E-Mobility Design

Tool Suite & Expertise

November 2024

ELECTROMOBILITY CHALLENGES

RANGE & TRANSPORT PLANNING

The range and technology of electric vehicles is evolving rapidly but is still limited compared to diesel vehicles. Vehicles' autonomy **must be carefully assessed** to ensure it **meets a route's energy demands:** factors such as **weather conditions**, **terrain**, and **traffic congestion** must also be considered.

INFRASTRUCTURE & SMART DEPOT

Electric vehicles require **charging infrastructure**, which must be **planned** and **built**. This can include **charging stations** at depots or along roads, as well as electrical upgrades to accommodate **higher power** requirements of certain electric vehicles.

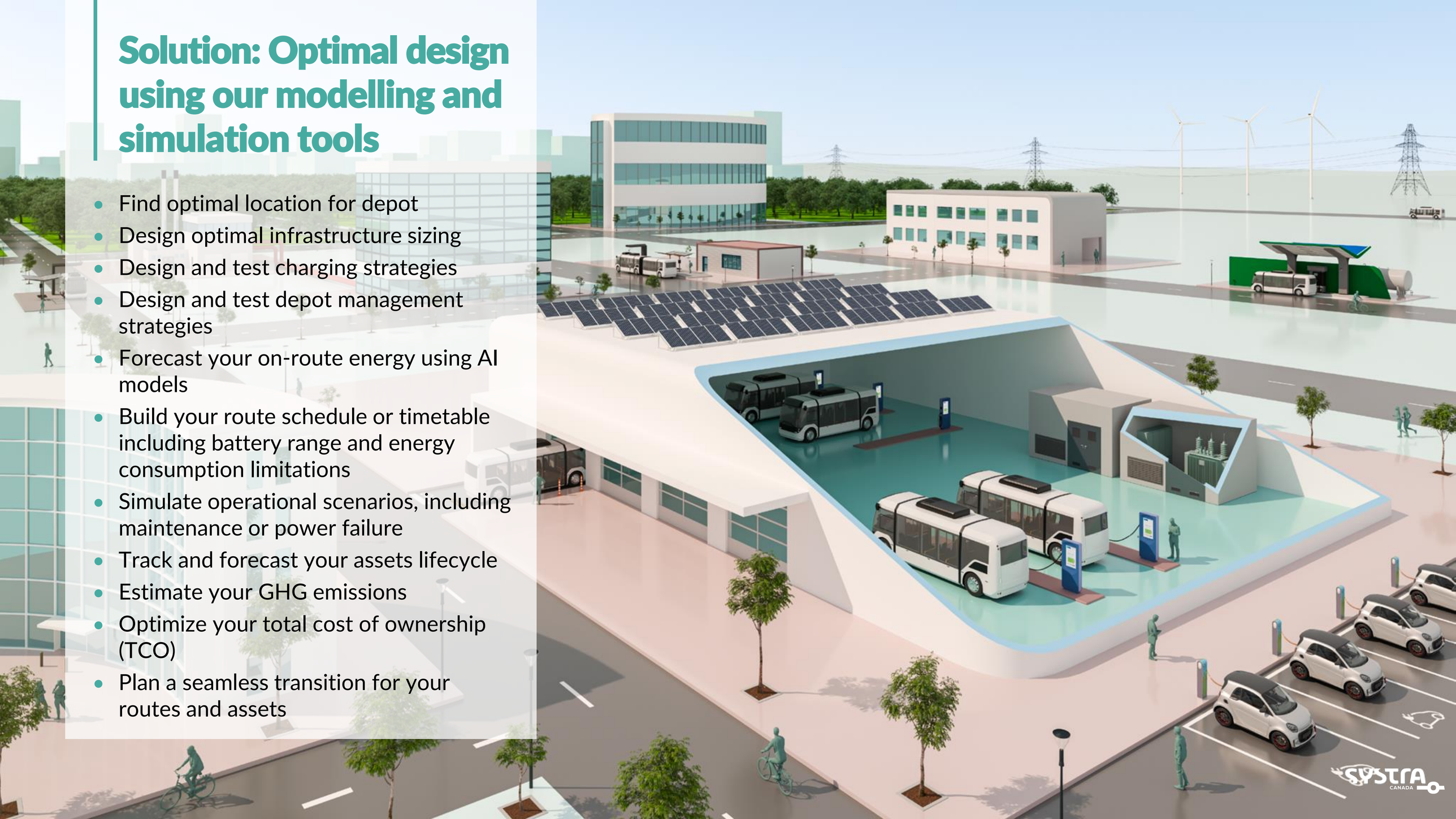
COSTS & INVESTMENT

Electric vehicles are generally **more expensive** than diesel vehicles at purchase. This means that the **upfront cost** of transitioning to an electric fleet can be **significant**. However, the **lower operating costs** of electric fleet (e.g., lower fuel and maintenance costs) can offset the upfront costs over time.

SYSTRA CANADA

Solution: Optimal design using our modelling and simulation tools

- Find optimal location for depot
- Design optimal infrastructure sizing
- Design and test charging strategies
- Design and test depot management strategies
- Forecast your on-route energy using AI models
- Build your route schedule or timetable including battery range and energy consumption limitations
- Simulate operational scenarios, including maintenance or power failure
- Track and forecast your assets lifecycle
- Estimate your GHG emissions
- Optimize your total cost of ownership (TCO)
- Plan a seamless transition for your routes and assets



An expertise that goes far beyond design tools

Preparatory studies
Norms & standards
Equipment benchmark

Simulations
Charger to bus ratio
Installed power
Normal operation
Power failure
Peak shaving

Design
Electrical room layout
Charging interfaces layout
CAPEX - OPEX

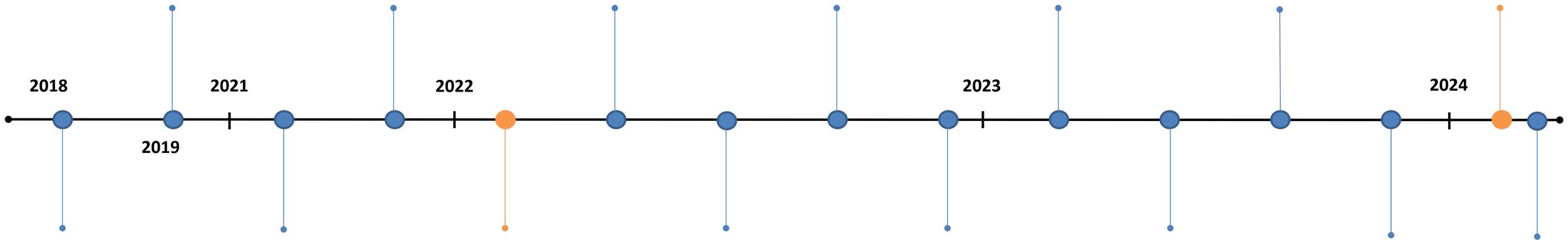
Call for tenders
Technical specification
Preliminary drawings
Support during tender process

Construction phase
Procurement support
Detailed drawings
Construction supervision

Testing & Commissioning
Testing procedures
Integration & functional testing
Smart charging integration

Operation
Lock-out rag out procedure
Maintenance procedures

E-Mobility projects



2018

94 x
102 x

RATP

Asnières & Lebrun Electrification Study (Asnières & Paris, France)

Bellechasse Feasibility Study (Montréal, Canada)

220 x

2019

172 x

RTC

Metrobus Electrification Study (Québec, Canada)

Electrification of the STL Garage Expansion - Phase IV (Laval, Canada)

266 x

2021

172 x
168 x

RTC

Newton & Metrobus Functional & technical program (Québec, Canada)

Predictive Energy Model (Laval, Canada)

9 x

2022

105 x

STTR Société de Transport de Trois-Rivières

STTR Functional & technical program (Trois-Rivière, Canada)

Electrification of the Vieux-Longueuil Transportation Center (Longueuil, Canada)

280 x

RTL Agglomération de Longueuil

2023

63 x

RATP DEV

Durham Electrification Study (Durham, USA)

Nupte Electrification Study (Lyon, France)

154 x

SYTRAL MOBILITÉS

105 x

STTR Société de Transport de Trois-Rivières

Electrification of the STTR Depot (Trois-Rivière, Canada)

Electrification Study (Singapore)

300 x

Land Transport Authority We Keep Your World Moving

2024

25 x

100% électrique Corridor décarboné Québec — Montréal

Data acquisition program and route scheduling (Montreal & Quebec, Canada)

Electrification of the Saint-Hubert Transportation Center (Longueuil, Canada)

216 x

RTL Agglomération de Longueuil

Electrification of:
- BRT (Bari, Italia)
- Transportation Center in Mississauga (Ontario, Canada)

MiWAY

SYSTRA CANADA

A suite of **design tools** to help our partners navigate through **e-mobility challenges** and **maximize benefits**

Transport Plan

Energy consumption

Electrified vehicle schedule

Electrified transport plan

HERON

Assess
Energy consumption

WILD TURKEY

Define
Electrified route schedule

Tess

TESS

Reduce
Fleet, infrastructure & power demand

SYSTRA CANADA

Our proven E-Mobility Design Suite ensures that your transition plan is…

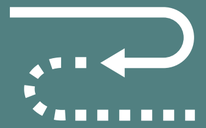
COST EFFECTIVE

UP TO

-60%

of initial CAPEX investment

MINIMIZING DISRUPTION



Electrified operation plan & charging strategy fully tested

IMPROVING SUSTAINABILITY

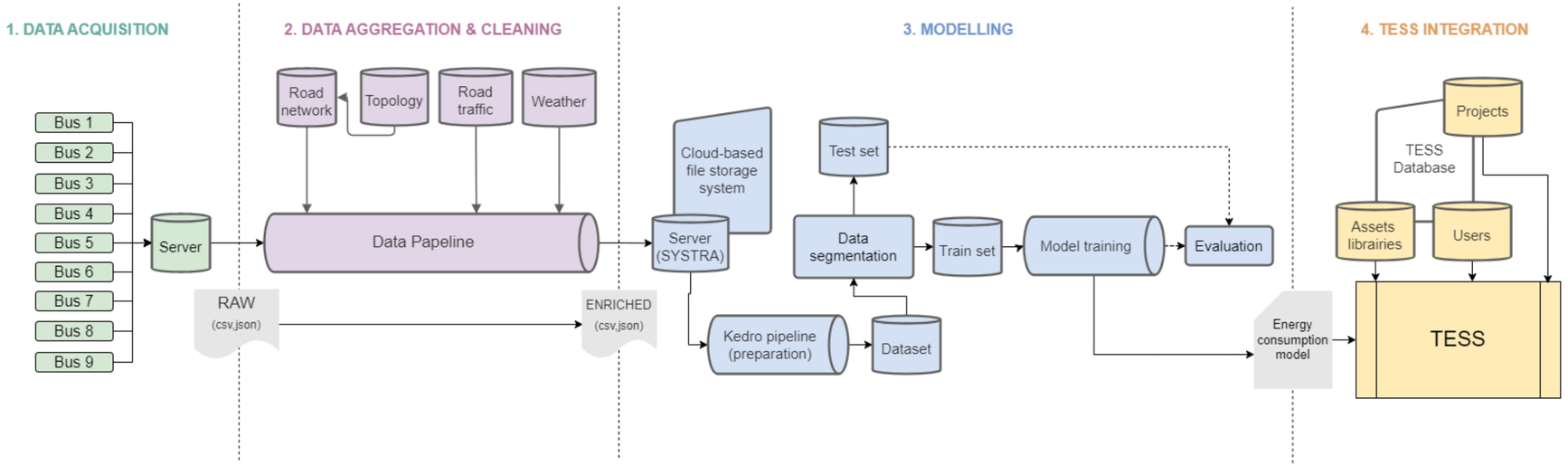
UP TO

-70%

In power demand

SYSTRA CANADA

Define on-route energy consumption according to exogenous variables



HERON

Python scripts
Automated scripts on AWS cloud infrastructure

Data acquisition from multiple sources
Access to live and historical data including traffic, climate conditions, vehicles, road network

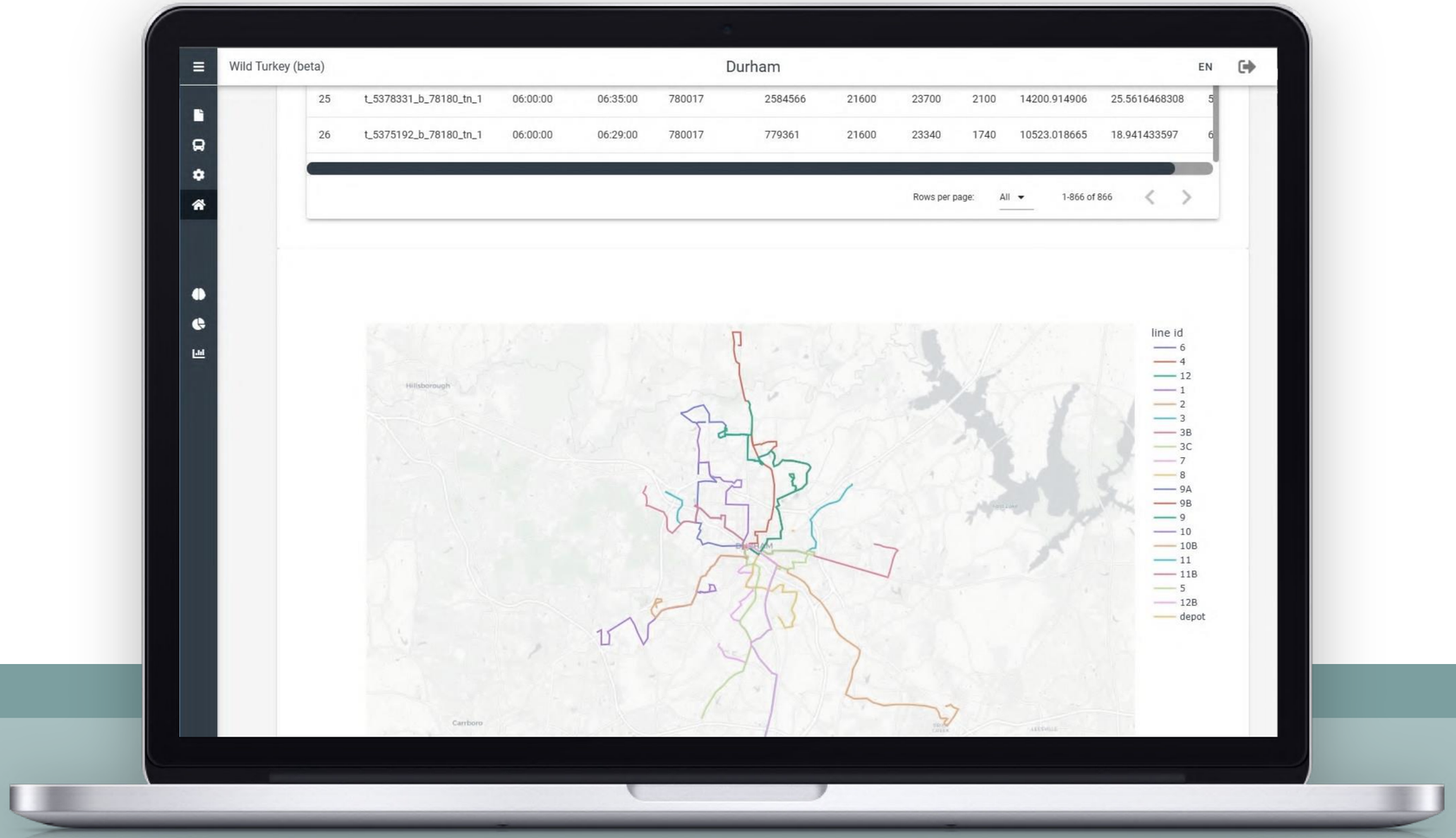
Data cleaning and processing
Data pipelines, aggregators, and databases

Predictive energy model
High accuracy for known networks and vehicles
Medium accuracy for unknown networks and vehicles

Custom AI model development and training
Using additional client data such as ridership, GTFS, or drivers

Other operational benefits
Eco-driving analysis
On-route consumption analysis

Build your block schedule integrating vehicle energy consumption & autonomy



WILD TURKEY

Web application
Role-Based Access Control to projects

Simple & fact scheduling
Draft a scenario within 30 minutes to an hour

Electric vehicle considerations
Set energy consumption per trip
Set battery autonomy per vehicle

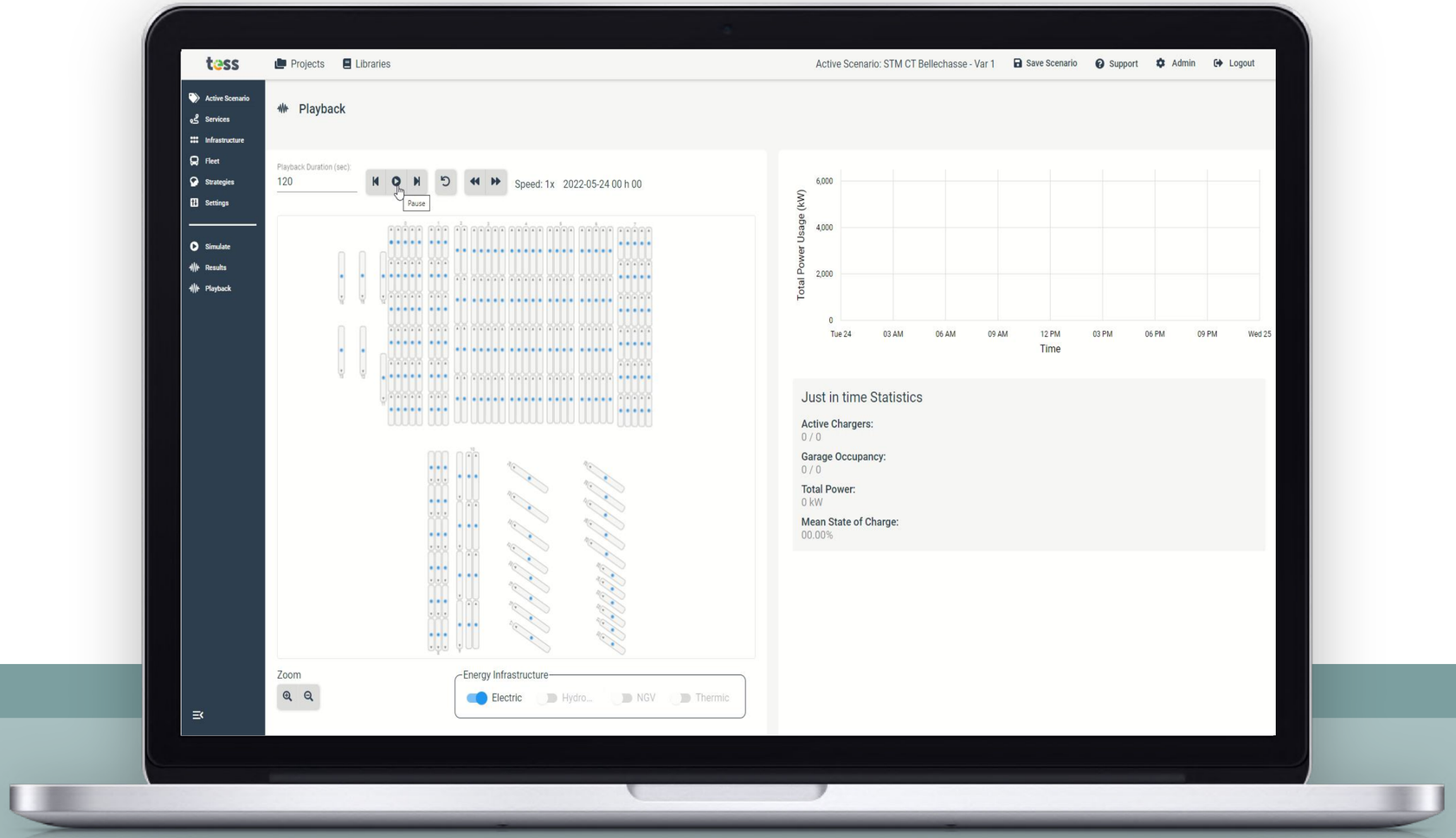
Industry standard inputs
GTFS file
CSV file

Phasing proof
Allow mixed fleet
Allow on-route charging

Convenient exports
Enhanced GTFS CSV export

SYSTRA CANADA

Model your depot and simulate operation & charging strategies



Tess

Web application
Role-Based Access Control to projects.

Integrated physical constraints
Accurately model parking space and depot layout.

Integrated operation constraints
Vehicle parking strategies, Vehicle trip matching strategies, Vehicle charging strategies.

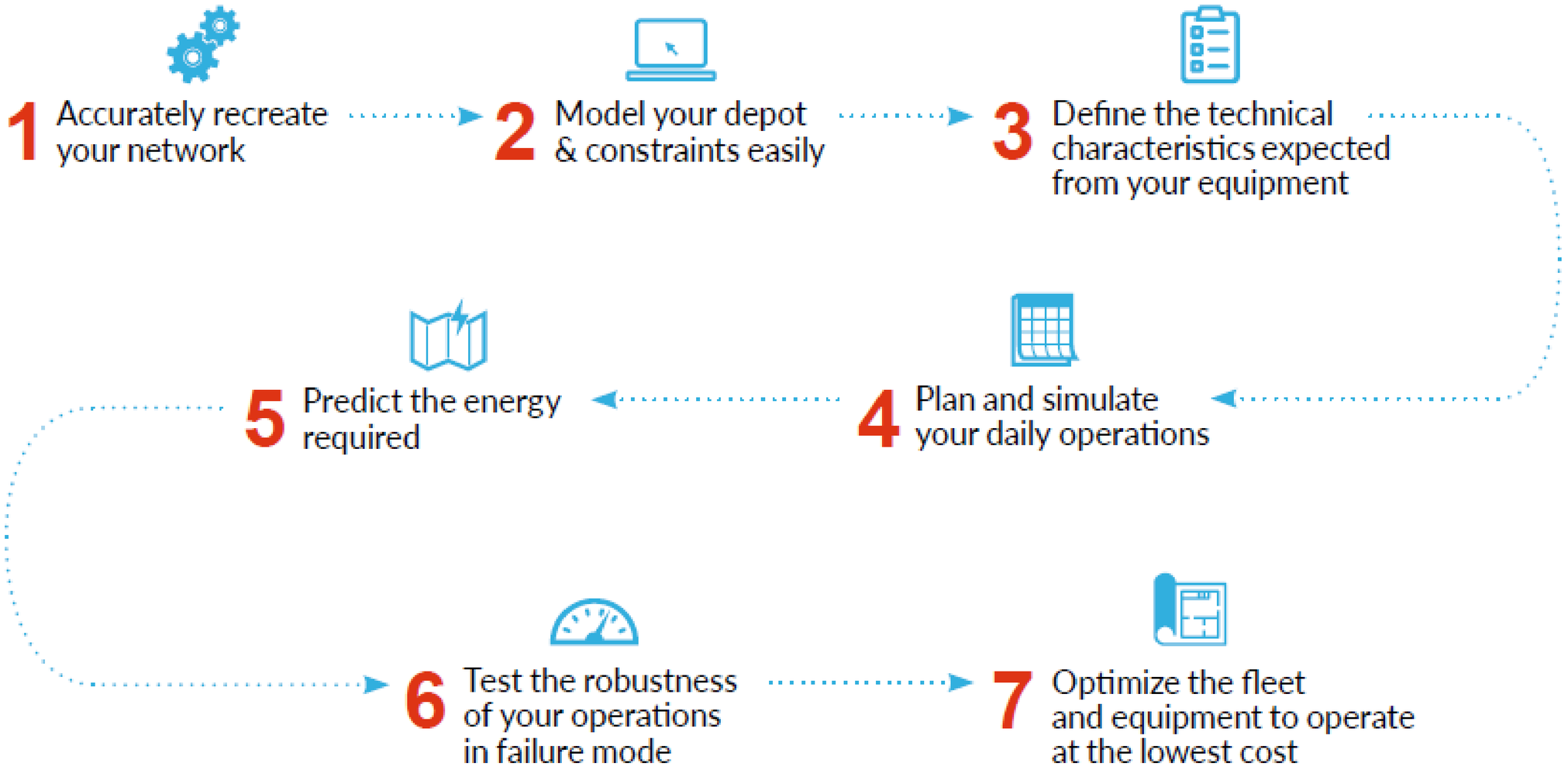
Minimize charging infrastructure
Test ratio: charger scenarios, Try various power capacities, Find the best CAPEX/reliability ratio.

Minimize power demand
Run peak shaving scenario, Integrate energy cost variation.

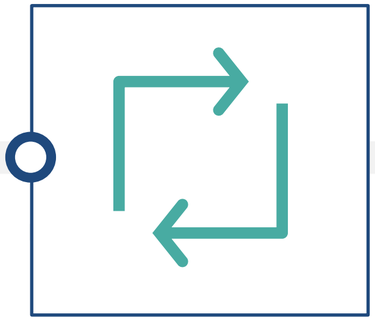
Simulate operation & validate charging strategy
Simulate daily operation, Run disruption scenarios, Export charging strategy pattern.

SYSTRA CANADA

Our approach for E-Mobility studies

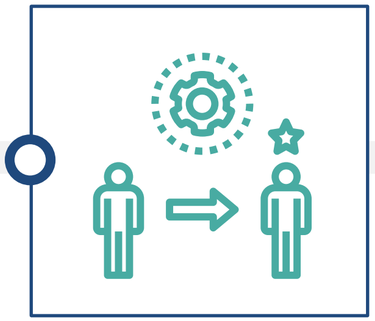


Conclusion
Key to success



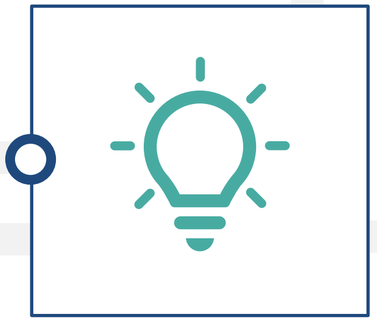
Planning the transition

Operational vision

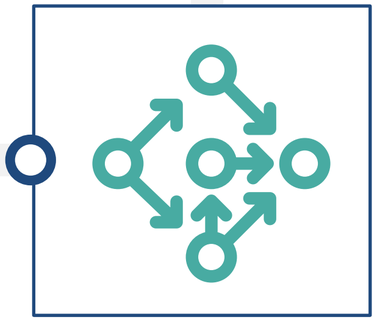


Professional evolution assistance

Proactive technological watch



Good knowledge of clients' needs and working methods



Simulations, critical path

Questions?

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