

HDR



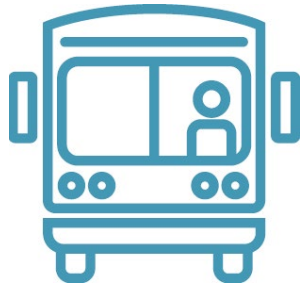
A Roadmap for Transitioning to Electric Waste Collection Fleets

Presented by John Carlton, PE, BCEE

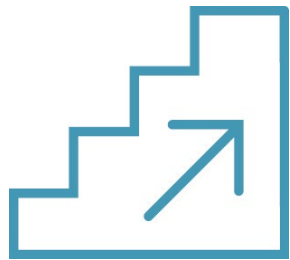


April 6, 2022

The future of waste collection fleets is electric!



Electric collection trucks are where electric buses were 7 years ago



Significant growth is expected



**Have you or are you considering a transition
to electric collection trucks?**



Why Electric Collection Trucks?



Promotes cleaner and healthier air in communities



Supports local climate action goals

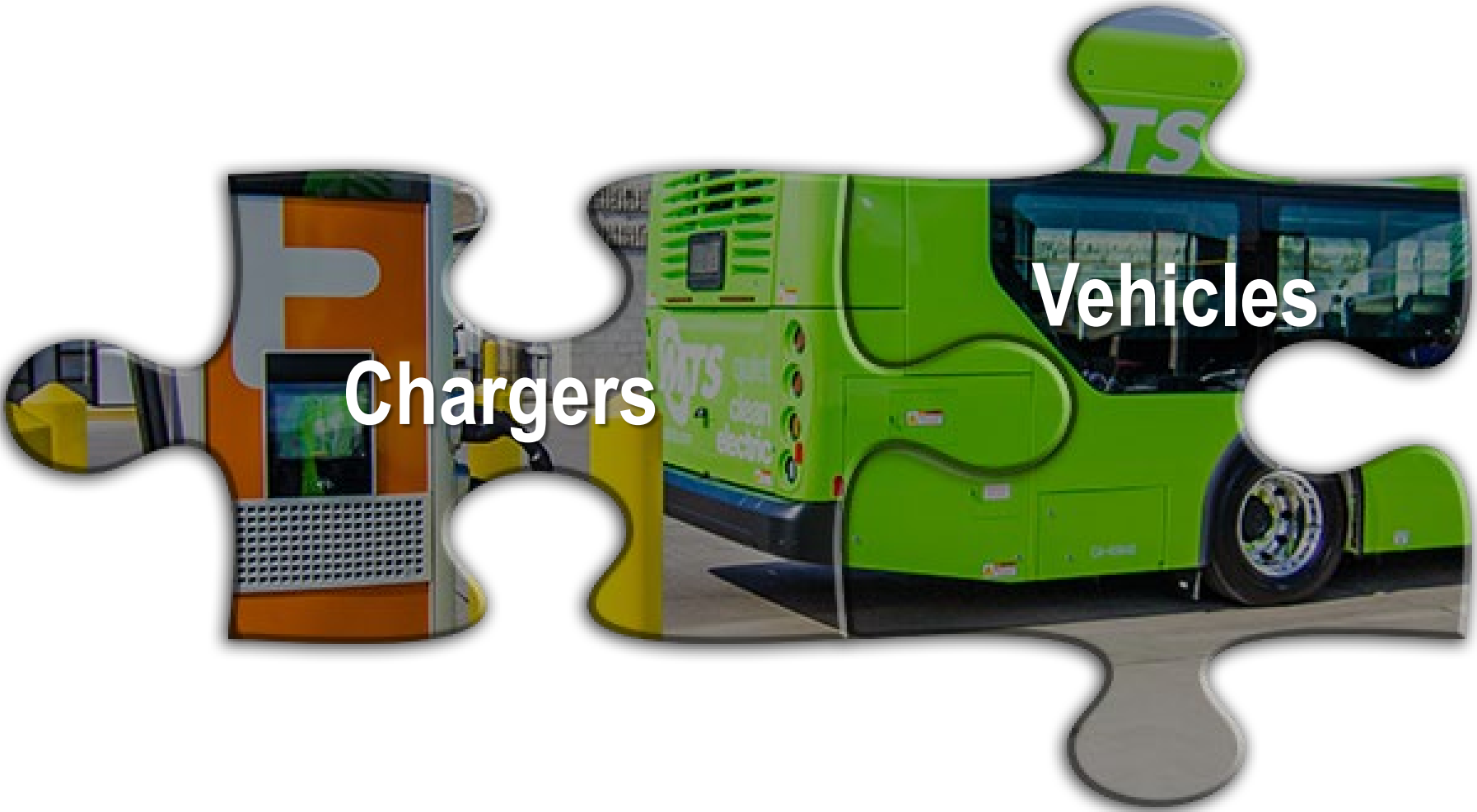


Reduces noise pollution



Requires lower maintenance

Perceived Transitioning to Electric Trucks

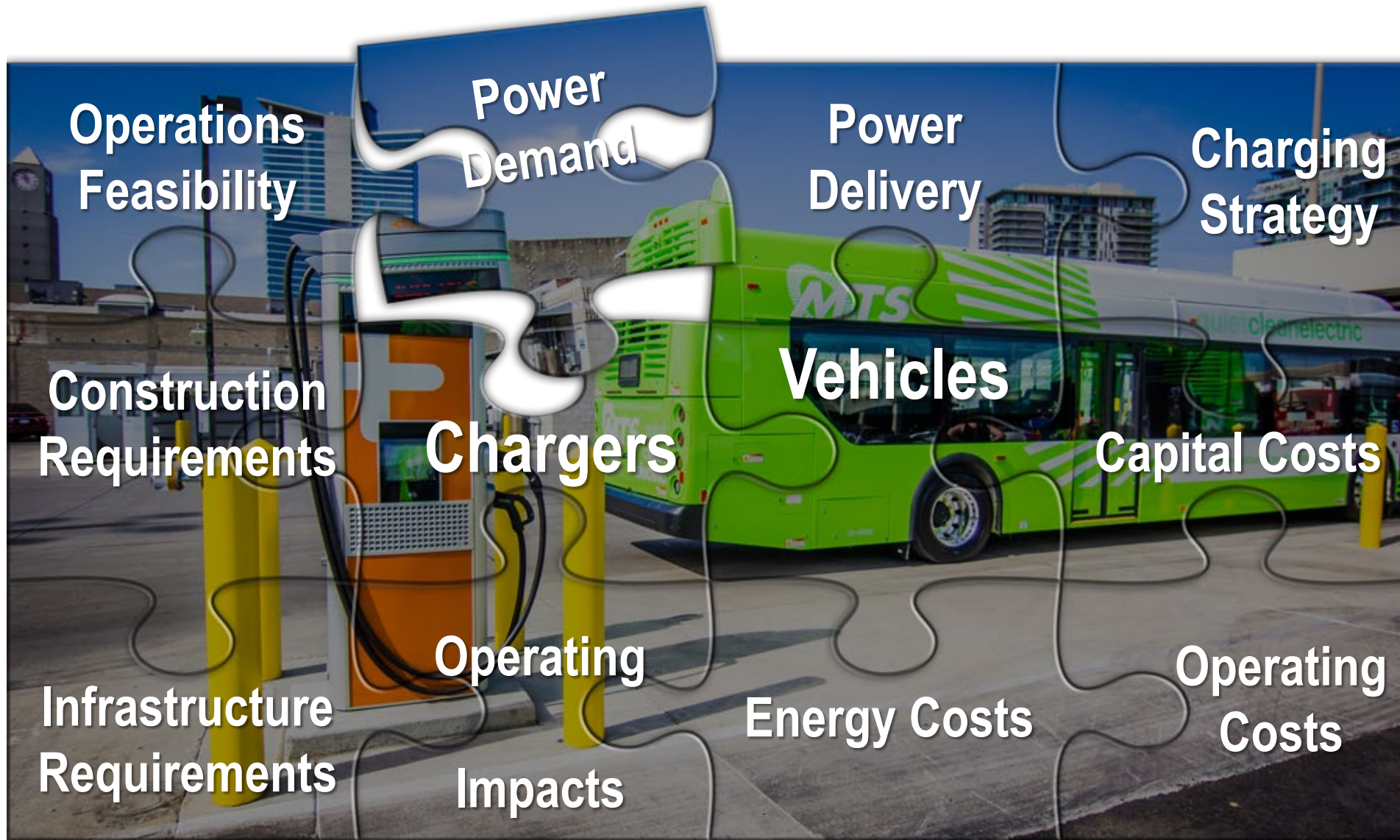




It's a Little More Complicated



Putting the Pieces Together



Things to Consider When Transitioning to ZEVs

3 Guiding Elements/Principals



- **Idea to Implementation**

Look for an industry-recognized expert in transportation, energy and facility design to collaborate on the full scope of your project — from research, planning and design through operations.



- **First Things First**

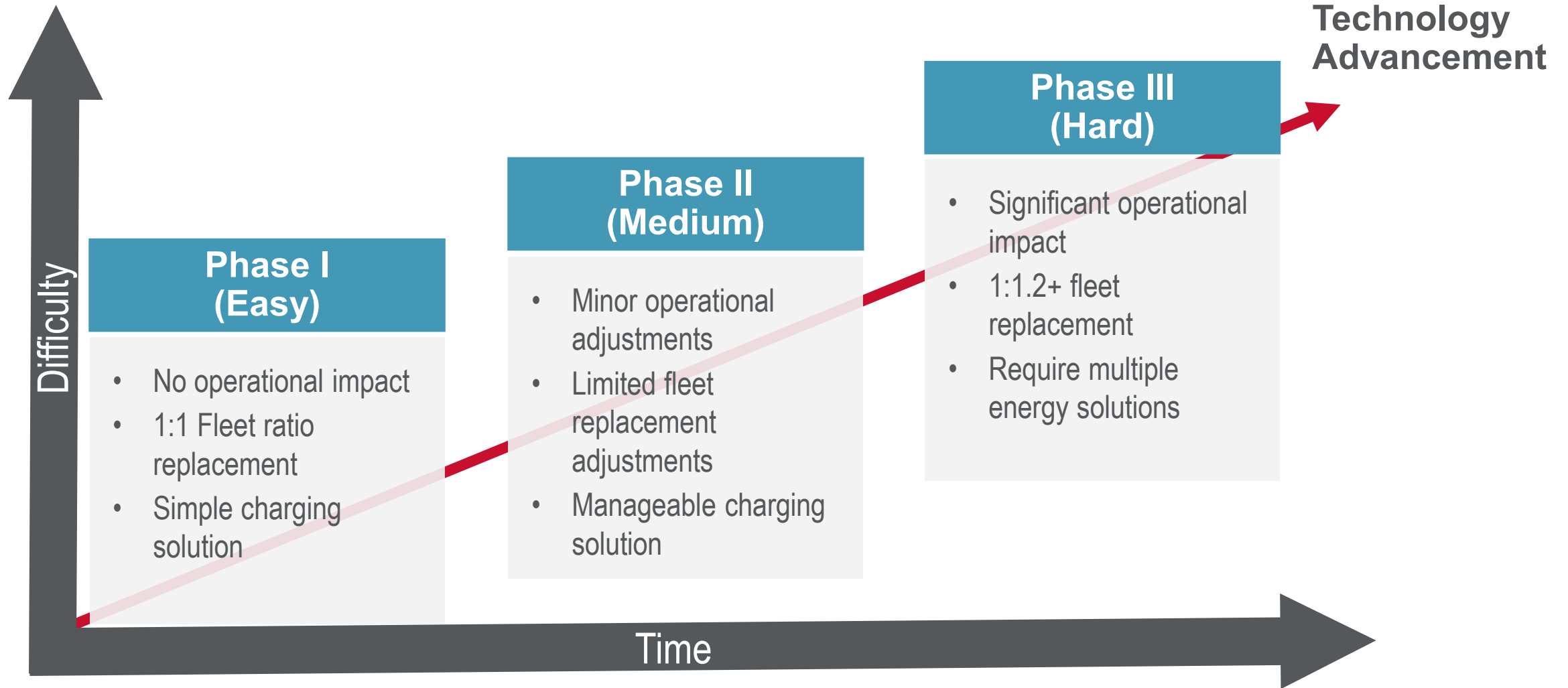
Lay a solid foundation with research, planning and design to create a clear roadmap that helps you avoid pitfalls and streamline scaling and implementation.



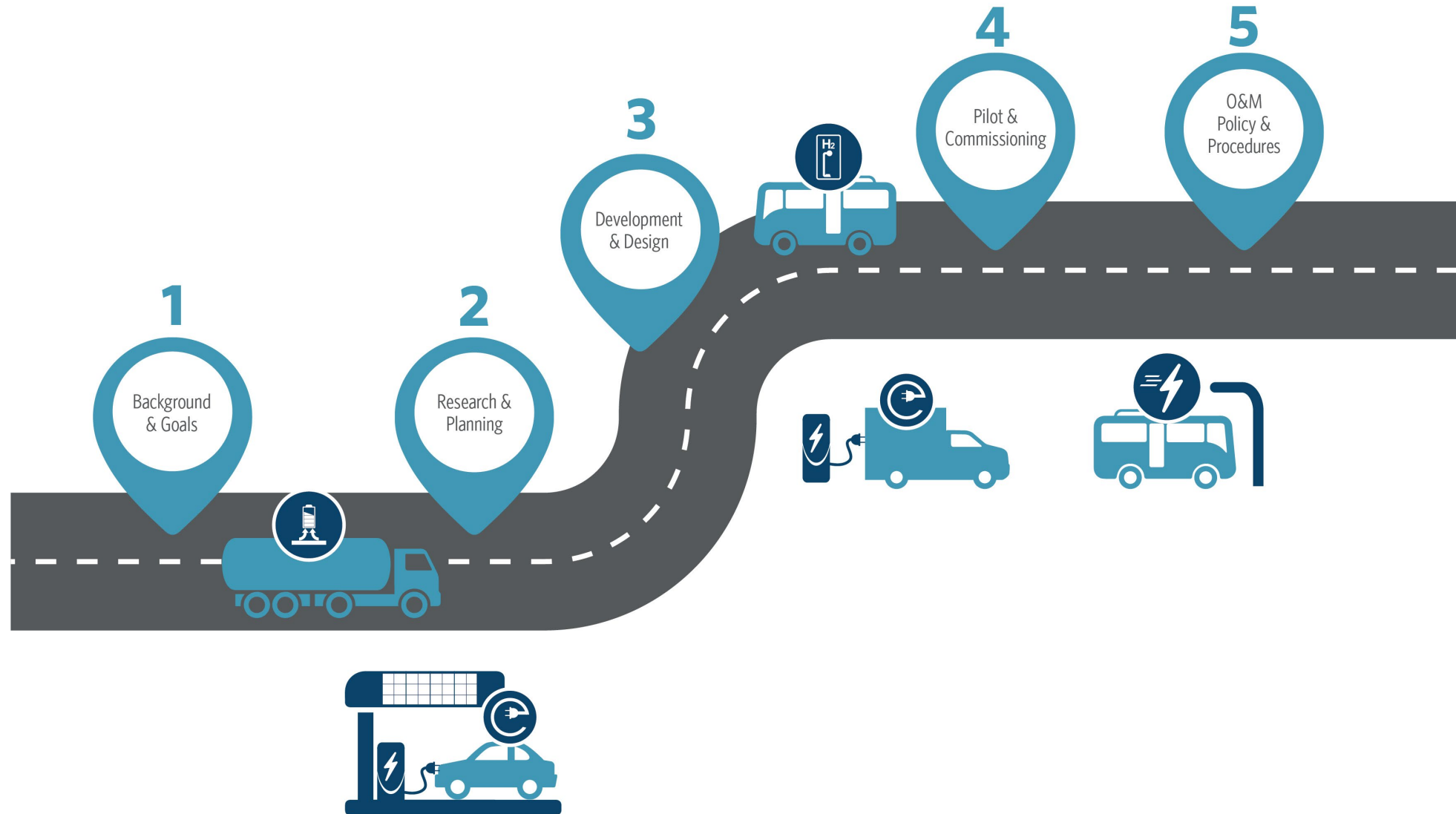
- **Data-driven Decisions**

Cross-layer GIS-based modeling with operational fleet data to understand operating, charging and energy cost scenarios. Integrate that data with suitability models to complete a sustainable value analysis to help you prioritize next steps.

Challenges of Transitioning

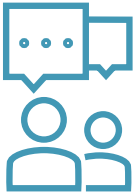


Development: Roadmap to Transition

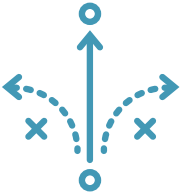




Factors for a Clear Roadmap



Utility Collaboration



Route Feasibility



Total Cost of Ownership



Sustainability



Grant Opportunities



The Right Tools Make a Difference

Zero+

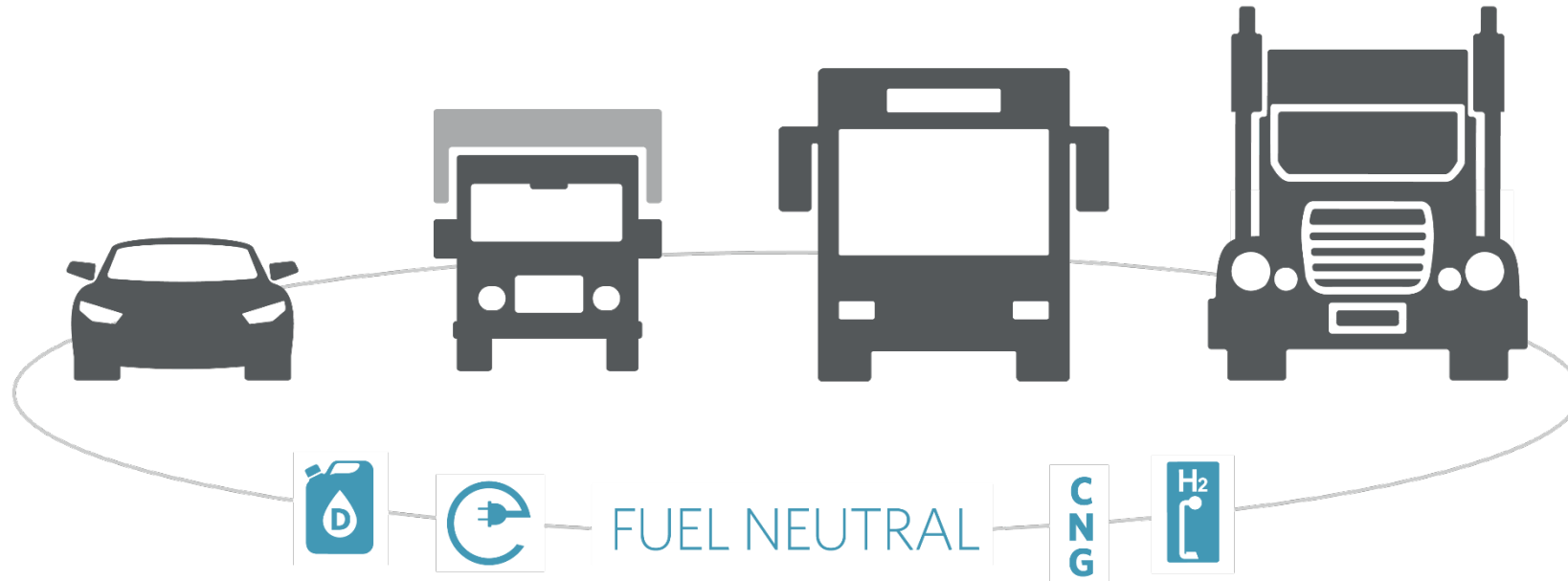
Fleet Optimization Tool

EconMOVES



HDR's ZERO+ Model Design

- Model is network based, implemented in a GIS environment utilizing GTFS or GPS data
- Energy estimation is performed using a simulation model called FASTSIM
- Fleet operation on each vehicle is simulated at a micro level
- Model can be easily customized to fit specific needs of a fleet operator
- Fuel-neutral (diesel, electric, hydrogen fuel cell and CNG can be modeled)





VEHICLE DETAILS

- Dimensions
- Weight
- Power Train
- Fuel Supply
- Etc.



ROUTE DETAILS (GTFS or GPS)

- Path
- Stops
- Etc.



ZERO+ INPUT MODULE

- USGS Elevation
- Acceleration
- Speed Limits
- Etc.



ZERO+ SIMULATOR (Customized FASTSim)

- Energy Consumption
- Fuel Consumption
- Energy Efficiency



ZERO+ SCHEDULER

- Vehicle Assignments
- Managed Charging
- Multiple Scenarios



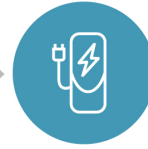
ENERGY CONSUMPTION

- Electric or Hydrogen
- By Trip/Block/Vehicle
- By Fueling Location



EN-ROUTE CHARGING INFRASTRUCTURE

- Power Level
- Location(s)



FACILITY CHARGING INFRASTRUCTURE

- Power Level
- Location
- Number



OPERATIONAL IMPACTS

- Hours and Miles
- Number of Vehicles
- Vehicle Swaps



EconMOVES DECISION SUPPORT TOOL

- Implementation Scenarios
- ROI and Break-Even Analysis
- Financial Planning

● Inputs

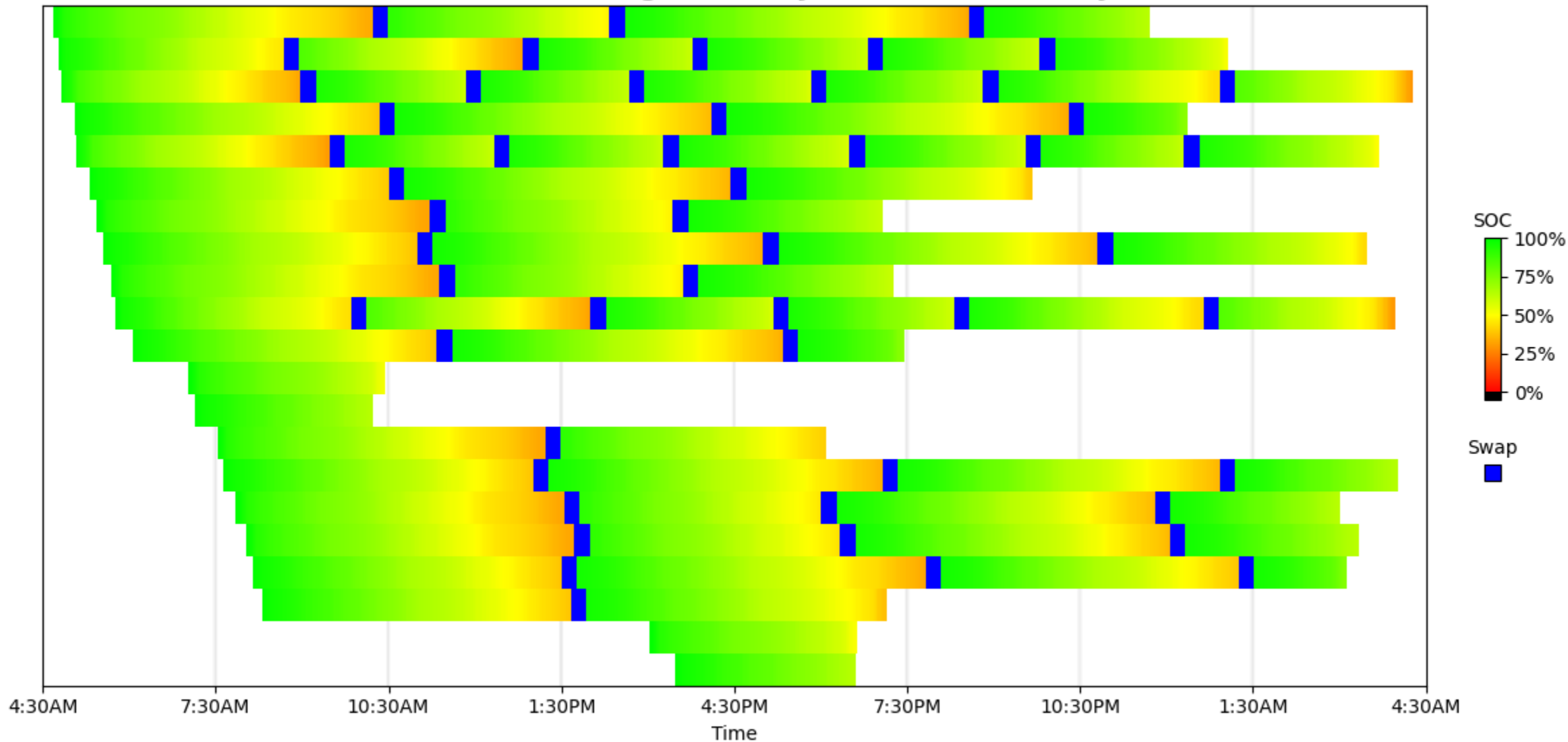
● Zero+ Energy Analysis

● Outputs

● EconMOVES

HDR Zero+ Fleet Optimization

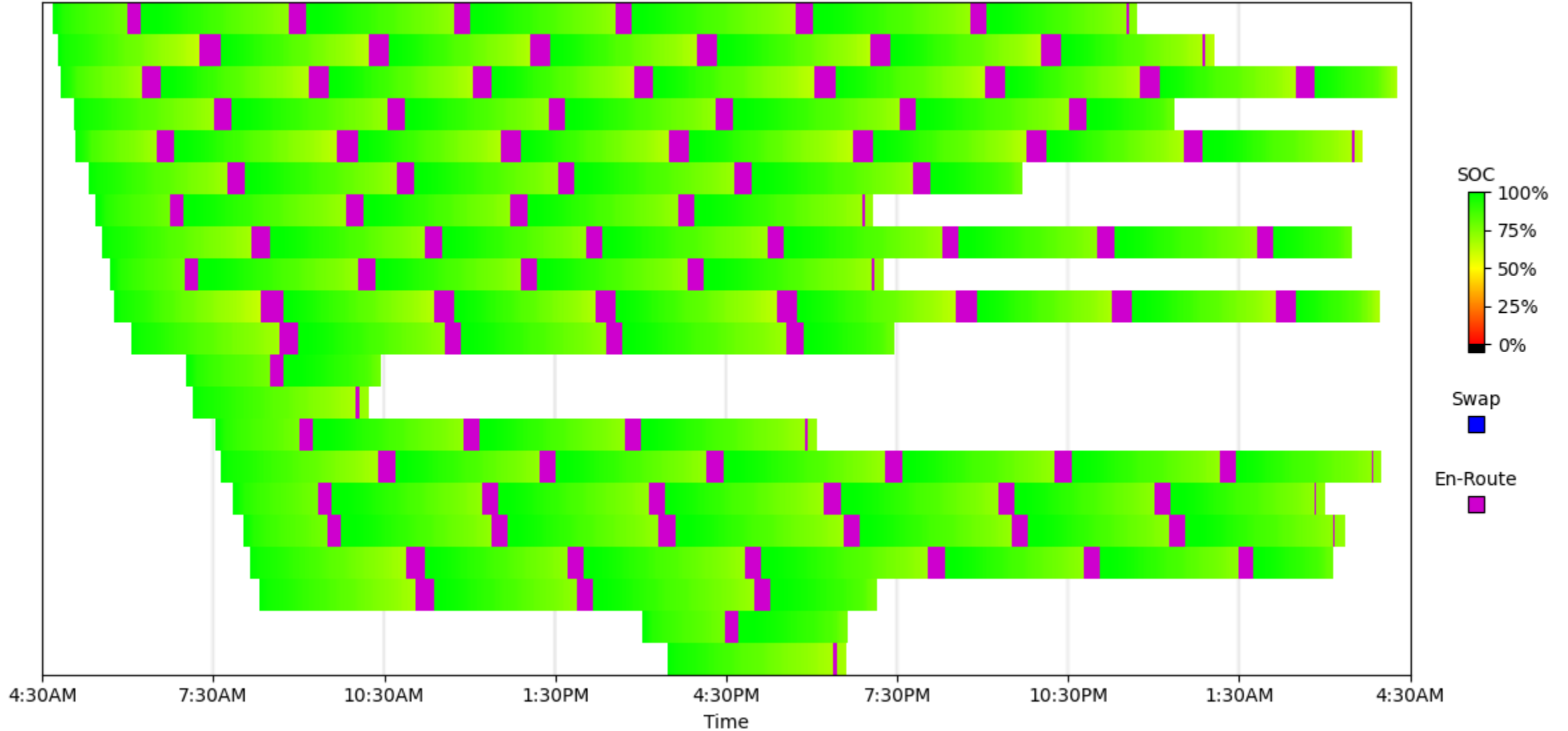
Block State of Charge (Monday) for Pleasant Valley





HDR Zero+ Fleet Optimization

Block State of Charge (Monday) for Pleasant Valley



HDR EconMOVES



Scenario Definition & Prioritization

INPUT PROJECTS

Go to Projects

INPUT EXISTING FLEET STATS

Enter Fleet Schedule

INPUT NEW SERVICE STATS

Go to New Service Stats

Use Manual Start Dates

ANALYSIS BASE YEAR: 2020

HORIZON YEAR: 2040

PRIORITIZATION

1

Input and View Criteria

2

Input Weights

3

Score Projects

Funding Strategy

BASE REVENUES AND EXPENSES

Input Baseline

INCREMENTAL FUNDING SCENARIOS

Year	New Revenue	Percent to O&M	Remainder to Capital
Round 1	2022 \$20M	10%	90%
Round 2	2026 \$20M	20%	80%
Round 3			

ESCALATION RATES

Input

FINANCING SOURCES

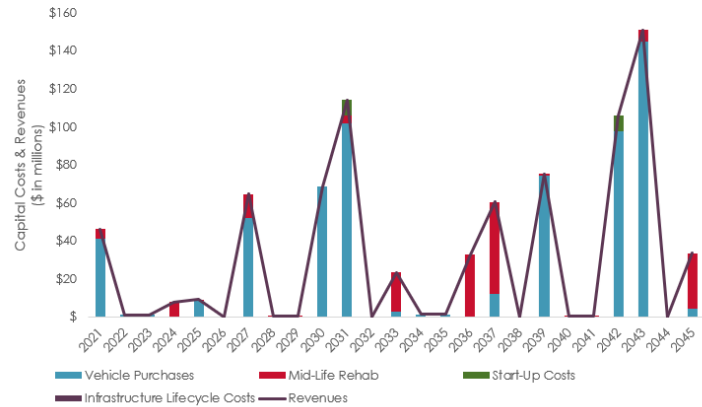
BONDS NO Funding: 3.0% Interest Rate: Coverage: 1 Repayment Deferral: 0 years Term: 30

Optimization

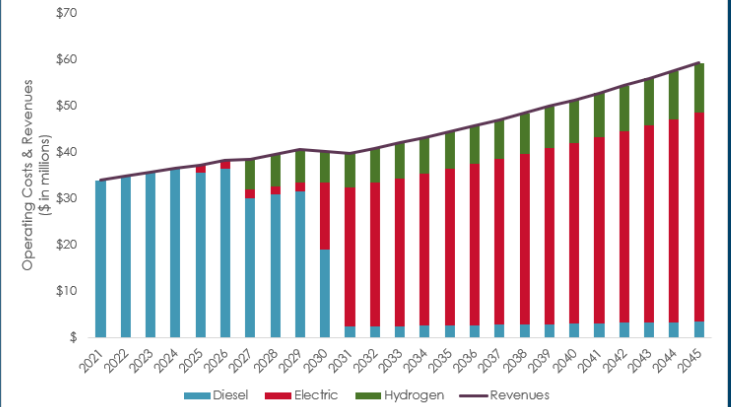
Optimize Use Staff Resources in Prioritization/Optimization

RUN MODEL

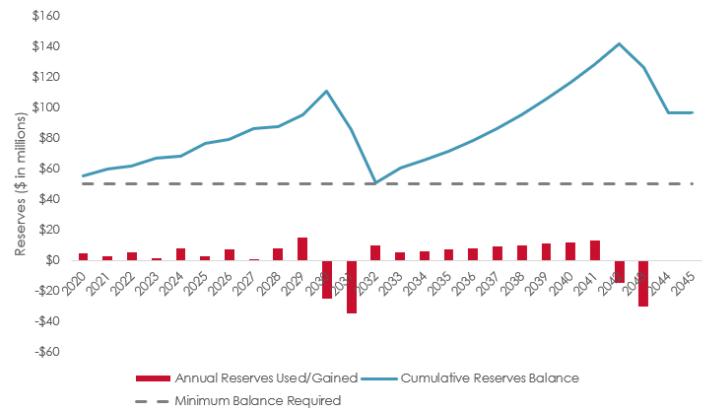
Capital Investment



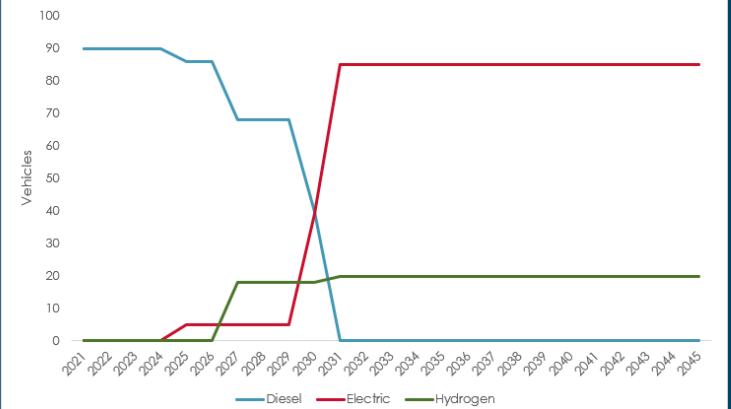
Operating Investment



Reserves Balance



Fleet Composition



DRAFT



HDR is Supporting EV Waste Collection



In Conclusion...



Plan from the very start to avoid pitfalls of the scaling trap



Functional analysis and incremental decision-making will lead to success



Well-thought-out roadmap leads to the best technical and financial outcomes

Questions?



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