# Facility Strategic Alternatives Study

U.S. Department of the Treasury
Bureau of Engraving and Printing

January 23, 2013 – Final
December 18, 2012 – Draft

## Submission 3 - Final Report

BEP Order #TEPV12-14041

**Prepared by:**
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# PREFACE

This Final Report is the last submission of a three-part study. While every effort has been made to have the final submission stand alone, the foundational data and analysis leading to the findings and recommendations of Submission 3 are detailed in Submissions 1 and 2, which are located in the Appendix. Also provided in Submission 3 is our evolved Decision-Making Model, which the Bureau of Engraving and Printing (BEP) can use to explore sensitivities and trade-offs for the three alternatives.

The purpose of Submission 3 is to provide final recommendations and best practices for reconfiguring BEP Washington, DC, production and administration facilities to meet future needs.

In Submission 2, we provided data and analysis to establish the following parameters for the three alternative configurations of the DC Facility over a 30-year lifecycle:

- Future production capacity needed
- Administration and production space program
- Production equipment strategy
- Initial capital project scope, schedule, and cost
- Recurring recapitalization costs
- Operating expenditures.

Our work for Submission 2, in turn, relied upon our basic data and assumptions which we presented in Submission 1. Submission 1 included the following analysis:

- Assessment of past studies, data, and information
- Review of laws, regulations, executive orders, and industry standards
- Real estate market assessment
- Impact to Landover Warehouse
- Flexibility for expansion
- Decision-Making Model framework.

The contents of this report represent interlinking sets of analysis and research, based on the approved assumptions and data sets from Submissions 1 and 2, driving towards recommendations for solving BEP's future operational challenges. This iterative approach has been essential to maintaining the continual flow of data and ideas between BEP and Booz Allen Hamilton (Booz Allen) while ultimately delivering a defensible, data-supported recommendation.

Booz Allen leveraged past reports and studies, numerous BEP expert interviews, facility tours, and raw data analysis to gather data for this report and previous submissions. Internally, we also used our own independent team of subject matter experts and market analysts to perform research and analysis. We thank the many BEP and Federal Reserve employees we have interviewed for their generous contribution of time and invaluable insights into BEP's processes, organization, and facilities.

# EXECUTIVE SUMMARY

The Bureau of Engraving and Printing (BEP) currently produces 40 percent of all US currency in its historic 98-year-old Main Building in Washington, DC. The current DC Facility (Main and Annex buildings) presents a risk to continuing operations because building systems could suffer a catastrophic failure and building environmental conditions (required to meet tolerances for currency production processes to produce high yield, on-specification notes) are becoming increasingly difficult to maintain.

Currency manufacturing is also evolving in complexity to stay a step ahead of counterfeiters. New security features are being added to currency, and the number of machine processing steps and the size and complexity of printing machinery is increasing. With each new security feature, it is becoming more challenging to produce high-quality notes reliably. As new printing technologies emerge, and the techniques available to counterfeiters evolve along with it, BEP will need to have a more flexible manufacturing platform and the ability to adapt its operations and processes quickly and cost effectively.

The BEP Facility Strategic Alternatives Study seeks to provide a data supported, comparative review of three facility alternatives across lifecycle cost and qualitative factors. The three alternatives are:

**Alternative 1:** Renovate the DC Facility to meet current standards and provide modernized infrastructure to support future equipment upgrades, including feasibility for rearranging existing equipment to achieve optimal production flow.

**Alternative 2:** Build a new technologically advanced and optimized production facility with administrative functional space within a 50-mile radius of the current DC Facility.

**Alternative 3:** Build a new technologically advanced and optimized production facility within a 50-mile radius of the current DC Facility. Consolidate administrative functions within renovated office space at the DC Facility. (Hybrid)

Throughout this report, we frequently refer to the three alternatives in abbreviated form as the Renovation, New Build, and Hybrid alternatives, respectively.

Booz Allen Hamilton (Booz Allen) was enlisted to assemble a team of subject matter experts in the areas of facilities operations and management, architecture, equipment planning, security, environmental health and safety, and operations and capital expenditure cost analysis to perform the study. Our charter included two primary objectives: (1) to provide an independent evaluation with unbiased recommendations, and (2) to develop conceptual plans—to the maximum extent possible—that do not interrupt production. The contents of this report represent the result of our comprehensive evaluation of the three alternatives along orthogonal dimensions: **Finance** and other **Non-Financial Factors**, including **Risk**.

### ***Recommendation***

Booz Allen recommends that BEP proceed with designing and building a new facility to jointly house production and administrative personnel and functions (Alternative 2). We believe that Alternative 2 will allow BEP to transform its organization and establish a more cost-effective structure that will enable significant savings in the future, when compared to the other Alternatives. The new production facility will provide a flexible production platform to increase BEP's adaptability to increasingly complex printing technologies and required equipment.

Specifically, Alternative 2 provides the:

- Best overall financial performance (lowest lifecycle costs)
- Shortest project schedule duration
- Highest non-financial performance rating
- Lowest overall risk among the three alternatives.

***Financial & Schedule Performance***

Our financial evaluation was focused on three factors: initial capital costs to build and fit out a new facility or renovate existing buildings, recurring recapitalization to maintain the facilities and production equipment, and operating costs over a 30-year lifecycle. A summary of these costs are shown in Table ES-1:

**Table ES-1: Cost Summary of Alternatives[1]**

| Cost Element (Constant $ Jan 2012) | Alternative 1: Renovation | | Alternative 2: New Build | | Alternative 3: Hybrid | |
|---|---|---|---|---|---|---|
| | $ million | % total | $ million | % total | $ million | % total |
| **Total** | **$21,417** | **100%** | **$19,967** | **100%** | **$20,081** | **100%** |
| Initial CAPEX | $1,496 | 7% | $697 | 4% | $744 | 4% |
| Recapitalization (30 years)[2] | $503 | 2% | $603 | 3% | $603 | 3% |
| OPEX (30 years) | $19,418 | 91% | $18,666 | 93% | $18,734 | 93% |

Alternative 2 represents a $1.4B savings estimate over Alternative 1 and $115M savings estimate over Alternative 3.

Additionally, the estimated schedule for Alternative 2 is significantly shorter than for the other Alternatives, as Table ES-2 shows. The construction duration for Alternative 1 is more than four times longer than for Alternatives 2 and 3, which is indicative of the challenges with renovating an aged operating facility. Our experience has shown that shorter construction durations reduce the opportunities for program overruns; this point is discussed further in our risk assessment section.

**Table ES-2: Schedule Summary of Alternatives**

| Schedule Characteristic | Duration in Years | | |
|---|---|---|---|
| | Alternative 1: Renovation | Alternative 2: New Build | Alternative 3: Hybrid |
| **Total** | **15.4** | **9.3*** | **10.2*** |
| Prospectus | 3 | 3 | 3 |
| Project | 12.4 | 6.8 | 7.7 |
| **Construction Period** | **9.2** | **2.1** | **3.0** |
| Pre/Post Construction | 3.2 | 4.7 | 4.7 |

* Prospectus and site selection can overlap 6 months for new facility.

***Non-Financial Performance***

Using BEP's mission and vision statements as guiding principles, we assessed six non-financial decision-making criteria. Our full analysis includes the rationale that established both the weighting and evaluation rating for each criterion. While these factors were discussed and vetted with Government and Federal Reserve stakeholders, their specific weights represent Booz Allen's professional opinion based on best practices gleaned from our experience in supporting large, federal construction projects as well as advising global companies with their industrial construction projects.

The six non-financial decision making criteria, with weights totaling 72 percent are[3]:

- Security 5%
- Flexibility 10%
- Workforce Impact 5%

[1] Costs are calculated in January 2012 dollars.
[2] Recapitalization associated with major equipment replacement is $191 million for Alternative 1 and $291 million for Alternatives 2 and 3.
[3] Finance represents the remaining 28% of the total rating.

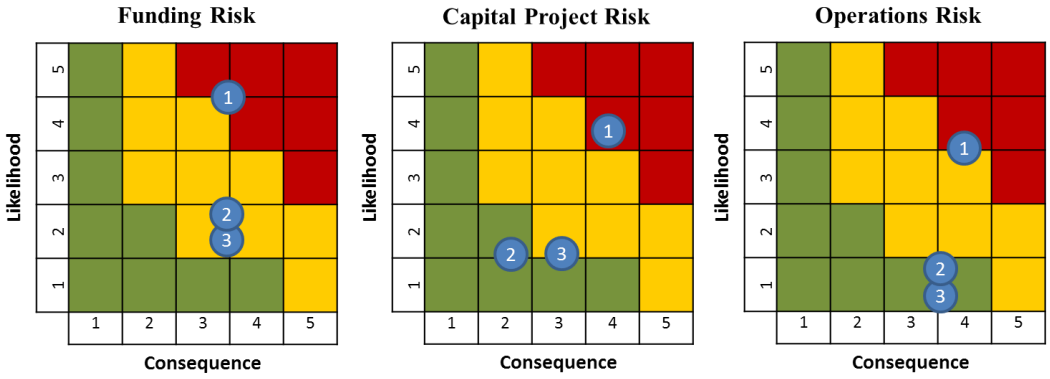
- Schedule 20%
- Risk 30%
- Tour 2%

Alternative 2 scored the highest in the first 5 of 6 categories. These six criteria, and their subcomponents, are fully adjustable in the accompanying Decision-Making Model so that users can customize the factors to fit their preferences.

***Risk Assessment***

To develop the risk ratings applied to the non-financial criteria, we a risk evaluation, which was divided into three categories: Funding, Capital Project, and Operations. As shown in Figure ES-1, each alternative was evaluated along a likelihood/consequence scale and assigned a rating.

**Figure ES-1: Risk Evaluation for Alternatives**




Alternatives 2 and 3 exhibit a clear separation from the higher risk Alternative 1. Alternative 2 has a more favorable capital project risk profile than Alternative 3.

***Next Steps***

We present recommendations and best practices for moving forward with Alternative 2 in two categories. Near-Term Actions should be initiated as soon as feasible and will position BEP and its stakeholders to maximize leverage in shaping the project before it is formally sanctioned. We have provided a list of Value-Improving Opportunities which are additional actions BEP can take during the next two years to optimize the scope to unlock additional value from the project.

Near-Term Actions:

- Begin budget planning and developing the Prospectus
- Begin quietly gathering data and assessing potential sites
- Evaluate property disposition options, costs, and benefits
- Begin forming the Program Management Office (PMO) which would establish the framework for: governance and change management processes, control plan, and organizational structure for managing the project
- Evaluate potential contracting strategies for design, construction, major equipment procurement, and project and construction management.

Value-Improving Opportunities:

- Right-size the organization for the future prior to developing the detailed program of requirements
- Optimize the production process and inject global best practices

- Reevaluate requirements for DC Facility functions that do not have a corollary at the Western Currency Facility (WCF) (e.g. Pre-Press, Siderography, Photo Lithography, Etching, and Miscellaneous Printing)
- Update the Continuity of Operations Plan (COOP)
- Identify key initiatives that BEP should drive concurrently with this project
- Implement a cost engineering capability within BEP
- Develop and implement a strategy for project data management.

# Appendix A

# Facility Strategic Alternatives Study

U.S. Department of Treasury,
Bureau of Engraving and Printing

January 23, 2013 – Final
December 18, 2012 – Revised Draft
August 28, 2012 – Draft

## Submission 1

BEP Order #TEPV12-14041

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# Executive Summary

The goal of our first submission is to present our early findings in the context of a larger, evolving final report that will evaluate future alternatives for East Coast currency production. This is significant because not only will we validate our assumptions and processes, but also give the Bureau of Engraving and Printing (BEP) the opportunity to provide feedback on emerging themes and outcomes.

The six deliverables represent discrete sets of analysis and research that will provide the foundation for the final report providing recommendations for solving BEP's space issues. This iterative approach is essential to maintaining the continual flow of data and ideas between BEP and Booz Allen while ultimately delivering a defendable, data supported recommendation. The following paragraphs describe the work accomplished thus far.

***Assessment of Past Studies, Data, and Information:***

- **Approach:** We used the information, detailed descriptions, and existing conditions from the 2010 Feasibility Study[1] as a starting point for our analysis. Findings on requirements for future facility configurations received additional scrutiny and analysis. We reevaluated internal and external physical security vulnerabilities identified in the 2004 Security Survey and Risk Assessment Methodology[2] under the lens of current security standards. Using these baseline data and findings, in the next phase of our analysis, we will take a deeper look into the scheduling of construction and alteration work while minimizing production disruptions.
- **Initial Findings and Takeaways:** There is an opportunity to take a deeper look at right-sizing future space requirements and staff full time equivalent (FTE) units for each of the alternatives being studied. For example, the previous reports did not quantify how many FTE were required in a modern production flow with reduced material flow transport requirements or how proper vault sizing and placement could smooth transportation procedures.

  We found the cost breakdowns in the 2010 Feasibility Study to be not very transparent, making it impossible to understand how cost components/drivers vary between alternatives. As we proceed with this work, we will quantify cost and efficiency differences in security (capital, operations, and maintenance), initial capital, capital maintenance, external transportation, operations, and maintenance costs. Fidelity of our cost analysis will depend upon the granularity of cost data provided by BEP.

  Operating and capital cost data necessary to develop a cost baseline was not received from BEP in time to include in this submission. The cost baseline will be included in Submission 2.

***Review of Laws, Regulations, Executive Orders, and Industry Standards:***

- **Approach:** Our team called upon BEP and internal subject matter experts to review all applicable laws, regulations, executive orders and industry standards and review their applicability to this project. Where we found a key, impactful standard, we outlined impacts to the three study alternatives. A full list of reviewed laws, regulations, Executive Orders, and standards is located in the Appendix.

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[1] *Feasibility Study for Renovation and/or Relocation of the Washington, DC Facility;* Bureau of Engraving and Printing; HOK and Jones Lang LaSalle, December 15, 2010

[2] *Security Survey and Risk Assessment Methodology for the US Bureau of Engraving and Printing*; Science Applications International Corporation, September 30, 2004.

- **Initial Findings and Takeaways:** Building a "Greenfield" new facility (Alternative 2) consistently emerged as the lowest risk option. The analysis showed the new facility would be built with modern codes already incorporated in the base price of the design and construction. Conversely, a large-scale existing site renovation project would face a higher degree of uncertainty and potential for discovery work to bring the building into code compliance, presenting a major risk to cost and schedule goals. These challenges would have to be addressed while maintaining a baseline production capability necessary to meet national goals.

***Real Estate Market Assessment:***

- **Approach:** We searched for available land within a 50-mile radius of the current DC Facility and used regression analysis to quantify proximity/price attributes. Then, using public information, we reviewed 25 local counties and 42 transactions involving relocation incentives.
- **Initial Findings and Takeaways:** BEP can expect to spend about $13,000 per acre in areas more than 20 miles driving distance from Washington, DC. Closer-in plots exhibit more variability in asking price because location becomes a strong differentiator in value. As land availability decreases and differentiation increases, prices are driven higher and with more variability. Further out from Washington, DC, there is little differentiation in value and thus little variation in pricing.

  Based on our research, BEP may expect to be able to negotiate a one-time incentive package on the order of $7,000 per job transferred, or approximately $7 to $10 million in total value. While this amount is fairly minor compared to the 30 year cost projection of a new facility, it could possibly cover the initial cost of land acquisition. The most common type of incentive offered is a grant funded by the host state. We did not find a single instance of a concession (land grant) being offered. The majority of incentives were distributed as cash in the form of grants, with infrastructure improvements, tax breaks and loans also recorded.

***Impact to Landover Warehouse:***

- **Approach:** BEP subject matter experts provided the majority of the Landover warehouse operational information while intra and interagency leasing agreements highlighted legal restrictions.
- **Initial Findings and Takeaways:** During the next decade, the impact to the Landover facility will be fairly minimal between the three alternatives. In the first scenario, the warehouse would serve as a construction staging ground and swing space for non-production equipment. Unless unforeseen space demands or security operating changes pushed space requirements beyond the lease capability, the Landover site should be able to accommodate BEP and its sub-lessees for the current contract term. At the end of the 10 year agreement, BEP will have to re-negotiate warehouse space as required.

  Under alternatives 2 and 3, the team worked under the assumption any Greenfield site would be built with sufficient attached warehouse space to serve all production requirements. Nevertheless, we project that by the time the new facility is ready for move in, the current Landover warehouse will be close enough to the end of its lease contract that early lease termination or surrendering it to the General Services Administration (GSA) may not be required. The Landover warehouse would provide a useful swing-space function during the Greenfield construction and BEP would allow the lease to expire at the end of its term. From that point forward, the team projects a yearly savings of roughly $3M in rent, services and transportation costs.

***Flexibility for Expansion:***

- **Approach:** We defined flexibility for expansion along four dimensions: (1) ability to expand capacity, (2) ability to modify process configuration and layout, (3) ability to adopt new processing technologies, and (4) ability to adapt infrastructure to support any type of expansion of core processing steps. As we analyzed flexibility for expansion along these four dimensions, we examined to what extent bottlenecks and constraints exist in the current state as well as in likely future renovated or Greenfield facilities.
- **Initial Findings and Takeaways:** When compared to a Greenfield facility, the existing main building will not provide as much flexibility for expansion, even after renovations. Basic constraints in room dimensions and layout limit future flexibility in multiple dimensions. The dismantling, moving and setting up of aging machinery appears to be cost prohibitive, especially coupled with the need for extensive renovations to the building. In addition, a marked improvement in materials handling capability, even with additional elevators, appears to be infeasible. The accommodation of new equipment, technology, and associated tighter, more uniform environmental controls necessitates an open floor plan, similar to that found at WCF. Going forward, it is expected that as currency becomes more sophisticated through the use of alternative substrates, processing, and inks, production needs will demand a modern, state-of-the-art facility that optimizes production flow and inbound/outbound logistics shipping.

***Decision-Making Model:***

- **Approach:** The draft decision-making model is a user-adjustable dashboard that places all inputs (including criteria weights), key assumptions, as well as outcomes in a single MS Excel spreadsheet tab. Detailed calculations are provided in subsequent tabs. Decision-making criteria include the categories of finance, security, flexibility, workforce impact, schedule, operational risk, historical continuity, tour, and location. This will give BEP decision makers more accurate long term lifecycle cost projections for the three alternatives and provide users with the ability to prioritize their cost-location considerations through adjustable weighting criteria.
- **Initial Findings and Takeaways:** Not available at this point in the project. Once the basic data and assumptions are confirmed with BEP as part of this submission, we will proceed into the more detailed cost and schedule analysis phase of this study.

# Appendix B

# Facility Strategic Alternatives Study

U.S. Department of the Treasury
Bureau of Engraving and Printing

January 23, 2013 – Final
December 18, 2012 – Revised Draft
November 6, 2012 – Draft

## Submission 2

BEP Order #TEPV12-14041

**Prepared by:**
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# EXECUTIVE SUMMARY

The goal of our second submission is to present our findings in the context of a comprehensive evaluation of three alternatives for the Washington, DC, currency production facility (DC Facility). This is significant because not only will we validate our assumptions and processes, but also give the Bureau of Engraving and Printing (BEP) the opportunity to discuss emerging themes and outcomes.

The contents of this report represent interlinking sets of analysis and research, based on the approved assumptions and data sets from Submission 1, driving towards a recommendation for solving BEP's facility issues. This iterative approach is essential to maintaining the continual flow of data and ideas between BEP and Booz Allen while ultimately delivering a defendable, data supported recommendation. The following paragraphs describe the work accomplished thus far.

***Capacity Planning***

- **Approach:** We analyzed historical production requirements and established the most likely scenario for future currency demand from 2013 through 2042. Based on future demand, we established a future target design capacity that meets future production requirements and calculated the number of production lines required to meet the target design capacity. We then added an additional line for research and development (R&D) and ensured that the production and R&D lines combined could meet continuity of operations requirements.
- **Initial Findings and Takeaways:**
  - Based anticipated production schedules for yearly currency orders, we estimated a future need of 8.147 billion notes per annum (npa) of BEP production. With a 60 percent / 40 percent split between Western Currency Facility (WCF) and the DC Facility, this results in a production level of 3.259 billion npa at the DC Facility.
  - Assuming current level of printing efficiency and successful transition to 50-subject sheets, four DC Facility production lines could produce 4.88 billion npa—sufficient capacity to cover additional currency volumes beyond current projections – exceeding continuity of operations requirements by 30 percent – plus use of the fourth line for R&D activities.
  - To ensure continuity of operations, the 4.95 billion npa volume for DC Facility can easily be met by running the four production lines at 7/24 operations.

***Space Programming***

- **Approach:** We developed space programs for each alternative using a separate approach for production space and administration space. The production space program was developed by taking the WCF production space allocation and scaling it to the configuration needed for the DC Facility. Spaces were scaled based on useable square footage (USF) per unit production or USF per machine. We developed the administration space program by establishing an office space standard and allocating space according to the standard, using full-time equivalents (FTEs) for both federal employees and contractors who require office space. Other administration space such as vaults and other special requirements were treated as fixed requirements, and we used the current space allocation. For both production and administration space, we made some adjustments to space based on our understanding of whether current space is under or oversized relative to needs. Scaling allowed us to determine the ideal production space program, which was allocated within the existing building. Existing constraints resulted in unavoidable deviations from the ideal space program beyond the difference between gross square feet and usable square feet.

- **Initial Findings and Takeaways:**
    - All three alternatives start with four production lines, with areas sized to support full 5/24 operations (4.88 billion npa).
    - All three alternatives will require less square footage than current DC Facility space (Main building, Annex building, and Landover warehouse): 1.597M GSF (1.131M USF), excluding 70,755 GSF of subleased warehouse space.
        - Alternative 1 (Renovation): 1.226M GSF (0.842M USF)
        - Alternative 2 (New Build): 0.891M GSF (0.796M USF)
        - Alternative 3 (Hybrid): 0.915M GSF (0.805M USF), which includes renovation of 0.066M GSF (0.047M USF) in the Main Building and 0.850M GSF (0.758M USF) of new building construction
    - Renovated spaces in the current DC Facility retain a higher gross to usable square footage ratio, based on the current geometric limitations of the Main and Annex buildings.

***Equipment Strategy***

- **Approach:** We mapped the equipment replacement cycles for major equipment (e.g., presses) and superimposed them with the proposed construction schedules for the three alternatives. If regularly-scheduled equipment replacements occur in the construction windows, we included this work in the overall project scope. In some cases, we deferred equipment replacement slightly beyond the 15-20 year guideline to avoid installing equipment that would only be in place for a year or two before being moved or disposed. We studied the economics of moving major equipment in lieu of replacing with new equipment to help guide our decision as to when equipment should be relocated rather than replaced.
- **Initial Findings and Takeaways:**
    - Economically, major security printing equipment is cheaper to replace with new equipment after about 16 years (with an expected useful life of 18 years).
    - Disassembly and re-assembly of existing printing equipment increases construction timelines and risk to currency production operations, but is viable.
    - Based on current equipment age, technology upgrades, and the need to maintain current production levels, most security equipment would be more economical to purchase new. In the new building production location (Alternatives 2 & 3), several pieces of major equipment would be more economical to disassemble and move from the Main building.

***Capital Project Scope, Schedule and Cost***

- **Approach:** We built separate scopes, schedules, and cost estimates for each alternative and ensured that the cost and schedule estimates were integrated. A variety of estimating data were used, including WCF historical costs (adjusted to January 2012 dollars and for Washington, DC labor cost and productivity), WCF historical construction schedule, DC Facility historical costs, RS Means cost estimating data, other capital projects for which Booz Allen has historical cost data, and in some cases cost data from the 2010 Facility Study. Cost data taken from the 2010 study are annotated in Appendix F, and were used in a few instances in which one or more of the following criteria were met: (1) the cost category was not highly leveraging on the total cost estimate, (2) alternative or better cost data was not available, and (3) the 2010 costs were found to be reasonable in 2012. After Submission 2 was delivered, we received additional detailed historical costs for BEP projects, which further reduced the use of 2010 study unit costs.

- **Initial Findings and Takeaways:**
    - Scope of the project will bring all three alternatives up to meet space and all building and life safety code requirements. Given the current condition of the DC Facility, the level of work required for all the alternatives to achieve the same standard varies.
    - The project duration includes a three year prospectus period followed by design / construction / acceptance before ready for full operations:
        - Alternative 1 (Renovation): 15.4 years
        - Alternative 2 (New Build): 9.3 years
        - Alternative 3 (Hybrid): 10.2 years
    - Project cost and timeline for Alternative 1 is higher due to the challenges posed by continuing operations while concurrently performing a comprehensive renovation around production.
    - Project cost includes all land purchases, incentives, design, construction, and initial capital equipment (in FY2012 dollars):
        - Alternative 1 (Renovation): $1.5B
        - Alternative 2 (New Build): $0.7B
        - Alternative 3 (Hybrid): $0.74B

***Recapitalization***

- **Approach:** We projected the cost for all major equipment replacements occurring after the capital projects for the three alternatives are completed. We assumed that equivalent major equipment replacements were 3 percent higher in a renovated facility than in a newly constructed facility because of site constraints. We also analyzed historical capital project spending at both the DC Facility and WCF and derived an annual level of minor, sustaining capital spending required to keep the current facilities operating during construction and to maintain the new facilities after construction is complete. We then combined minor and major capital over 30 years to determine the recapitalization requirement for each alternative. We do not have the data to justify an increase in recapitalization during this period, and we assume that BEP will avoid any unnecessary expenditures. Emergency projects could emerge that would require additional funding, which is a risk associated with the approach of Alternative 1.
- **Initial Findings and Takeaways:**
    - Based on the construction schedule timing of the three alternatives, recapitalization of building systems and printing equipment consists of an annual steady-state of about $10M per year plus major equipment replacements.
        - Alternative 1: $0.5B total for 30 year period
        - Alternative 2: $0.6B total for 30 year period
        - Alternative 3: $0.6B total for 30 year period
    - The differences in recapitalization costs among alternatives are somewhat arbitrary given where some events occur near the end of the 30 year window. Because Alternative 1 construction does not end until 2028, some equipment and systems will not have been replaced by 2042. Conversely, under Alternatives 2 and 3, those recapitalization costs

would have been incurred because construction of the production facility would have been completed earlier in 2021.

***Operations Expenditures (OPEX)***

- **Approach**: We focused on operational costs that would be significantly impacted by a move to a new site or renovated facility. Using the WCF as our efficiency benchmark, we scaled operational expenditures to future production forecasts and interwove cost and schedule OPEX requirements with the renovation or new build ramp-up schedule. We included a base level of recapitalization to maintain operations during construction. Cost savings associated with a more energy efficient building envelope, more efficient space plan, and reductions in personnel support have been incorporated into the analysis.
- **Initial Findings and Takeaways:**
  - Based on the resulting facility layout, differences in operating costs were calculated for the three alternatives. Differences were in utility consumption, personnel, contracted services, Landover warehouse lease, and temporary labor used during construction:
    - Alternative 1: $19.4B total for 30 year period
    - Alternative 2: $18.7B total for 30 year period
    - Alternative 3: $18.7B total for 30 year period
  - More efficient layout of the production activities and overall facility layout in a new building allows for fewer FTEs in Security Printing, Operations Support, and Security. Facilities Support will also decrease given the smaller facility footprint and younger facility age, reducing maintenance and repair needs.
  - Space and operational constraints (e.g., maintaining full production) generally precluded us from achieving improved material handling and associated OPEX savings. A new elevator was added in the Main Building for use in production.

Tables ES-1 and ES-2 summarize the costs and schedules of the three Alternatives.

**Table ES-1: Cost Summary of Alternatives:**

| Cost Element (Constant $ Jan 2012 ) | Alternative 1: Renovation | | Alternative 2: New Build | | Alternative 3: Hybrid | |
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**Table ES-2: Schedule Summary of Alternatives:**

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| Construction Period | 9.2 | 2.1 | 3.0 |
| Pre/Post Construction | 3.2 | 4.7 | 4.7 |

* Prospectus and site selection can overlap 6 months for new facility.

Note that under Alternatives 1 and 3, areas of the Main Building that have already been renovated will receive only replacement windows.