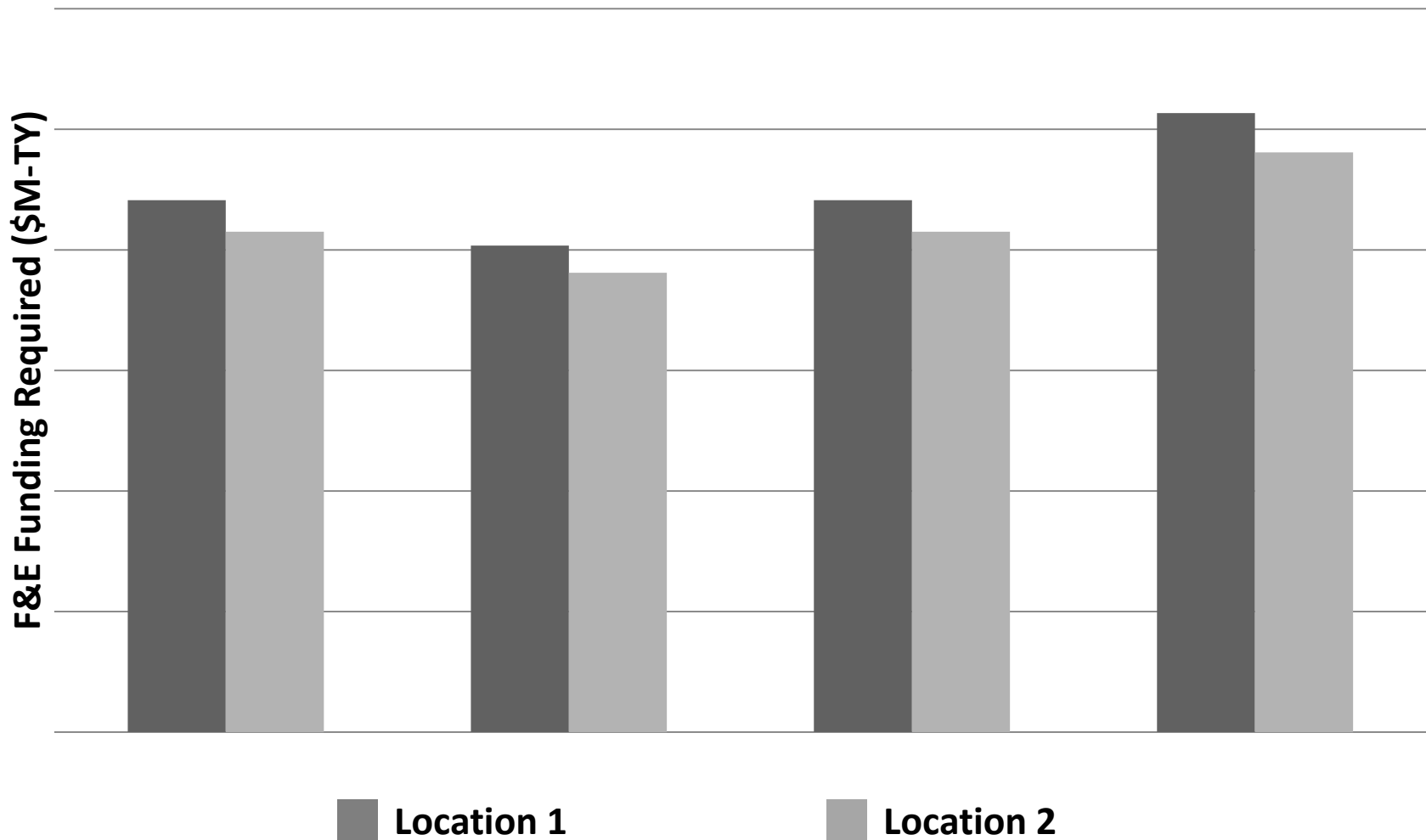


Analysis Examples

- **Minimum configuration for operations**
- **Legacy Reconstruction timing**
- **Impact of Location**
- **What-if Combinations**
- **Operating Positions Uncertainty**

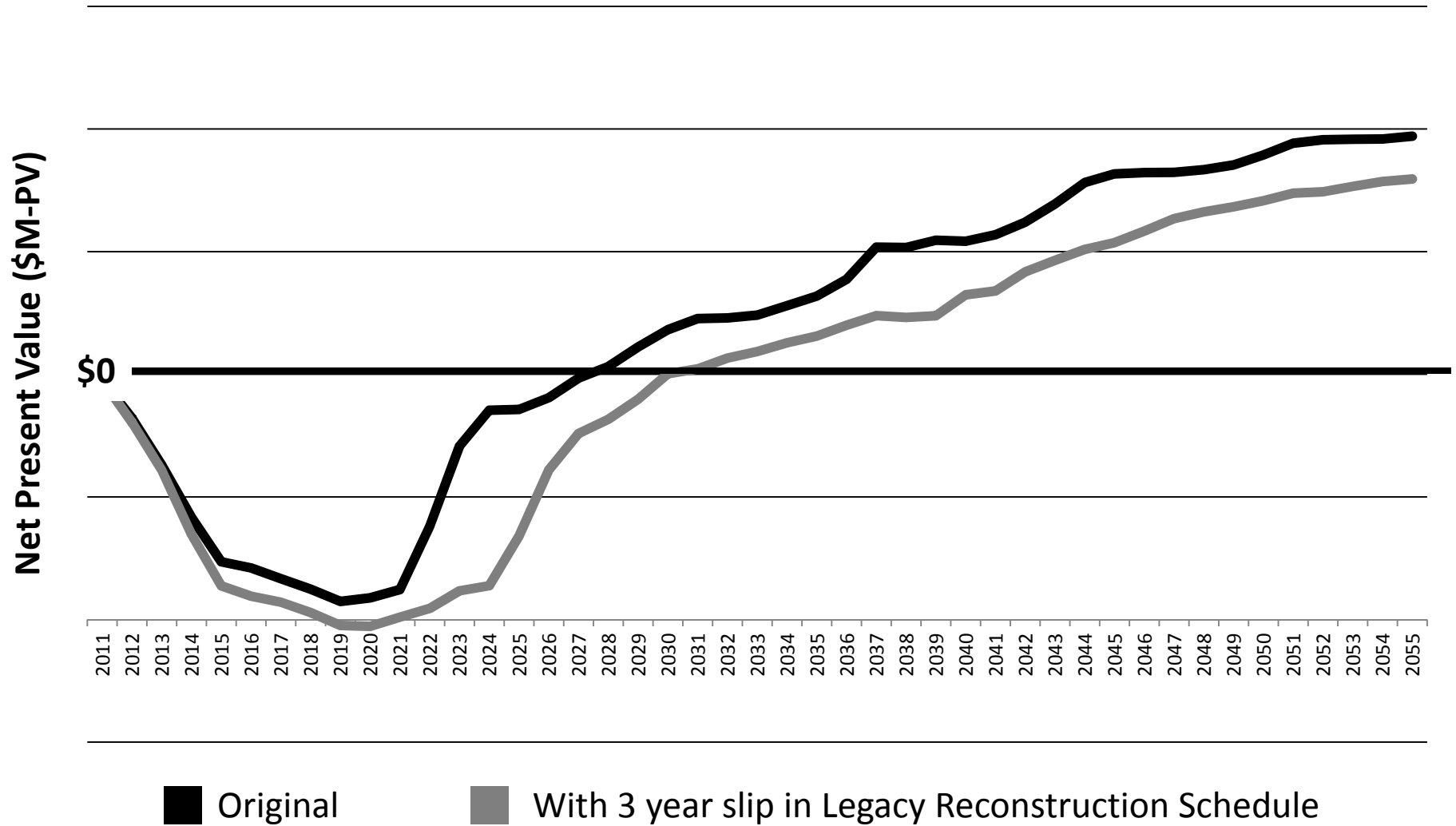


Minimum Configuration





Legacy Reconstruction Slip





QUESTIONS



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