Leveraging TBL-CBA for a Utility Infrastructure Master Plan

Leading engineering firm, HNTB, combined forces with the consulting arm of Autocase® to prioritize utility infrastructure designs for Los Angeles International Airport (LAX)

Challenge: LAX utility infrastructure, some dating from the 1960s and 1980s, was beginning to show signs of age. Several utilities would soon become outdated, reach capacity or require relocation. Los Angeles World Airports (LAWA) sought to develop a forward-looking Utility Infrastructure Plan (UIP) that would consider campus-wide needs over time to better inform each standalone improvement project. A new UIP would also aid LAWA in developing a prioritized and phased upgradeprogram.

For six different utility types—domestic water distribution, fire water distribution, sewage distribution, electrical supply, chilled and heated water capacity, and chilled and heated water distribution—sophisticated engineering designs had been developed by HNTB and project partners and evaluated for their performance. These designs would replace aging infrastructure, increase capacity, provide appropriate redundancies or backup systems to mitigate the risk of utility outages or failures, and/or implement new technology and efficiency systems to manage operational costs.

However, to support the choice of investment decisions, LAWA sought a fuller understanding of the lifecycle cost ramifications and broader set of impacts produced from each design alternative. **How could the project designs within each utility category be evaluated side-by-side using a model that would allow for a valid monetary-based comparison across alternatives?**

HNTB and LOS ANGELES WORLD AIRPORTS

Utility Project Analysis for a Master Plan

- Informed the LAX Capital Improvement Plan (CIP) at the design stage
- Prioritized 17 designs for 6 utility types
- Conducted full Life Cycle Cost Analysis (LCCA)
- Applied Cost-Benefit Analysis (CBA) across financial, social and environmental impacts for an expanded, Triple Bottom Line (TBL) project scope

Risk-adjusted economic business cases deliver a method for comparison.

Solution: Working together with HNTB, the TBL-CBA Consulting Services arm of Autocase built risk-adjusted economic business cases to assess the entire range of hard and soft dollar costs and understand project outcomes.

The assessment provided a full life cycle cost analysis (LCCA), accounting for the capital costs, ongoing operations and maintenance costs, and replacement costs, as well as energy, water, emissions and other relevant lifecycle costs. The results of different design alternatives were presented in terms of Net Present Value (NPV) and Discounted Payback Period (DPP).

As this was a Triple Bottom Line (financial, social and environmental) Cost Benefit Analysis, the evaluation also quantified and monetized the broader social and environmental impacts of the utility alternatives. Those impact areas included energy efficiency (i.e., electricity and natural gas), potable water conservation, and improved environmental air quality (greenhouse gases and criteria air contaminants).

To take uncertainty of future values into account, a Monte Carlo-based simulation of the possible outcomes and final project value was conducted. The resulting probability distribution was used to assess the risk of each projected outcome.

TBL-CBA Analysis Results	Alternative	Sustainable NPV*	Sustainable NPV Variance from the Base Case*	Discounted Payback Period (years)*
Domestic Water	2	-$6,867,759	-48.5%	Does not pay back
Fire water	2	$465,715	8.0%	0.0
Sewage	2	-$37,098,745	-308.5%	Does not pay back
Electricity	2	-$31,295,755	-32.5%	Does not pay back
	3	-$12,598,080	-13.1%	Does not pay back
Chilled and heated water capacity	2A	$45,935,624	18.4%	15.9
	2B	$44,582,807	17.8%	16.5
	3	$24,773,647	9.9%	20.5
	4	$18,534,428	7.4%	4.0
	5	$57,822,278	23.1%	14.2
Chilled and heated water distribution	2	-$671,617	-43.6%	Does not pay back

Outcome: The baseline scenario delivered the best financial Net Present Value for most alternatives, and only a marginal improvement from Alternative 2 for Fire Water. However, for Chilled and Heated Water Capacity, the broader financial social and environmental analysis highlighted the importance of matching timing to the need for capacity expansion and pointed to the use of Thermal Energy Storage in the near term to reduce electrical demand and the associated energy costs and environmental impacts.

Here, the project team gained insights across the six utility types as to how the Net Present Values (NPV's) of the alternatives differed from the base case.