

CEPE Escalation Study

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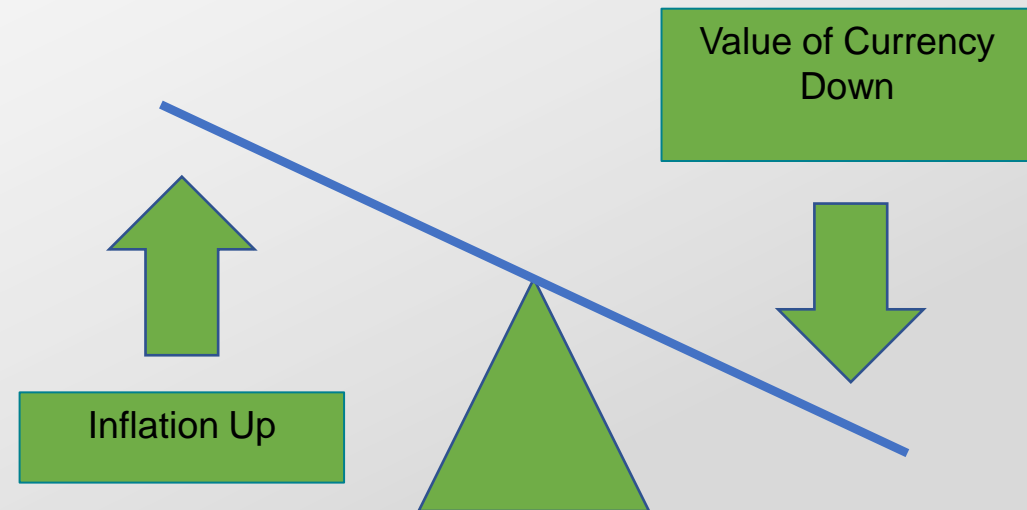


Definitions

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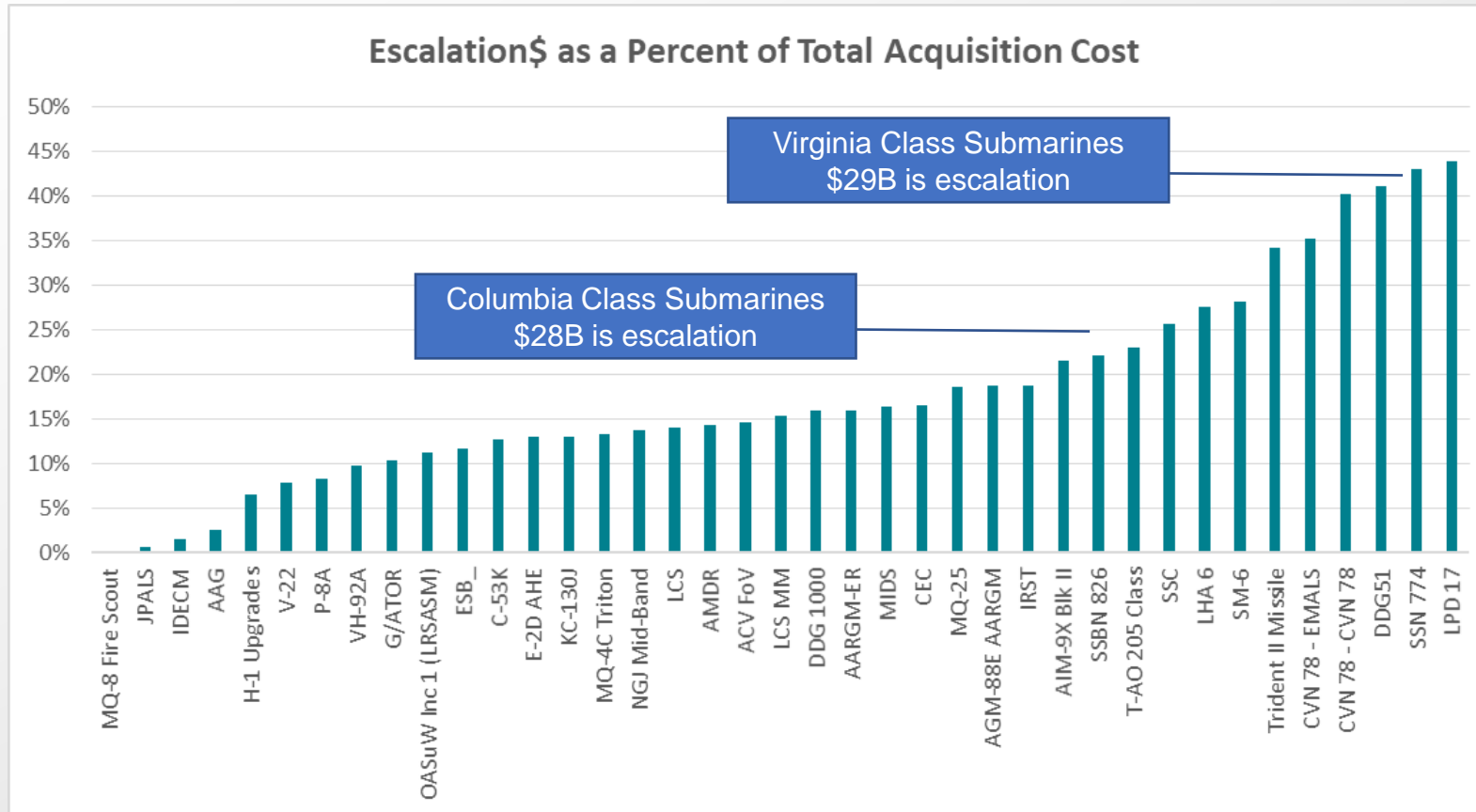
- Inflation
 - economy-wide price changes
- Escalation
 - unique indexes for a basket of items
- Compound Annual Growth Rate (CAGR)
 - Rate of return required for an investment to grow over a specified time period

$$\text{CAGR} = \left(\frac{V_{\text{final}}}{V_{\text{begin}}} \right)^{1/t} - 1$$



Prelude – The Stakes Are High

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Escalation on average is 17% of acquisition cost for Navy programs

- GAP: Definitive methodology and guidance to support point and probabilistic estimates of escalation for fully-burdened components of cost, by site
- SOLUTION: Guidance/methodology for point estimates and probability distributions for outyear escalation for labor and material by site
 - Fully visible, transparent, and updateable methodology
 - Full coverage of costs
 - Risk-based escalation decisions
 - Use of market-based (“skin in the game”) financial instruments

Credible Support to AoAs, ICEs, ICRs, Programming Estimates
and other Cost Estimates

General Approach

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1. Collect data of actual escalation for NNSA-specific commodities/categories (site labor, outside labor, material, overhead) in or around NNSA sites
2. Build composite escalation actuals by site for four categories of NNSA program/projects: nuclear construction; non-nuclear construction; LEP design; and LEP production
3. Compare NNSA historical actuals by site to market-wide inflation
4. Develop NNSA projections and distributions for each site and category based on market inflation projections

Methodology

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- Data Collection

- Macro Inflation: GDP Price Index, Producer Price Index (PPI), and the Consumer Price Index (CPI)
- NNSA Unique Escalation: Salaries and headcounts from LANL and other sites; PPI material prices; national indices from BEA and BLS; other indices from government and private sector

- Analysis

- Escalation trends for labor, material, and projects
 - Use of a Fisher index to disentangle headcount changes from wage-rate changes
 - Calculations of Compound Annual Growth Rates (CAGR's)
- Estimates of deltas (basis points) between NNSA unique escalation and macro measures of inflation

- Forecasts

- Treasury “Breakevens” (delta between nominal and inflation-protected securities)
- Inflation options (puts and calls)
- Survey of Professional Forecasters (Philly FED)
- Application of NNSA deltas to point estimates of macro inflation

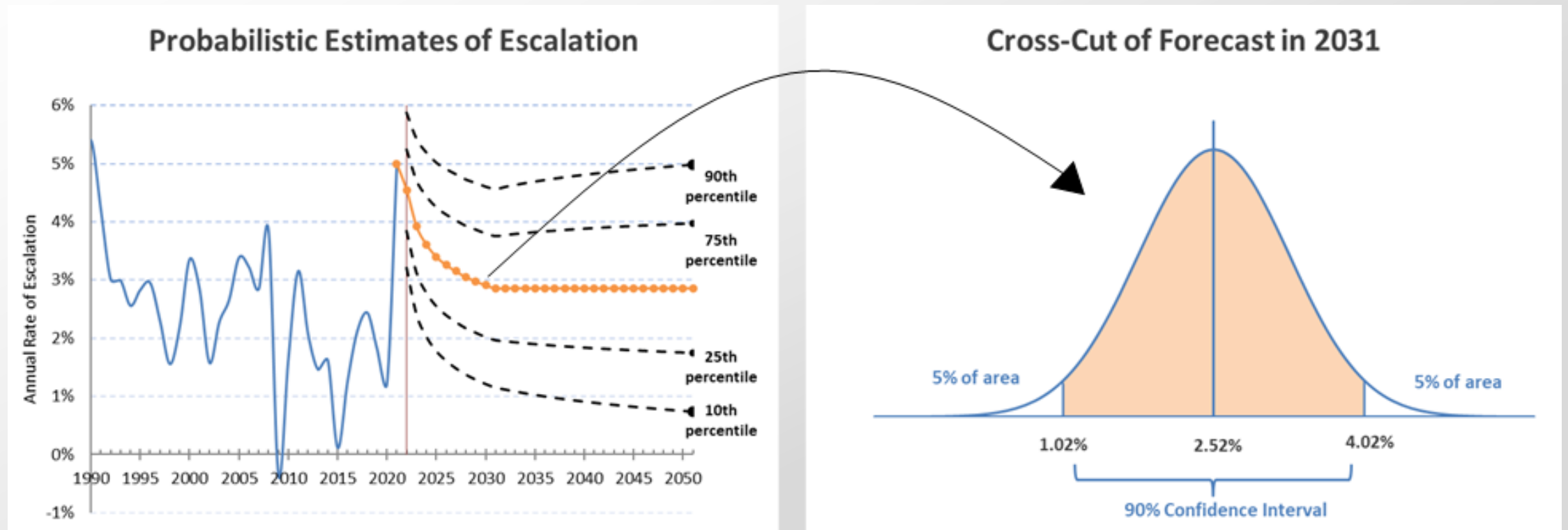
} Yields Probability Density Functions & a Fan Graph

Sample Results

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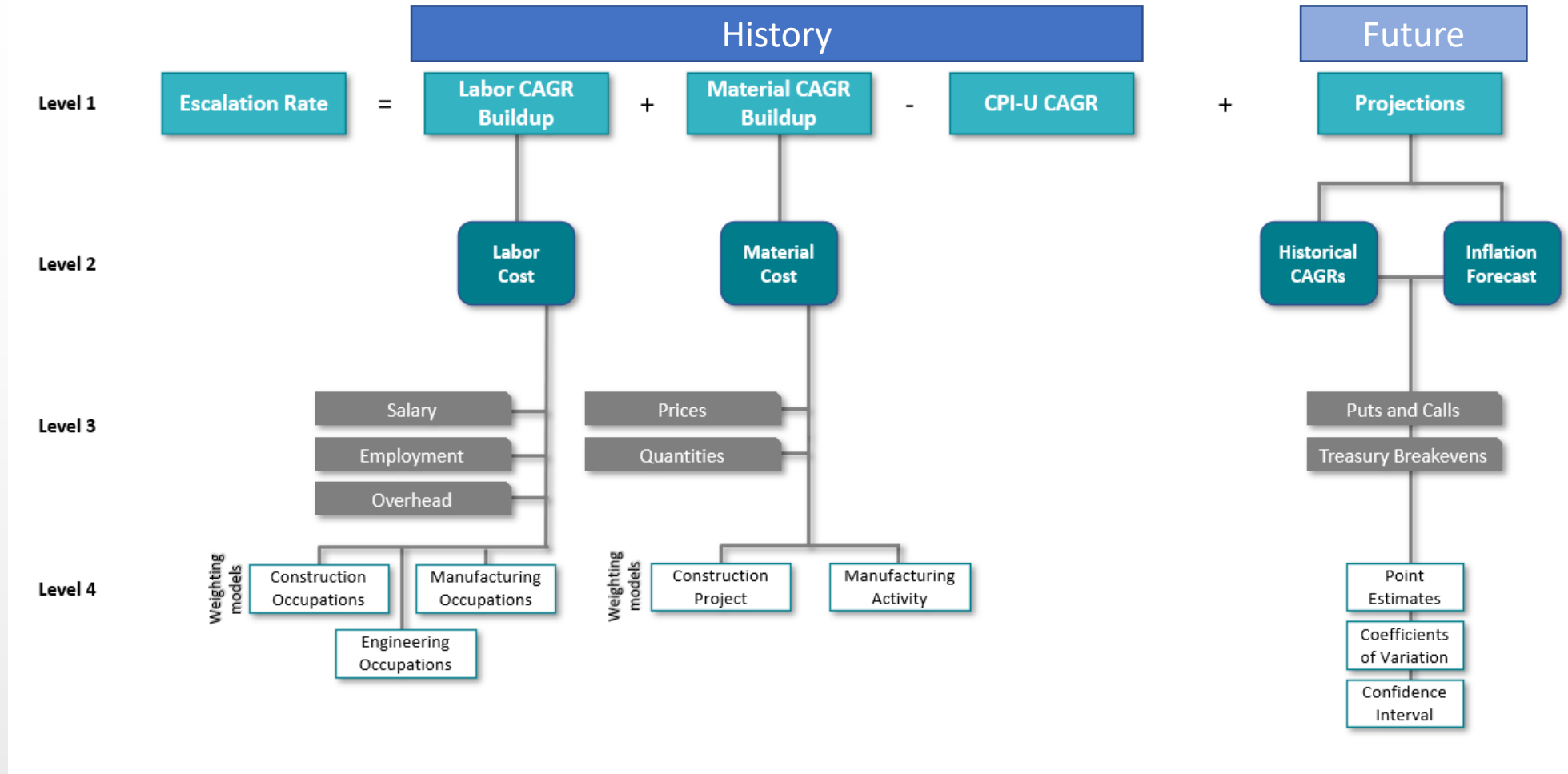
- Result

- Projected composite (labor and material) escalation using market-based inflation forecasts and the relationship between historical NNSA escalation and general inflation



Data Collection – General Taxonomy

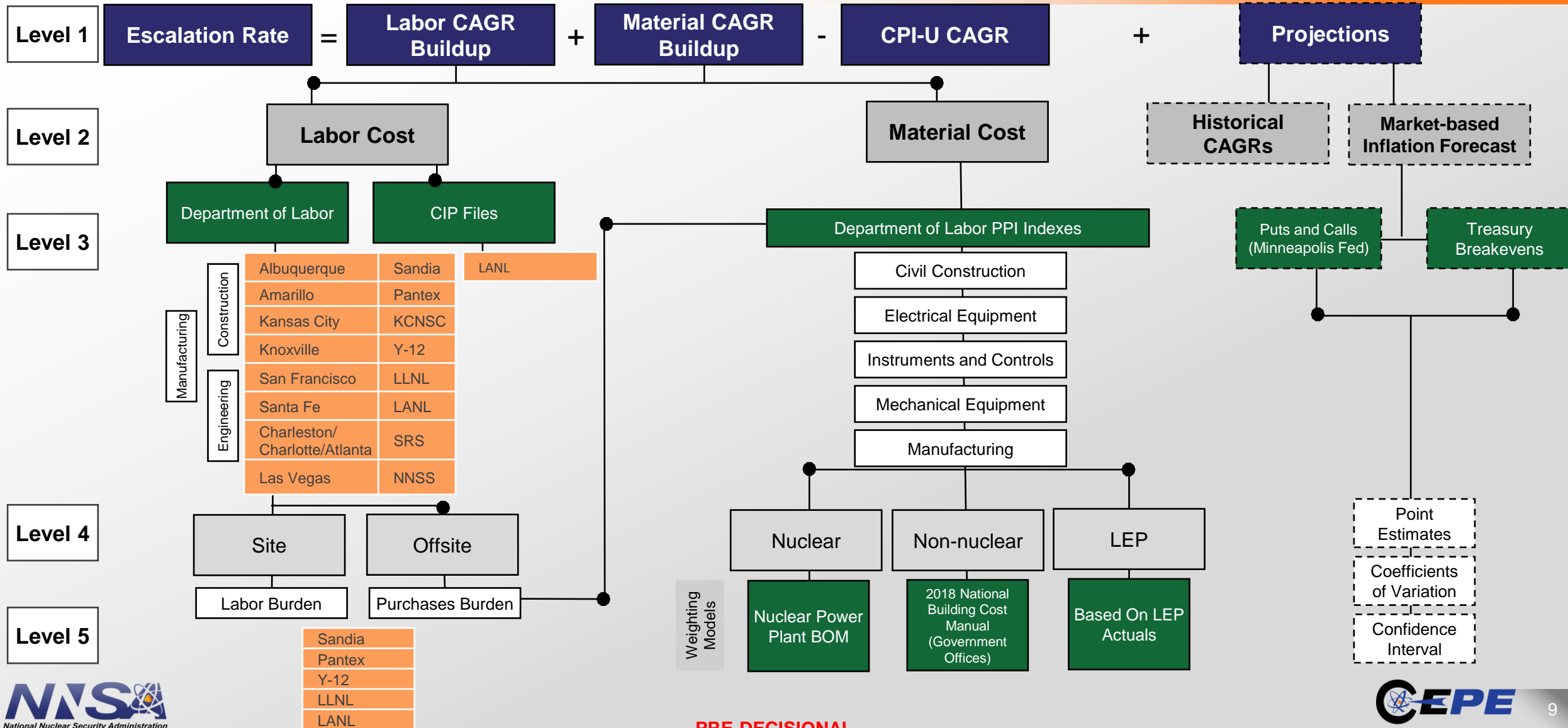
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Strong results depend upon an extensive data-collection effort

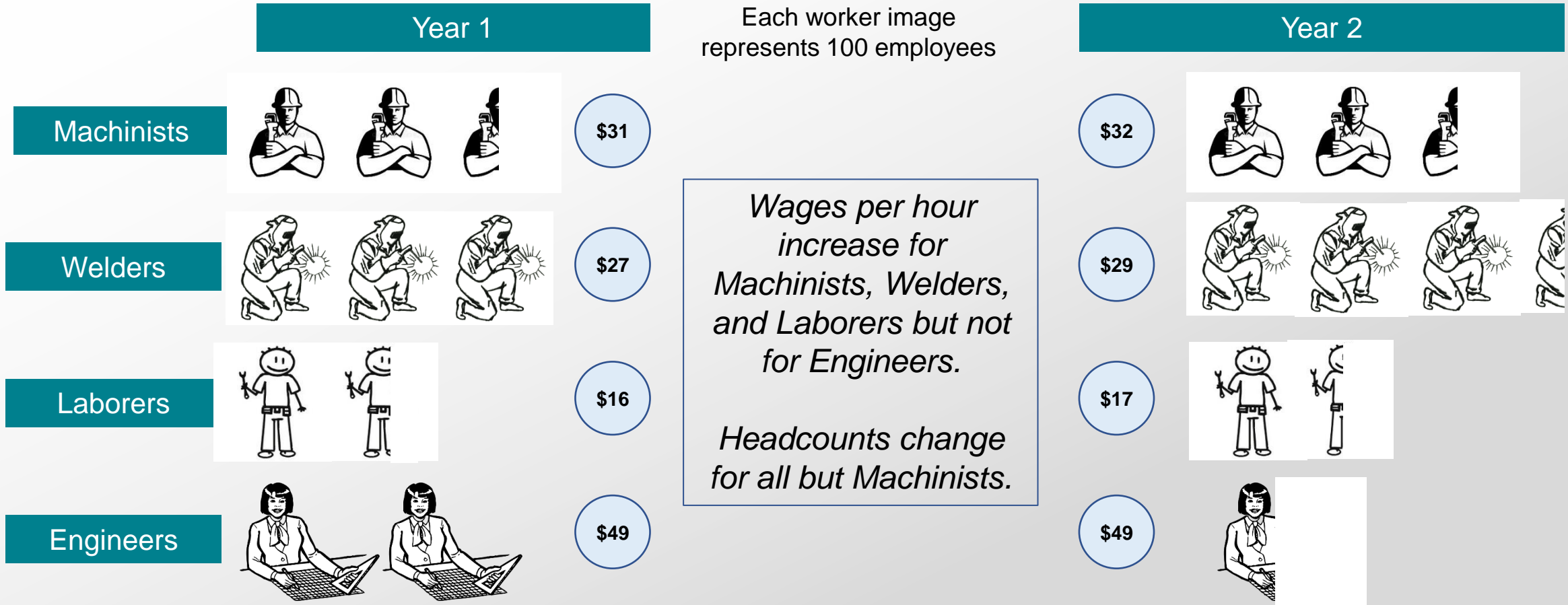
Data Collection – CEPE Study Taxonomy

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The Index Number Problem – Shipyard Example

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How do you build an escalation index for labor for the yard?

Methodology – Finding Labor Price and Quantity

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Low-Level Data

Annual Direct Labor Expense
Job Categories = 1 to n

Salary = p_i

Headcount = q_i

180 Job Codes at LANL. E.g.:

R&D Manager 1 to 6

R&D Engineer 1 to 6

Accountant 1 to 4

Machinist 1 to 5

R&D Scientist 1 to 6

Market Basket

Laspeyres

$$P_L^{0,t} = \frac{\sum_{i=1}^n p_{ti} q_{0i}}{\sum_{i=1}^n p_{0i} q_{0i}}$$

Laspeyres uses base period headcounts (q_{0i})

Paasche

$$P_P^{0,t} = \frac{\sum_{i=1}^n p_{ti} q_{ti}}{\sum_{i=1}^n p_{0i} q_{ti}}$$

Paasche uses end period headcounts (q_{ti})

Best-in-Class Index

*Fisher's
"Ideal Index"*

$$P_F^{0,t} = \sqrt{P_L P_P}$$

Pure Escalation Index for Labor: Hold headcounts constant but use them as weights or measures of relative importance within the site

Data Collection – Labor

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- Labor
 - Salary labor data
 - Locality-based data from the Department of Labor
 - Localities around NNSA sites for relevant job codes from the Occupational Employment and Wage Statistics (OEWS) Survey, 2001 to 2020
 - 46 occupations (30 construction; 16 engineering; 8 manufacturing)
 - Compensation Increase Plan (CIP) and CIP Justification for Rates and Labor Mix
 - Substantiated DOL locality data
 - Non-salary data
 - Site-specific burden multipliers for labor and purchases as reported by each site (2010 – 2021)

Note: Data from individual projects charge code and Financial Integration were target data sources that did not provide adequate fidelity or history

Data Collection – Materials

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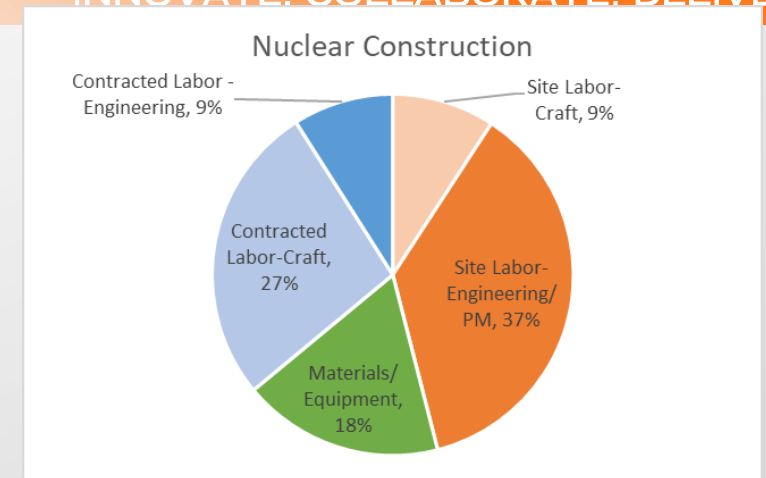
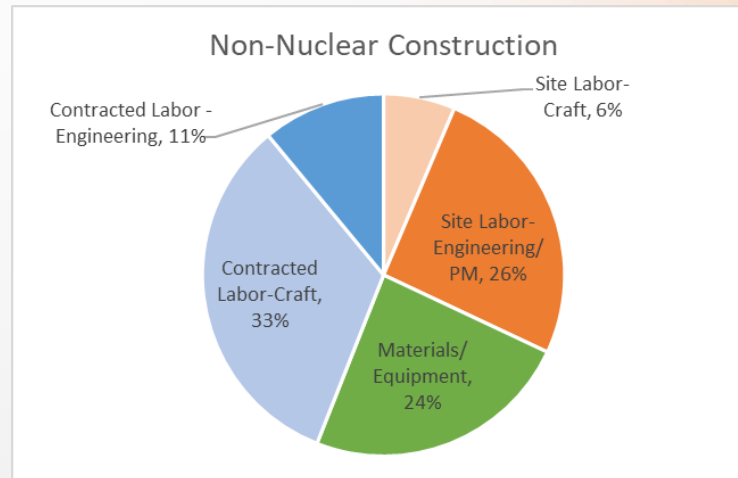
- Materials
 - Monthly commodity data from the Producer Price Index (PPI)
 - 49 unique indexes
 - Set spans 2000 to 2021; provides at least 10 years of history with 5-year averages from the latest year
 - For example, our reformulated index for 2010 is an average of the indexes from 2006 to 2010
 - December 2021 indexes
 - Weights
 - Nuclear Power Plant bill of materials (nuclear)
 - Government offices from the 2018 National Building Cost Manual (non-nuclear)
 - Charge Code data materials costs (LEPs)

Weightings for Construction and LEP Composites

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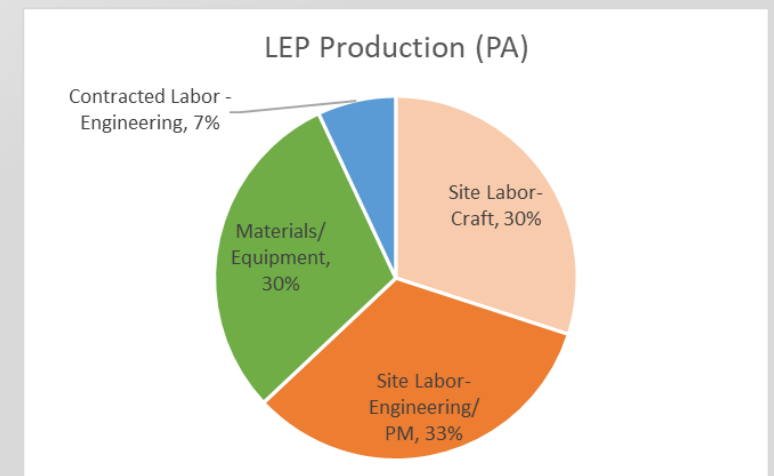
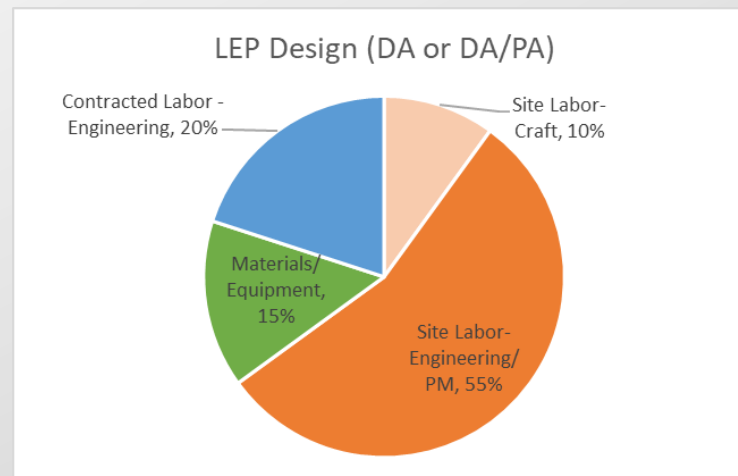
Construction weights calculated from 42 completed and ongoing projects

- Data from PARS EVM and Financial Integration actuals and projections



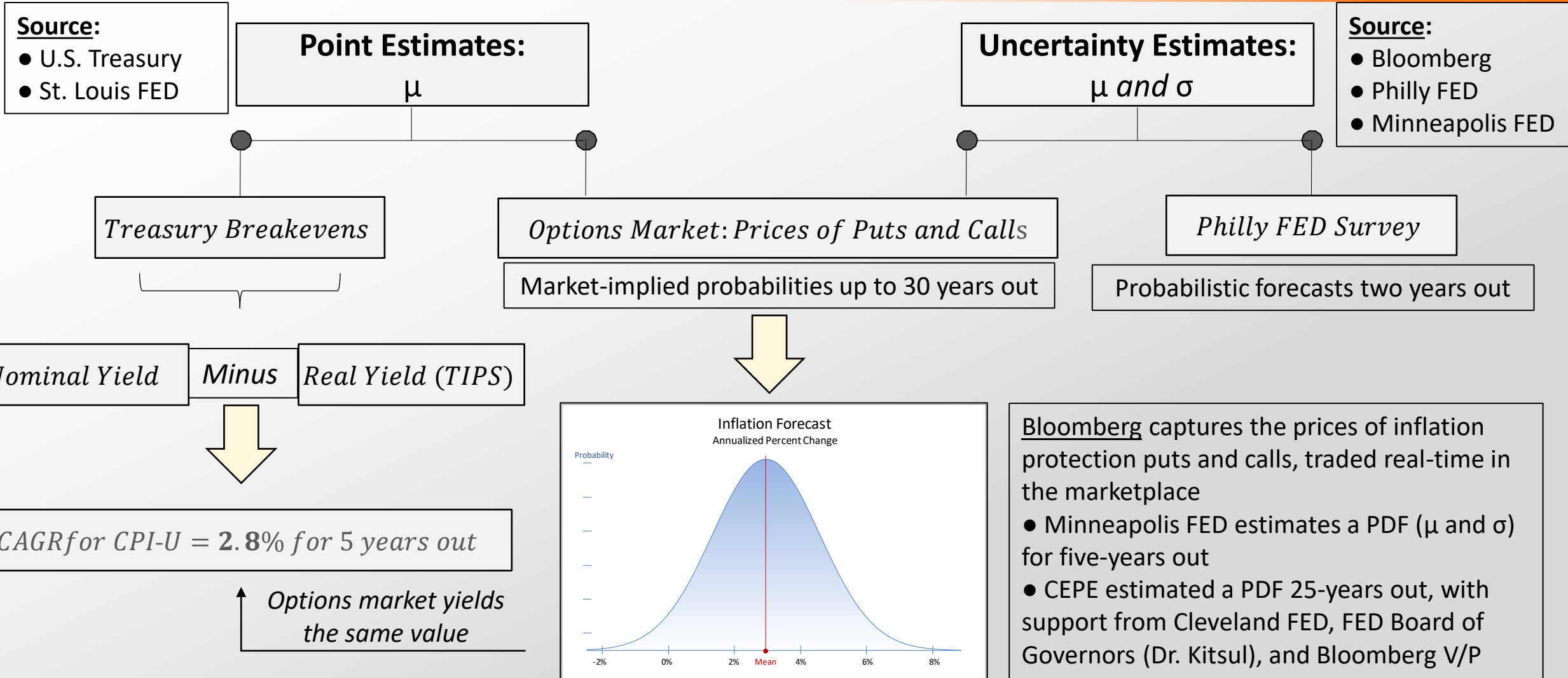
LEP weights calculated taken from actuals from W76-1 and B61-12

- Data from site Charge Code actuals



Inflation Forecasts

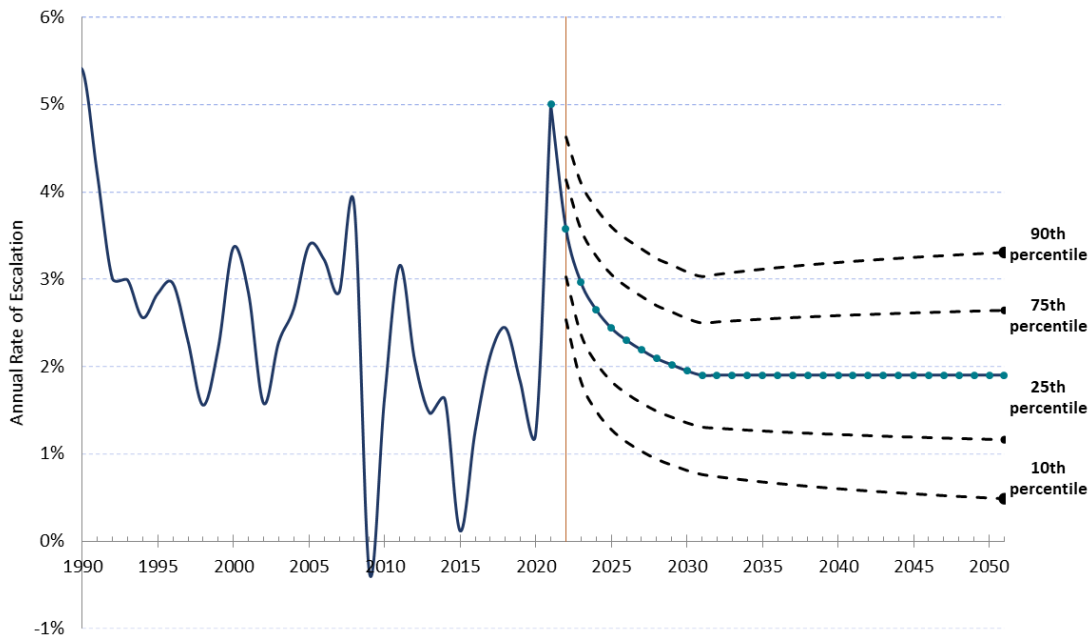
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Methodology – Macro Inflation Forecast

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Probabilistic Estimates of CPI-U Inflation



Historical Data:

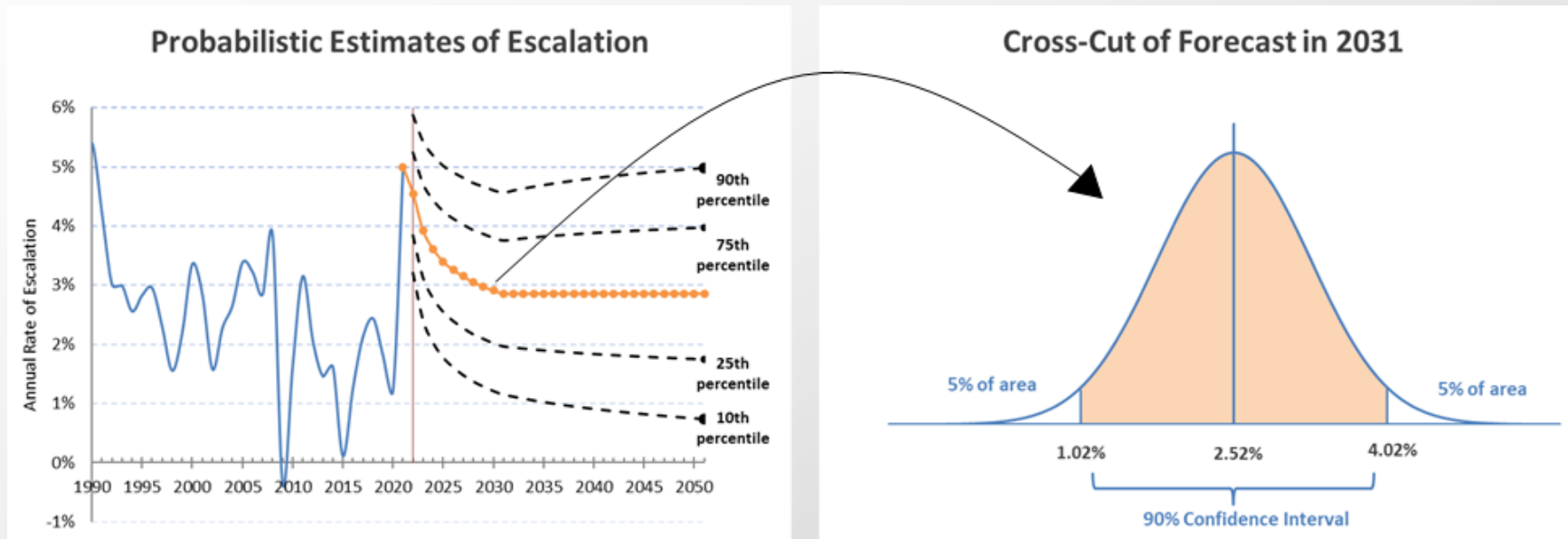
- Collected historic national CPI-U indexes and calculated Compound Annual Growth Rate (CAGR)
- Calculated a delta between historical NNSA escalation to general inflation (Consumer Price Index – Urban Workers [CPI-U]) for 2011-2021

Projections:

- Applied market-based models to calculate point estimates for CPI-U inflation out 30 years
- Also produced probability distributions of projected inflation rates
- Used the historical deltas to forecast composite NNSA escalation (labor, materials and overhead) by site and for NNSA

Results: Projection Example

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Results – Takeaways

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- General Methodology Benefits
 - Accurately measures escalation and models the risk and uncertainty of projections supports better decision making
 - Allows for escalation risk consideration applying an escalation factor at different percentiles
- NNSA Impacts
 - NNSA escalation generally outpaced inflation in the last 10 years
 - Higher inflationary expectations through the next 5 years than in the years following 2026
 - Escalation and CI NAP will provide site-specific rate updates every 6 months

Results: Main Takeaways

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- NNSA escalation generally outpaced inflation in the last 10 years
- Allows for escalation risk consideration applying an escalation factor at different percentiles
- Materials component can be adjusted to pair with the project of study by changing the weights of the PPI indexes
- Higher inflationary expectations through the next 5 years than in the years following 2028
- Accurately measuring escalation and modeling the risk and uncertainty of projections supports better decision making