IndyGo ZEV Transition Plan Briefing

April 18, 2024

Agenda

1. Review of Project Background
2. Overview of Five Scenarios for Analysis
3. Lifecycle Cost Analysis and Emissions Analysis
4. Preferred Scenario
5. Transition Decision Framework and Conditions
6. Discussion and Acceptance of Playbook

Review of Project Background

Project Overview

- **Zero-emission vehicle** transition plan that sets **strategic direction** for the agency to identify near-term implementation projects and to incorporate future learning and trends over time.
- Analysis and planning for **all revenue and non-revenue vehicles**
- Explore feasibility of **battery-electric and hydrogen fuel cell technologies**
  - Trolleybuses with catenary wires not studied, as they would be considerably more expensive to construct.
  - RNG buses not considered due to limited fuel supply.

Project Guiding Principles (Based on workshop feedback)

Top Purposes of a Transition

- Improved air quality and public health
- Federal funding to support transition
- Potential operating cost savings
- Reduce greenhouse gas emissions

Top Guardrails on a Transition

- Protect reliability of service
- Reduce/control costs
- Resiliency in severe conditions

Our transition would be contingent upon financial and operational criteria.

Project Overview

We are here.

Note: Our previous briefing shared findings regarding vehicle technologies, schedule compatibility, and facility upgrade requirements.

Scenario Overview

Scenario Overview

- All assume **transition by 2040** as a current target (can be adjusted over time)

- Cutaway, paratransit and non-revenue vehicles are treated the same in all ZE scenarios.
  - 67% of cutaways are EVs, based on compatibility
  - 100% of non-revenue vehicles are EVs (fully compatible)
  - Minimal to no fuel cell options for these vehicle types

- Our scenarios include an ICE/hybrid baseline and four zero-emission (ZE) transition scenarios:
  1. **ICE/hybrid Baseline**
  2. **All BEBs**
  3. **All FCEBs**
  4. **40’ FCEBs, 60’ BEBs**
  5. **40’ BEBs, 60’ FCEBs**

Scenario 1: ICE/Hybrid Baseline

Pros:

- No need for additional vehicles
- No range or schedule compatibility issues
- Lowest cost overall and no need for additional facility upgrades
- No additional operational complexity (e.g. depot management or maintenance changes)

Cons:

- No emissions reductions
- Risk of negative public perception
- Long-term risk of OEM transition away from ICE hybrid buses and support for them
- Does not take advantage of current BEB infrastructure investments

Scenario 2: All BEBs

Pros:

- Takes advantage of existing infrastructure (Corporate Campus power upgrades, on-route chargers)
- IndyGo already has experience with this technology
- More flexibility to decide which fleet to house at which campus, as both are highly compatible with BEB technology
- Electricity as a power source is already reliably available and generally expected to get cleaner over time.
- Maintenance costs expected to decrease (though changes may be difficult)

Cons:

- Longer charging times (compared to fueling times) limit scheduling of 60’ buses and lead to need for additional vehicles
- Additional complexity with depot management, charge management, ensuring that fully charged vehicles are deployed into service

Scenario 3: All FCEBs

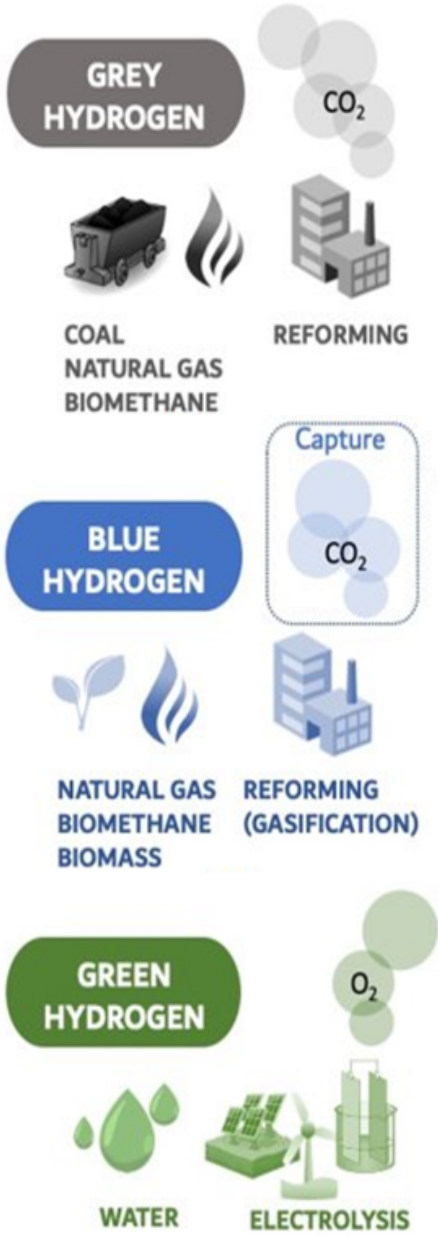
Pros:

- Shorter fueling time allows for quicker turnaround of buses into service
- Less complexity with managing vehicle refueling and re-deployment into service compared with BEBs
- Maintenance costs expected to decrease (though changes may be difficult)
- Longer range

Cons:

- FCEB technology is still nascent and supply chain still being developed.
- Long-term availability and affordability of green hydrogen is uncertain.
- No IndyGo experience with this technology, there would be a learning curve.
- More investment needed in Corporate Campus

➔ A mix of the two technologies has resiliency benefits, though this can also be achieved with BEBs and back-up power.



The current hydrogen supply is over 99% from natural gas or coal. Truly zero emissions hydrogen is produced from renewable electricity

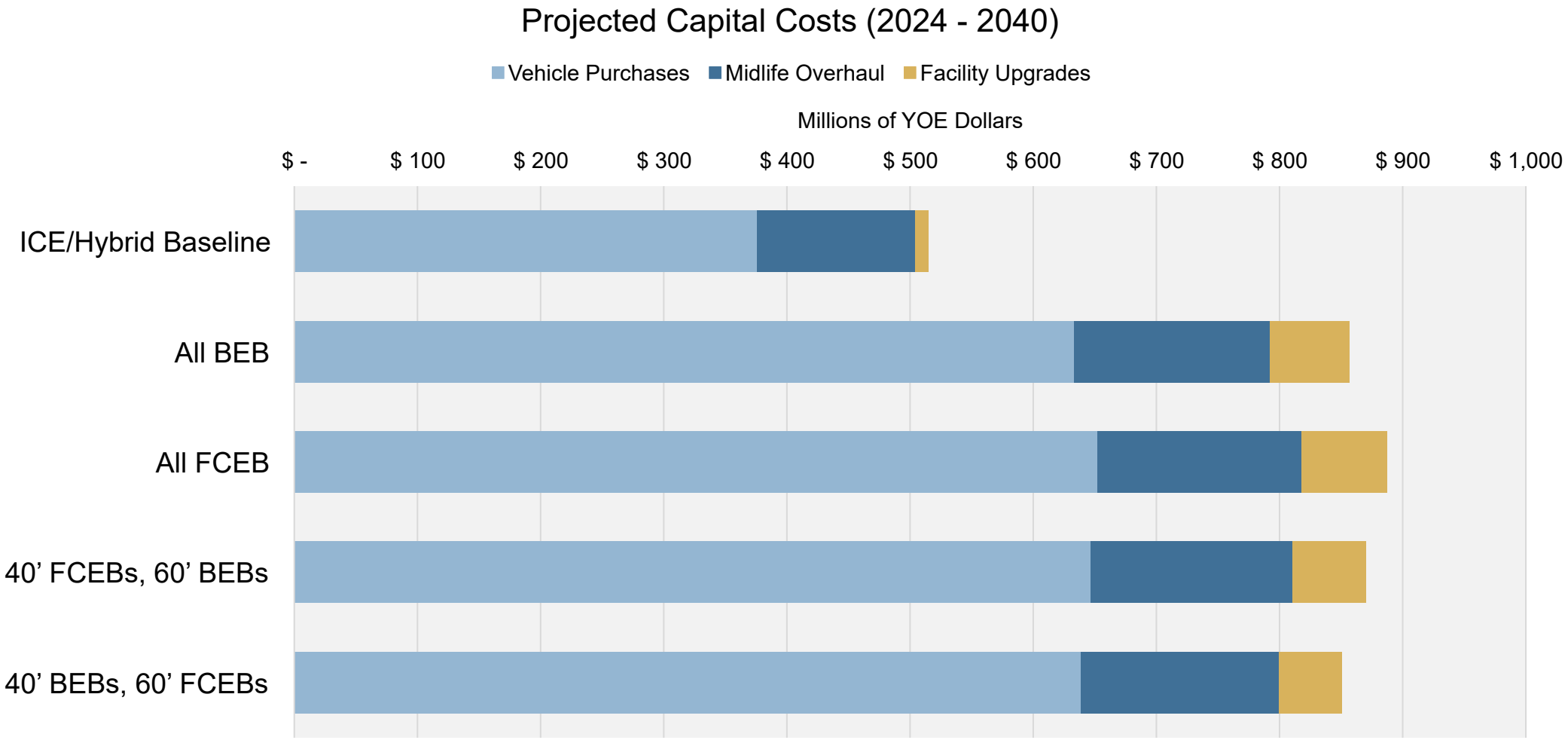
Image: http://www.chem4us.be/blue-green-gray-the-colors-of-hydrogen/

Scenario 4: 40’ FCEBs, 60’ BEBs & Scenario 5: 40’ BEBs, 60’ FCEBs

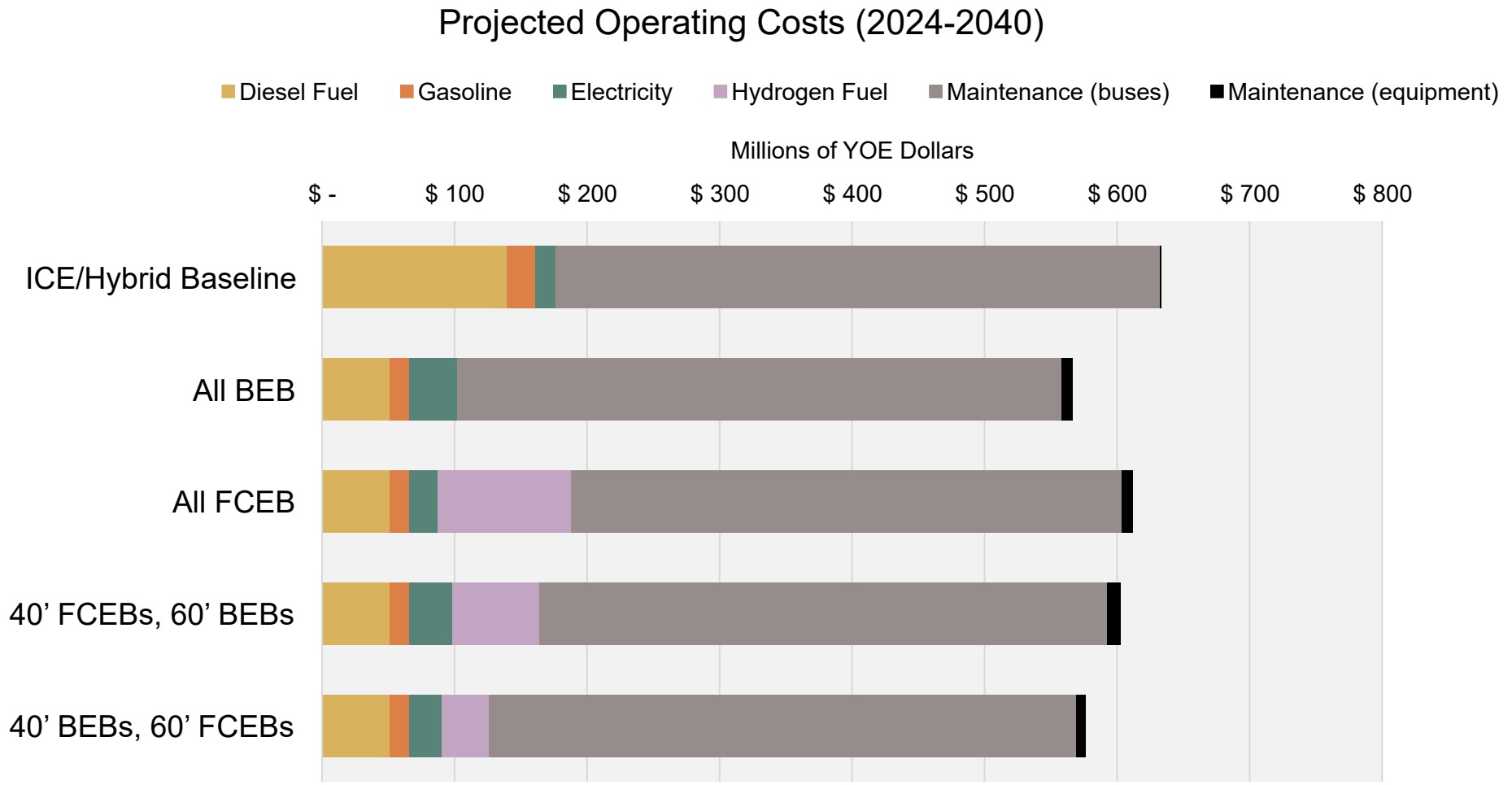
- The last two scenarios would blend the pros and cons of BEBs and FCEBs that were just discussed.

Lifecycle Cost Analysis and Emissions Analysis of Scenarios

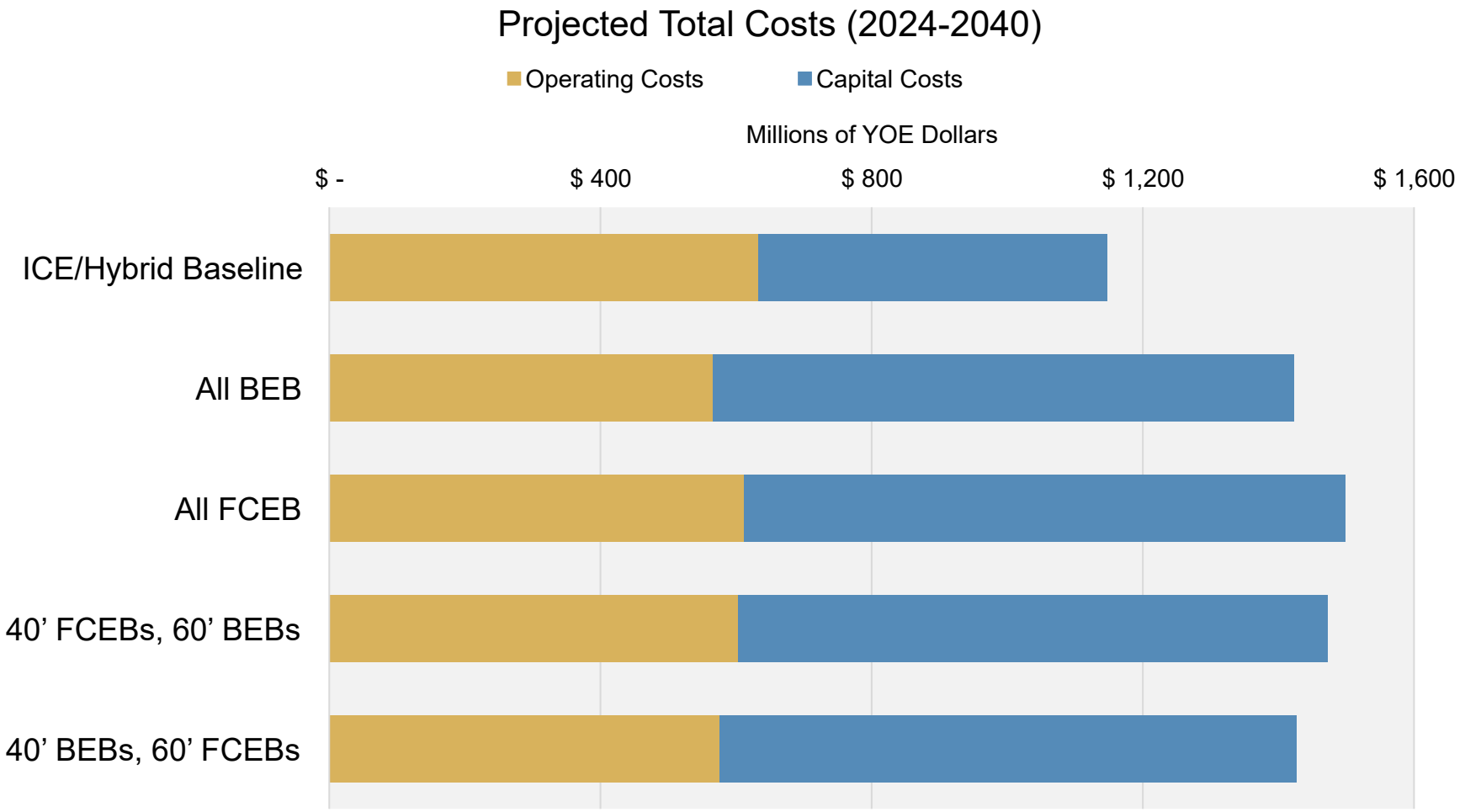
Scenario Capital Costs Compared



Scenario Operating Costs Compared

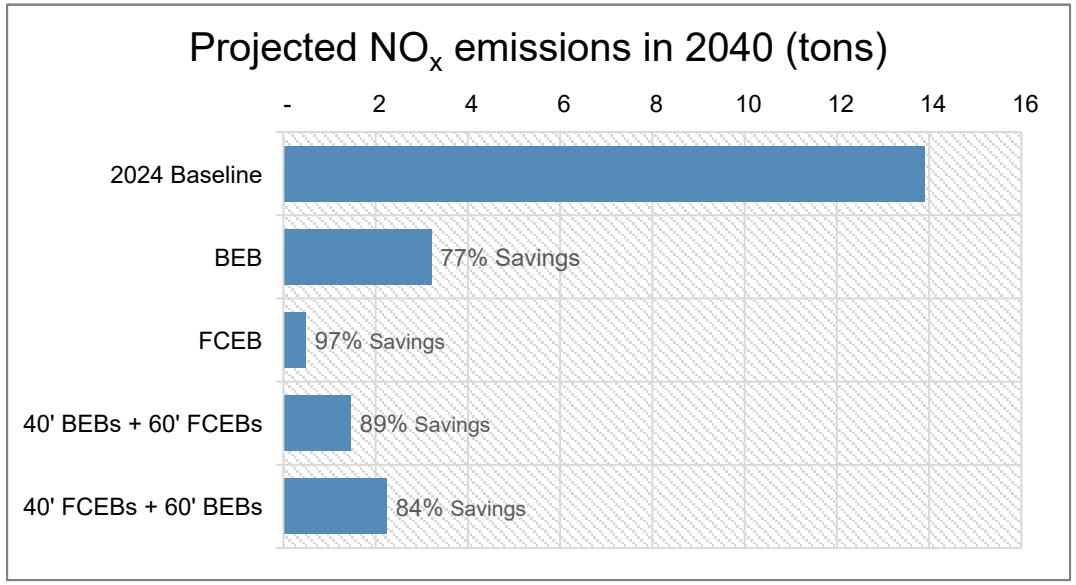


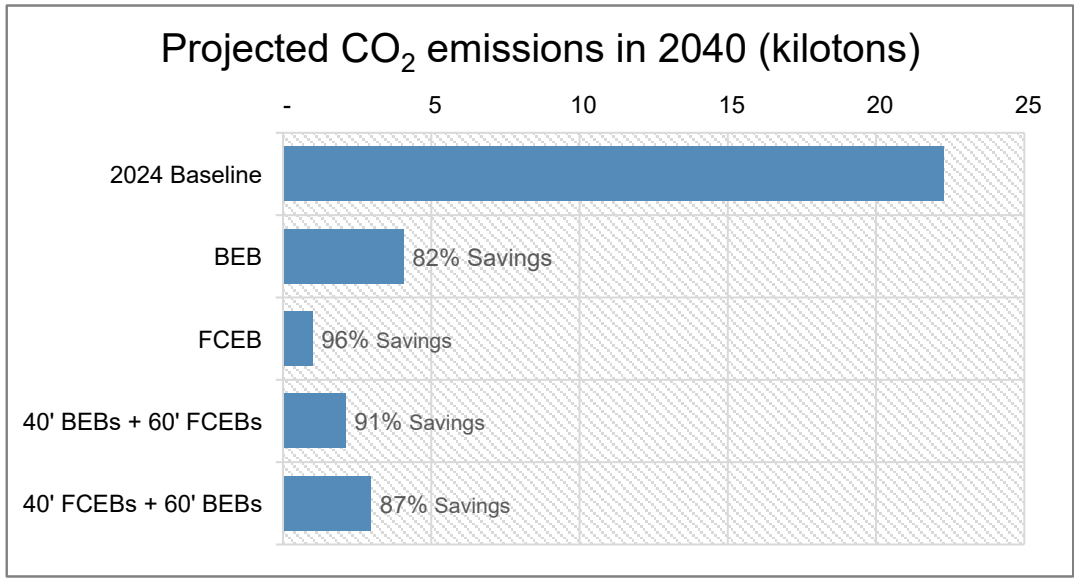
Scenario Total Costs Compared

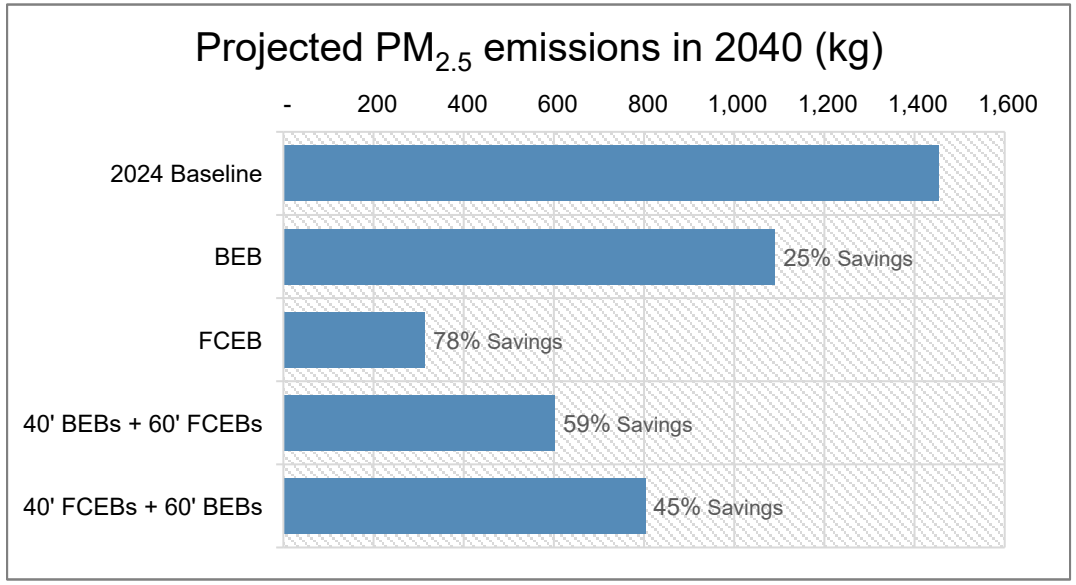


Scenario Emissions Impacts

For context, IndyGo's CO_2 emissions are less than 1% of Indianapolis' 2019 emissions reported by the Indianapolis Office of Sustainability.







Preferred Scenario

Preferred Scenario: All BEBs

- Leverages investments and knowledge to date
- Highly compatible with service schedules
- Lowest projected operating costs and second-lowest capital costs
- Lower risk of fuel costs and availability
- More flexibility to decide which fleet to house at which campus, as both are highly compatible with BEB technology (minimizes run-on/off miles)
- Power resiliency can be handled with battery storage and/or generators
- Longer charging times at depots are feasible to accommodate

Transition Decision Framework and Conditions

Playbook Decision Framework

1. The Playbook recommends the preferred scenario (All BEBs), with specific conditions for moving forward.

2. It also recommends reevaluating preferred ZEB technology direction at **key decision points** (in advance of infrastructure investments and initial/significant ZEB fleet purchases).

3. For each annual bus purchase, IndyGo can decide whether to proceed with ZEBs or ICE/hybrid buses, based on cost and technology readiness.

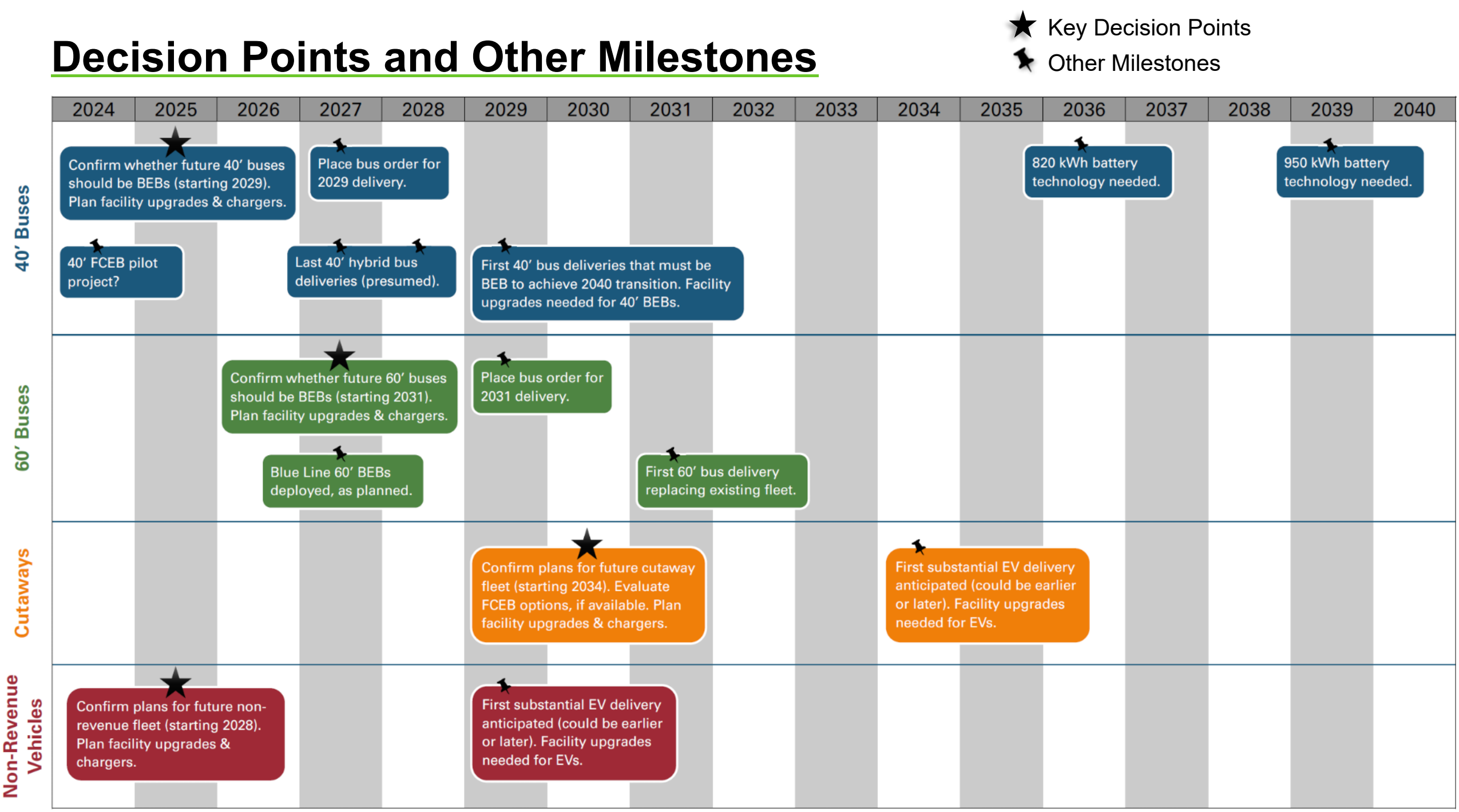
Potential Conditions for Annual ZEB Purchases

- **Costs** do not impact ability to maintain service levels. Grant funding can help offset costs.
- **BEB technology** advances to enable use on longer blocks of service, per Blueprint assumptions. This will minimize number of extra vehicles needed.

Staff Perspectives from Polling

- On average, staff have **moderate** views on ZEVs: Technology may not be quite ready today but will be soon.
- On average, staff **agree** that the preferred scenario will accomplish our purposes.
- On average, staff are **neutral** on whether the preferred scenario will adhere to our guardrails.
  - It will be important to monitor costs and performance as the ZEV industry evolves.

Decision Points and Other Milestones



Decision Points and Other Milestones (Near Term 2024-2028)

➔ **2024**
- 40’ FCEB pilot project?

➔ **2025**
- Confirm whether future 40’ buses should be BEBs (starting 2029). Plan facility upgrades & chargers.
- Confirm plans for future non-revenue fleet (starting 2028). Plan facility upgrades & chargers.

➔ **2027**
- Place 40’ bus order for 2029 delivery.
- Last 40’ hybrid bus deliveries (presumed).
- Confirm whether future 60’ buses should be BEBs (starting 2031). Plan facility upgrades & chargers.
- Blue Line 60’ BEBs deployed, as planned.

➔ **2028**
- Last 40’ hybrid bus deliveries (presumed).

Considerations at Key Decision Points ★

- Projected capital and operating costs
  - However, the differences between scenarios may be small or have many unknowns
  - Could also depend on securing grant funding
- Technology reliability, schedule compatibility, and resiliency
- Use of existing investments at Corporate Campus and on-route
- Operational considerations, such as which campus to operate out of and investments required to facilitate that

Discussion and Acceptance of Playbook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