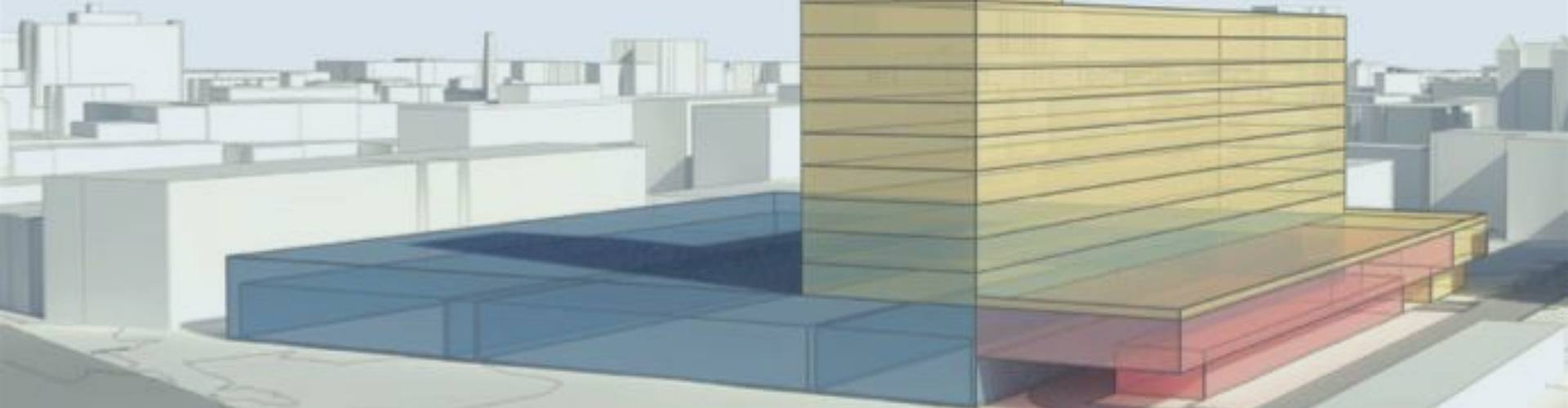


New MBTA Bus Maintenance Facilities & Evolving Battery Electric Bus Technology

CASE STUDY: Albany Street Garage

JACOBS



July 29, 2019

ACKNOWLEDGEMENTS

We would like to acknowledge the many stakeholders who participate in and supported the development of this study

- Jacobs Team
- A Better City
- Public officials, advocates, and other stakeholders
- The Barr Foundation

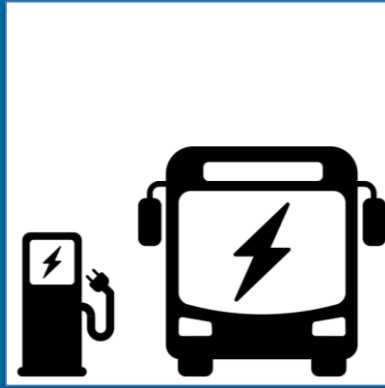
TAKEAWAYS

1. Approximately \$1 B financial challenge
2. BEB fleets in NE likely in 5-7 years
3. Joint-development benefits may help
 - Cost-effective procurement
 - Better neighborhood fit for facilities, not divest urban sites
 - Decarbonization and climate goals

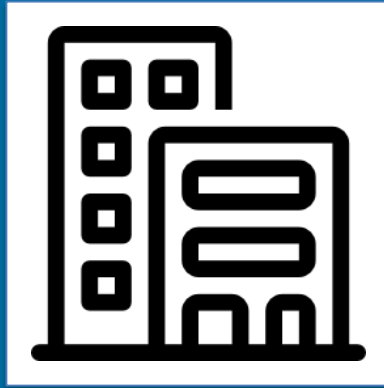
NEED



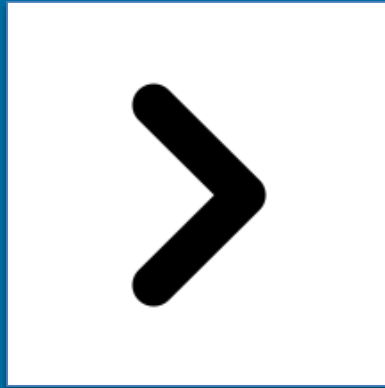
Need



BEB



Multi-use



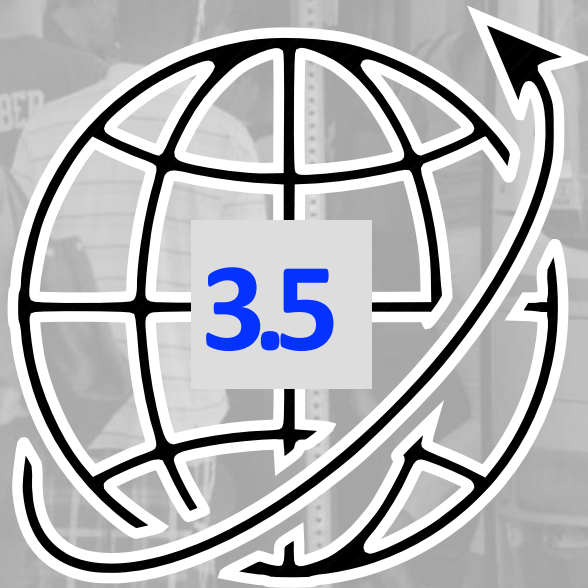
Next

BUS



33%

3.5



\$1B FUNDING NEED

	Facility	Age	Capacity	Rating
1.	Albany	76	116	2.7
2.	Arborway	13	118	3.1
3.	Cabot	42	180	2.8
4.	Charlestown	42	254	2.0
5.	Fellsway	92	76	2.4
6.	Lynn	81	90	2.7
7.	North Cambridge	38	28	3.2
8.	Quincy	87	86	2.4
9.	Southampton	15	98	3.6
	Fleet Average	49	1,046	2.8

MBTA, INTEGRATED FLEET & FACILITIES PLAN, DEC. 2017

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CHALLENGING LAYOUTS



OUTDOORS & FULL



OBSOLETE



JACOBS



MODERNIZED

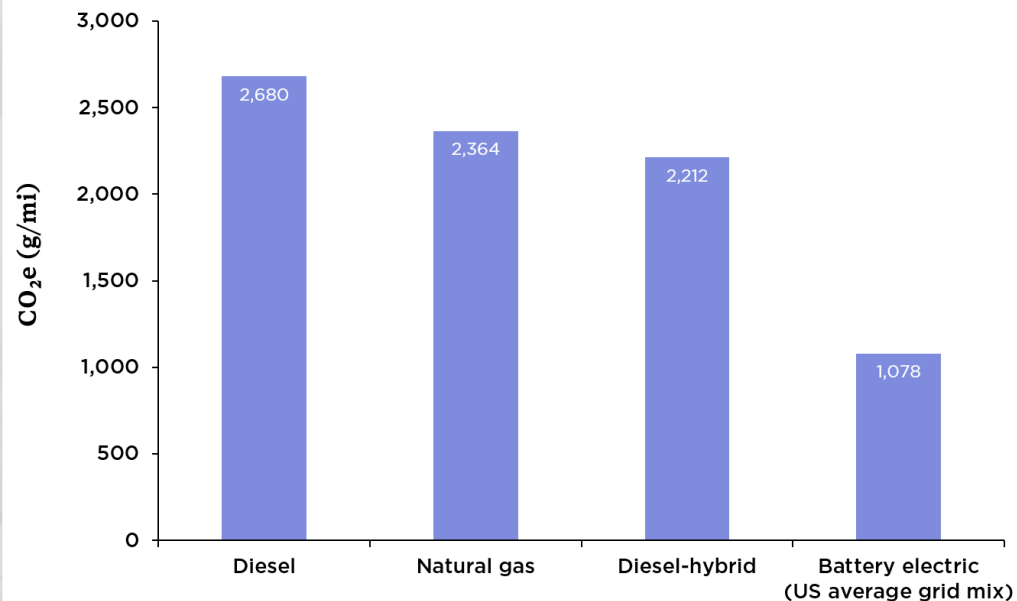


CLIMATE GOALS

- “Achieving the Commonwealth’s [2040 goals] will require the near-complete transition of our vehicle fleet...buses...to electric vehicles.
- “...by 2030, all...buses (as appropriate) purchased with state resources will be ZEVs

BEB CO₂ BENEFITS

Life cycle global warming emissions from different types of transit buses



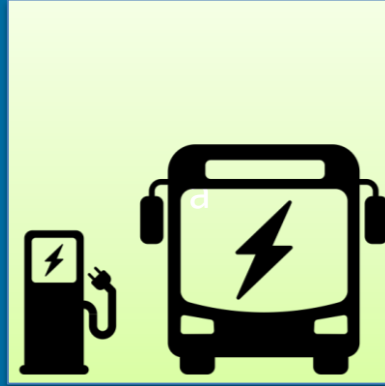
<https://blog.ucsusa.org/jimmy-odea/electric-vs-diesel-vs-natural-gas-which-bus-is-best-for-the-climate>

Note: Power plant data as of 2016

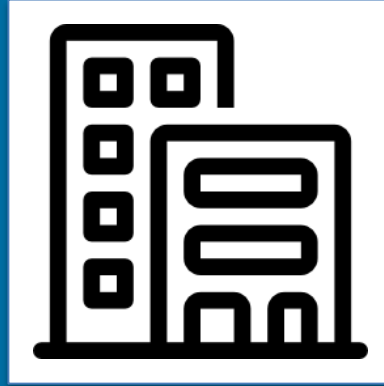
BATTERY-ELECTRIC BUSES



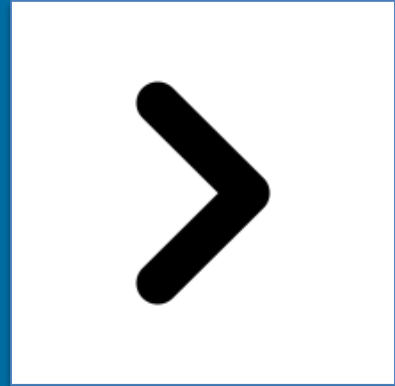
Need



BEB



Multi-use



Next

BEB NORTH AMERICAN MARKET



BEB \$/BUS

Type	Cost (\$)	Year	Agency
40' Proterra E2	950,000	2014	The City of Seneca
40' Proterra E2	789,000	2015	Foothill Transit
40' Proterra E2	797,882	2016	King County Metro
40' Proterra E2	784,000	2017	King County Metro
40' Proterra E2	700,000	2018	DC's National Mall

\$/BUS COMPARISON

Type	Cost (\$)	Year	Agency
Diesel	553,760	2015	MBTA
CNG	585,990	2015	MBTA
Diesel-Hybrid	769,000	2017	King County Metro
Diesel-Hybrid	736,927	2018	MBTA
BEB	784,000	2017	King County Metro

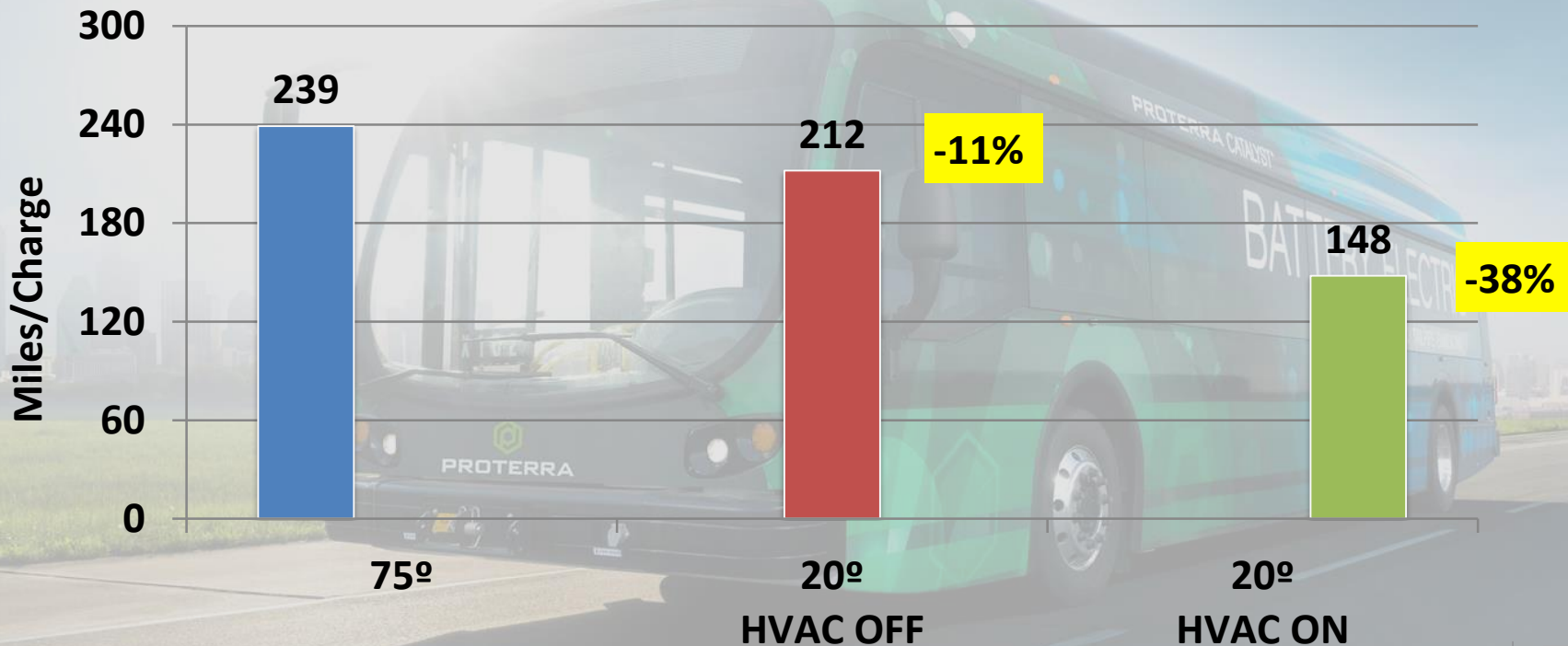
MBTA BEB INITIATIVES

- 5x 60-foot BEBs bought under FTA “Lo-No” grant program
- Support Silver Line service
- Evaluate technology in MBTA service / climate
- 40-foot BEB evaluation program anticipated



COLD IMPACTS RANGE

Tesla Model S



Note: % reductions compared to 75°

AAA-Electric Vehicle Range Testing Report, Feb. 2019

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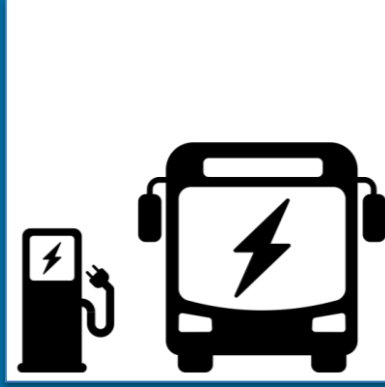
KEY BEB CONSIDERATIONS

Issue	Conventional Fleet	BEB Fleet
Maintenance	<ul style="list-style-type: none">• Ventilation needed	<ul style="list-style-type: none">• Ventilation not needed
Vehicle Range & Cold Weather Performance	<ul style="list-style-type: none">• 350+ miles	<ul style="list-style-type: none">• 200-400 miles• Cold weather impacts• Indoor storage
Fueling / Charging	<ul style="list-style-type: none">• 10 minutes	<ul style="list-style-type: none">• 2-5 hours to charge• Strategic parking of buses• Overhead / plug-in / inductive?
Power Infrastructure	<ul style="list-style-type: none">• Established fuel supply chain and logistics	<ul style="list-style-type: none">• Fleet power requirements under development• Backup generation required for redundancy?
Potential for Joint Development	<ul style="list-style-type: none">• Low	<ul style="list-style-type: none">• High?

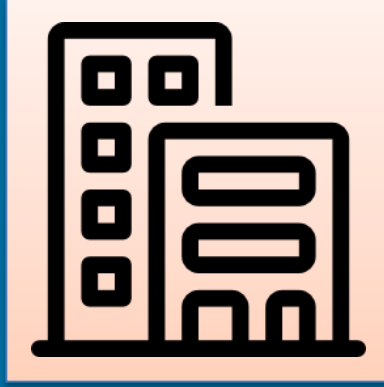
MULTI-USE CONCEPT



Need



BEB



Multi-use



Next

CASE STUDY OVERVIEW

- The Case Study is intended to demonstrate the viability of a concept
- Not specific to the Albany Street Garage
- This model could be adapted to any number of potential locations

ALBANY GARAGE

I-90

Ink
Block

I-93

Randolph St.

Albany St.

MAJOR DEVELOPMENTS



ZONING



MBTA Albany St.

I-93

Albany St.

BOSTON FLOWER EXCHANGE

500 Albany St.

EXCHANGE SOUTH END

MBTA Albany St.

I-93

Mass. Ave. Connector

RANDOLPH ST.

PROGRAM

55 PARKING SPACES

TOD RETAIL

8 PARK.
SPACES

WORK ROW
6 BUSES

ALBANY ST.

BUS
ENTRANCE

AUTO
ENTRANCE
EXIT
GENERATOR
UNDER

9 STORY
RESIDENTIAL TOWER

UP TO
17 STORY IN
THIS ZONE

FORMER CENTRAL
POWER STATION

BUS EXIT

BUS
STOR.
&
BUSES

BUS PARKING &
CHARGING

SERVICE ROAD / FIRE ACCESS

GARAGE BASE

55 PARKING SPACES

TOD

8 PARK. SPACES

WORK ROW
6 BUSES

ELECTRIC ROOM

10 SERVICE BAYS

MAINT. SUPPORT

AUTO
ENTRANCE
EXIT

DRY TO
GARAGE

BUS
ENTRANCE

PASS THROUGH LANE

PULL THROUGH SERVICE LANE 1

SERVICE SUPPORT

BUS STORAGE BARN 84 BUSES

PASS THROUGH LANE

BUS EXIT

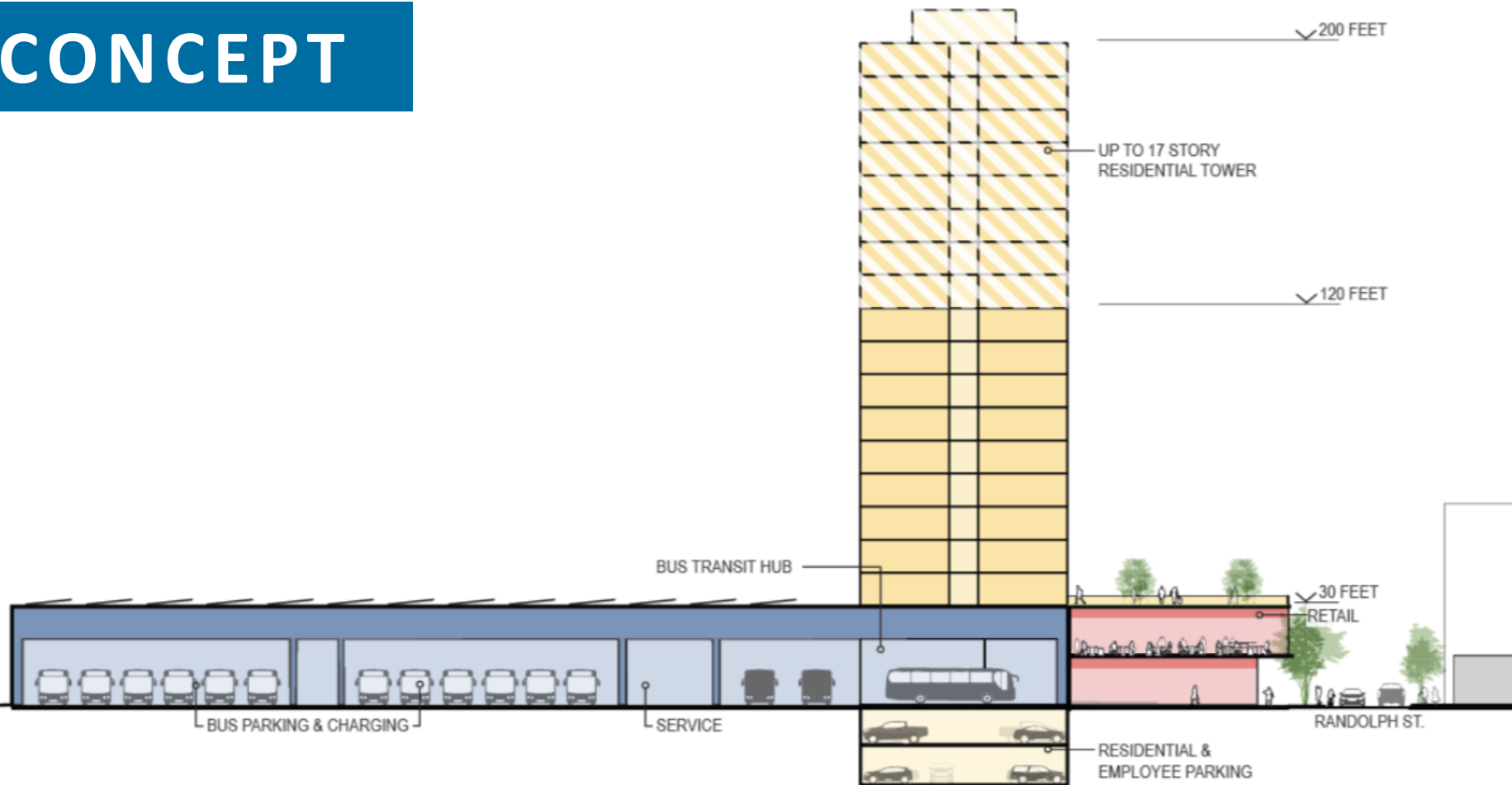
SERVICE ROAD / FIRE ACCESS

FORMER CENTRAL
POWER STATION

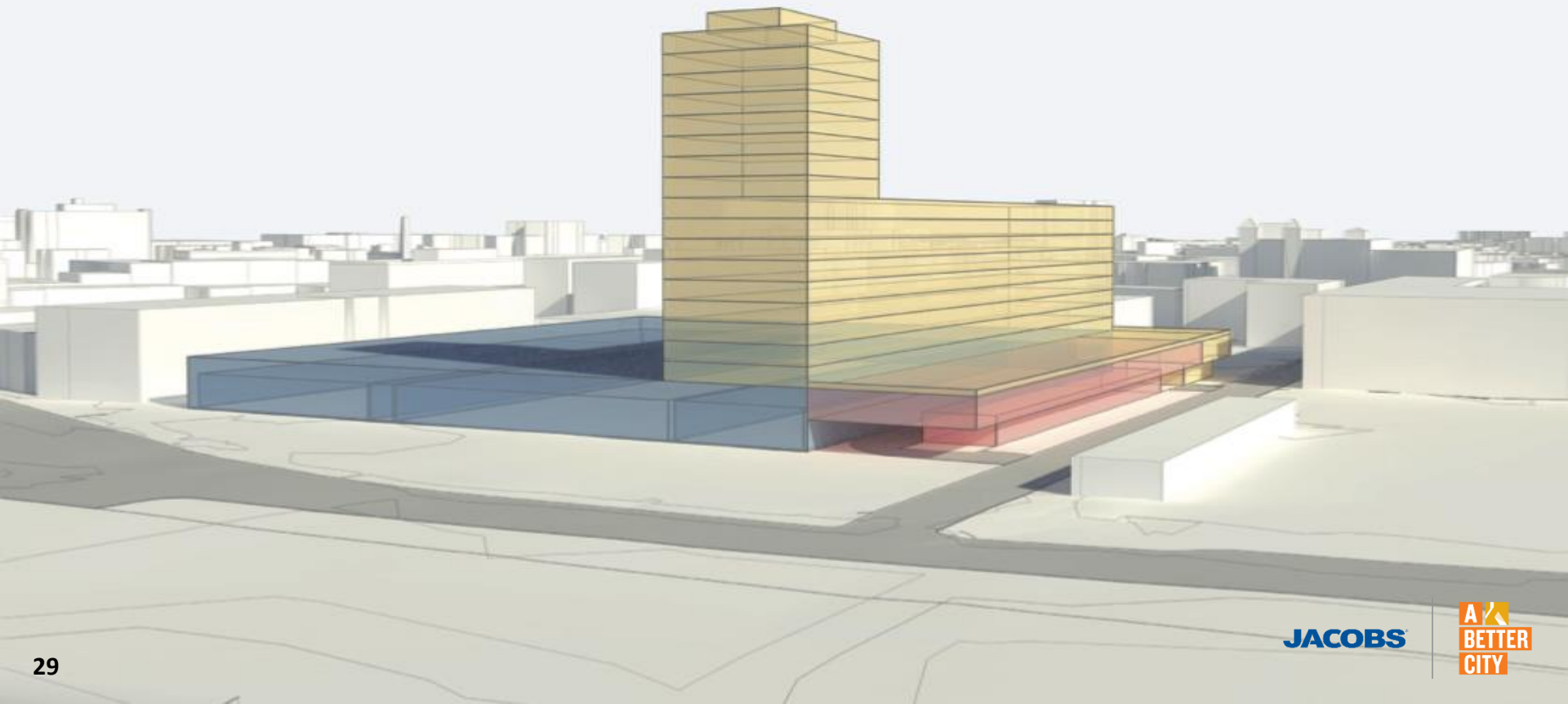
BUS
STOR.
BUSES

ALBANY ST.

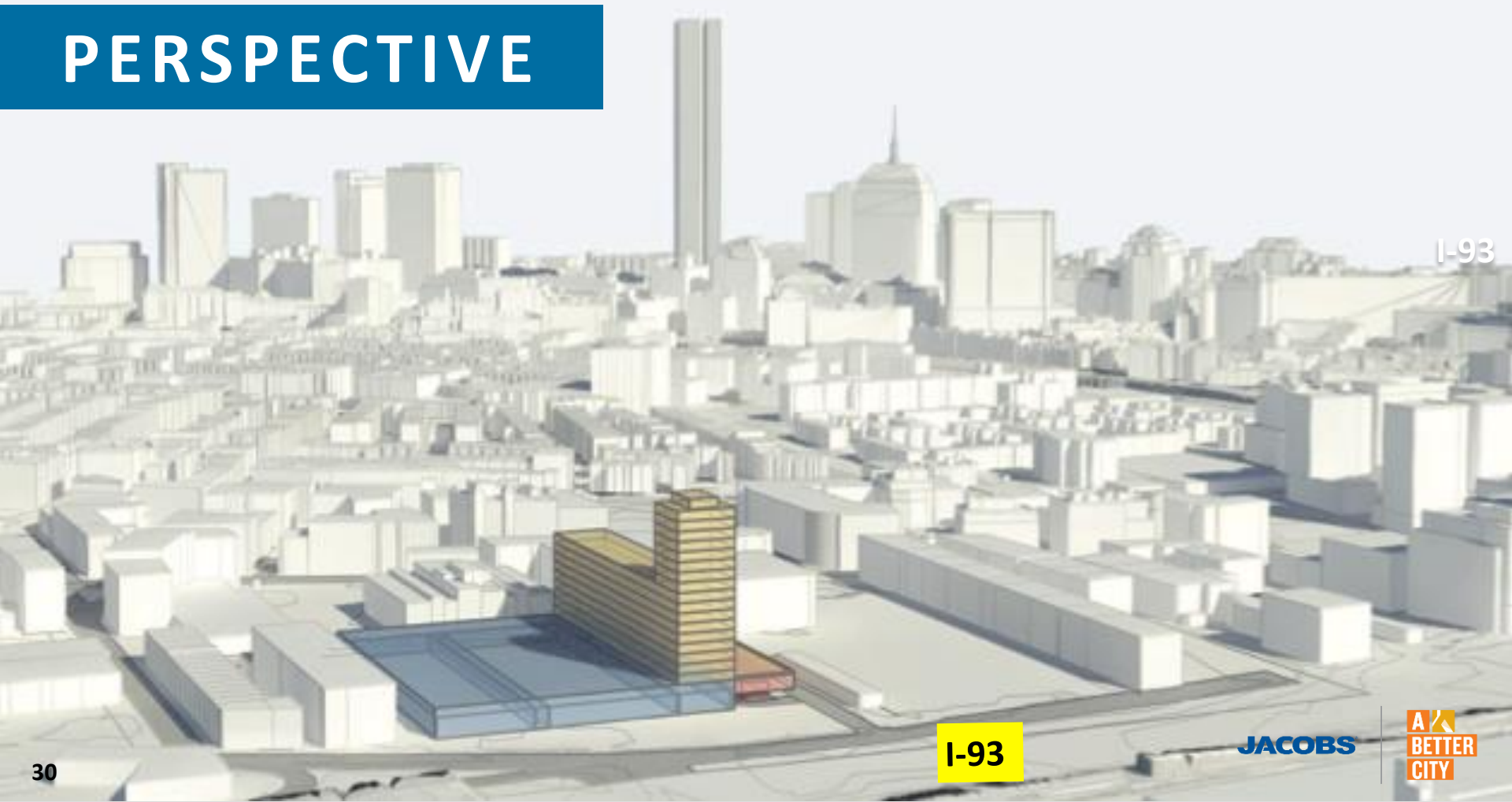
CONCEPT



MULTI-USE CONCEPT



PERSPECTIVE



I-93

I-93

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BETTER
CITY

FT² DETAILS

Program	BEB Storage and Maintenance Facility	BEB Facility and TOD Mixed-Use Development
Residential Space	--	226,548 ft ²
Retail Space	--	22,766 ft ²
Transit Hub	--	12,232 ft ²
Bus Maintenance & Support	25,366 ft ² (10 bays)	25,366 ft ² (10 bays)
Indoor Bus Storage	80,975 ft ² (94 buses)	80,975 ft ² (94 buses)
Onsite Employee Parking	25,562 ft ² (55 cars)	25,562 ft ² (55 cars)
Underground Car Parking	63,222 ft ² (68 cars)	63,222 ft ² (68 cars)

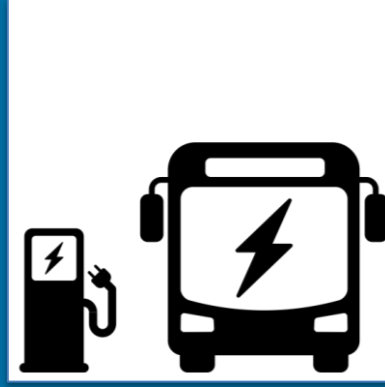
CONCEPTUAL BUDGET

Program	Assumed Cost	BEB Storage and Maintenance Facility	BEB Facility and TOD Mixed-Use Development
Bus Storage	\$42,000,000	\$42,000,000	\$42,000,000
Bus Maintenance	\$20,000,000	\$20,000,000	\$20,000,000
Bus Electrification	\$30,000,000	\$30,000,000	\$30,000,000
Apartment Tower	\$255 / square foot		\$67,000,000
	Total	\$92,000,000	\$159,000,000

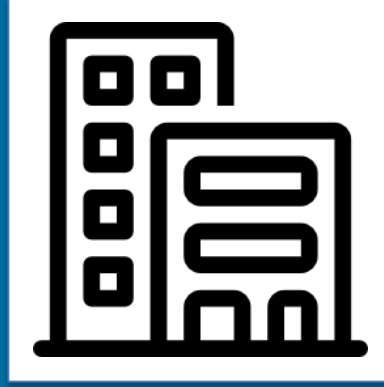
SUMMARY



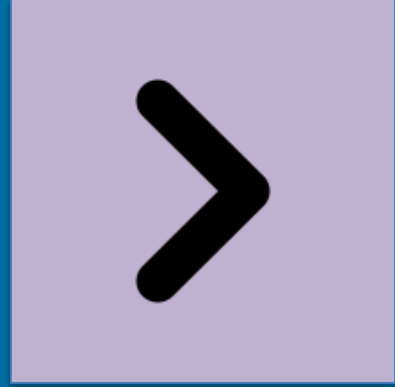
Need



BEB



Multi-use



Next

SUMMARY

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3. Joint-development benefits may help:
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DISCUSSION

