

Transportation Megatrends and Efficiency Opportunities

International Workshop on Green Freight Initiatives
Sharing, Learning and Co-Creating Toward a Sustainable Ecosystem

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US EPA

November 19, 2019



OVERVIEW



- ❖ **Megatrends & Key Enablers**
- ❖ **Strategies for Efficiency Improvements**
- ❖ **Subsector Opportunities**
- ❖ **Intermodal Concepts**

AUTOMATION & DIGITALIZATION

SENSORS,
IOT, TELEMATICS, 5G

DRONES,
ROBOTICS

3D PRINTING,
DISTRIBUTED MANUFACTURING,
RIGHT-SHORING



eCOMMERCE

MACHINE LEARNING,
ARTIFICIAL INTELLIGENCE



SUPERGRID LOGISTICS,
BIG DATA, BLOCKCHAINS

PREDICTIVE ANALYTICS,
AUGMENTED REALITY



STRATEGIES

 Biofuels

 Hydrogen Fuel Cell

 Battery Electric

 Natural Gas

 Petroleum



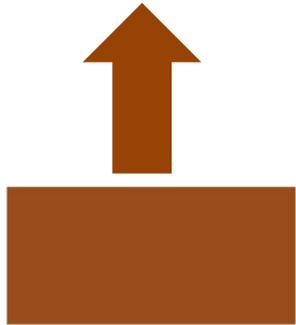
Equipment

AERODYNAMICS
LIGHTWEIGHTING
ENGINE EFFICIENCY
LRR TIRES (NOTE: STANDS FOR "LOW ROLLING RESISTANCE")



Operations

AUTOMATION
V2X COMMUNICATION
BIG DATA & LOGISTICS
MODE-SWITCHING



Fuels

ELECTRICITY
HYDROGEN
HYBRIDS & RANGE EXTENDERS
BIOFUELS

Idling Reduction Technology
(for trucks and school buses)

Aerodynamic Devices
(for trucks)



Low Rolling Resistance Tires
(for trucks)



Light Duty Vehicle



Refuse Truck



School Bus



Dump Truck



Cement Truck



Box Truck



Fire Truck



Delivery Van



Transit Bus



Heavy-duty Pick-up



Truck Tractor



Walk-in Van



Light Duty Vehicle



Refuse Truck



School Bus



Scraper



Dump Truck



Cement Truck



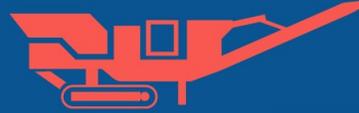
Rubber Tire Loader



Box Truck



Fire Truck



Mining Crusher



Delivery Van



Transit Bus



Excavator



Air Compressor



Heavy-duty Pick-up



Truck Tractor



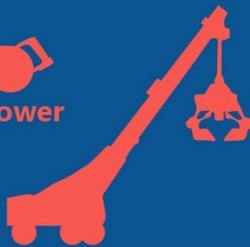
Lawn Tractor



Walk-in Van



Leaf Blower



Crane



Crawler Tractor



Snowmobile



Light Duty Vehicle



Agricultural Tractor



Wood Chipper



Forklift



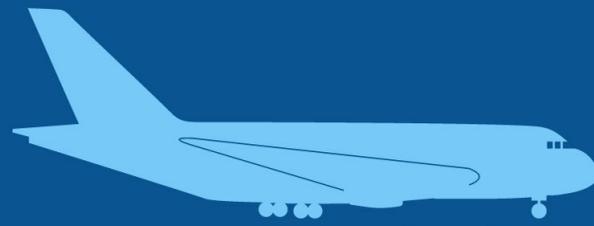
Refuse Truck



School Bus



Scraper



Cargo Plane



Dump Truck



Cement Truck



Rubber Tire Loader



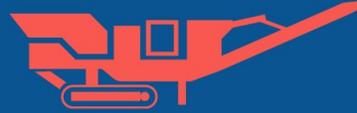
Drone



Box Truck



Fire Truck



Mining Crusher



Helicopter



Delivery Van



Transit Bus



Excavator



Business Jet



Regional Jet



Heavy-duty Pick-up



Truck Tractor



Air Compressor



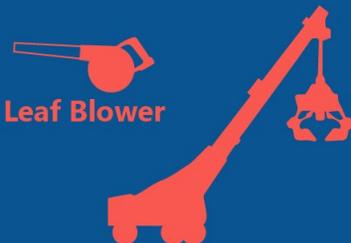
Turboprop



Wide Body Airliner



Walk-in Van



Crane



Lawn Tractor



Crawler Tractor



Snowmobile



Freight Locomotive



Transit Locomotive



Light Duty Vehicle



Agricultural Tractor



Wood Chipper



Forklift



Switcher



Passenger Locomotive



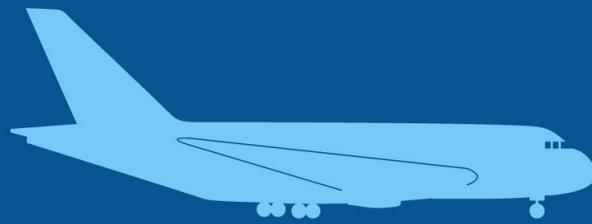
Refuse Truck



School Bus



Scraper



Cargo Plane



Fishing Vessels



Dump Truck



Cement Truck



Rubber Tire Loader



Drone



Outboard Pleasure Craft



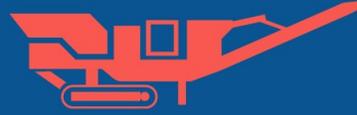
Yacht



Box Truck



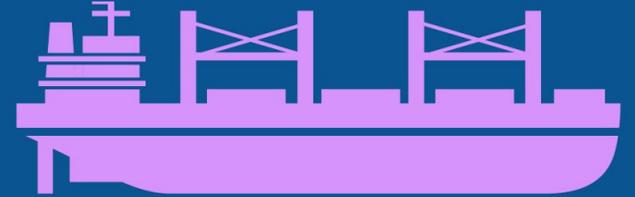
Fire Truck



Mining Crusher



Helicopter



Bulk Carrier



Delivery Van



Transit Bus



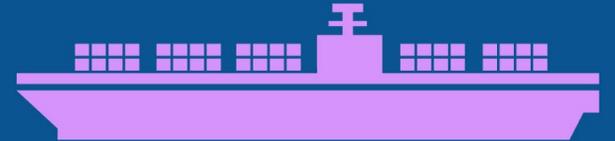
Excavator



Business Jet



Regional Jet



Container Ship



Heavy-duty Pick-up



Truck Tractor



Air Compressor



Turboprop



Cruise Ship



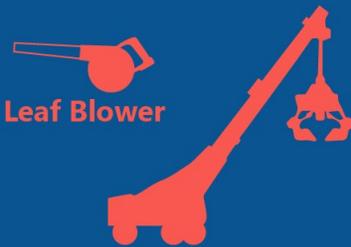
Lawn Tractor



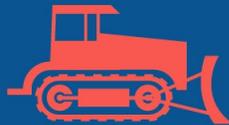
Wide Body Airliner



Walk-in Van



Crane



Crawler Tractor



Snowmobile



Freight Locomotive



Transit Locomotive



Light Duty Vehicle



Agricultural Tractor



Wood Chipper



Forklift



Switcher



Passenger Locomotive

SMALLER

LIGHTER MODES/SHORTER DISTANCE

LARGER

HEAVIER MODES/LONGER DISTANCE



Battery Electric



Hydrogen Fuel Cell Electric



Range Extenders, Hybrids, Diesel Electrics, Shorepower



Low-Carbon Biofuels, Legacy Fuels



Transit Locomotive



Transit Bus



Agricultural Tractor



Wood Chipper



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Outboard Pleasure Craft



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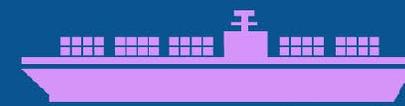
Crawler Tractor



Passenger Locomotive



Box Truck



Container Ship



Bulk Carrier



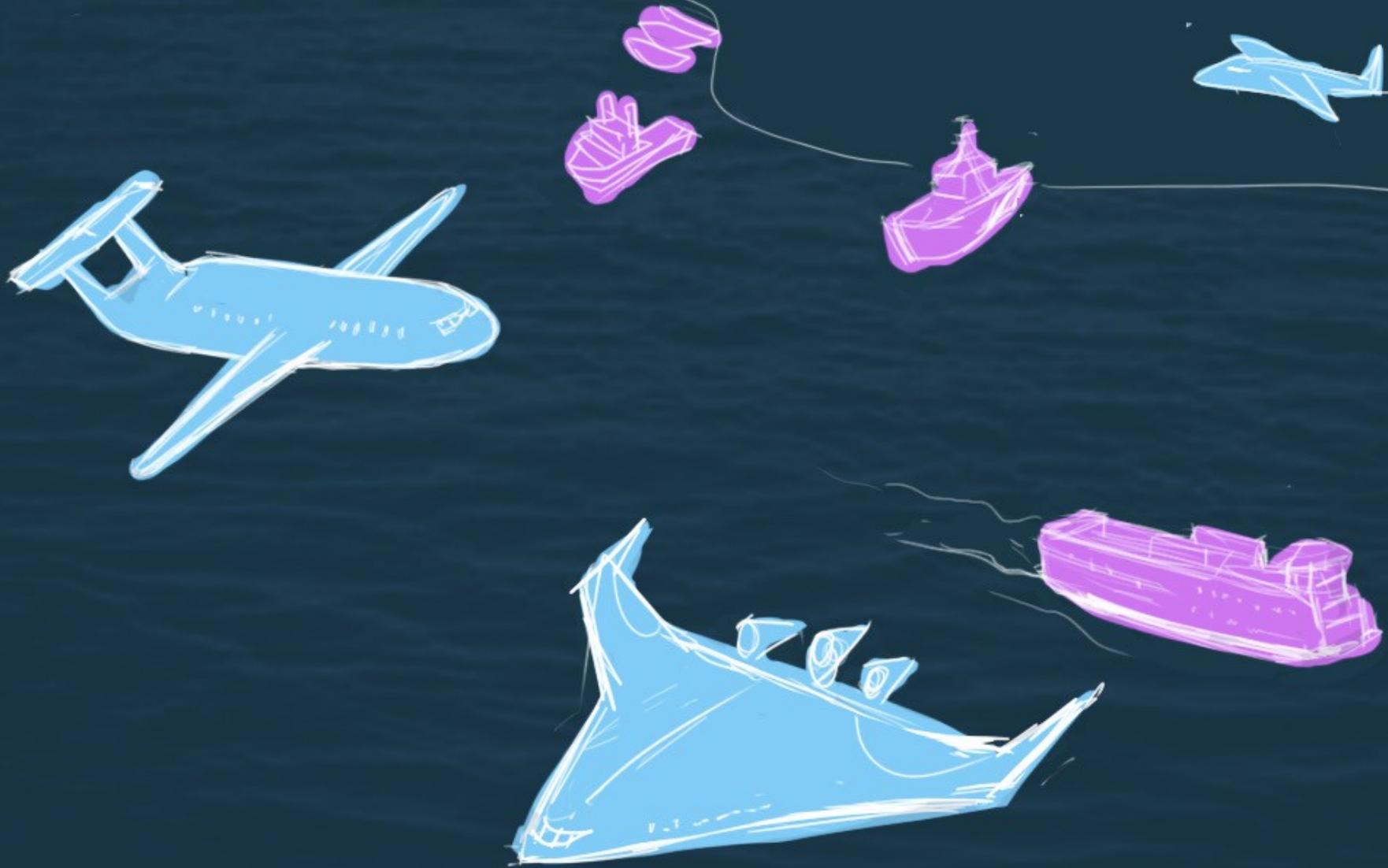
Wide Body Airliner

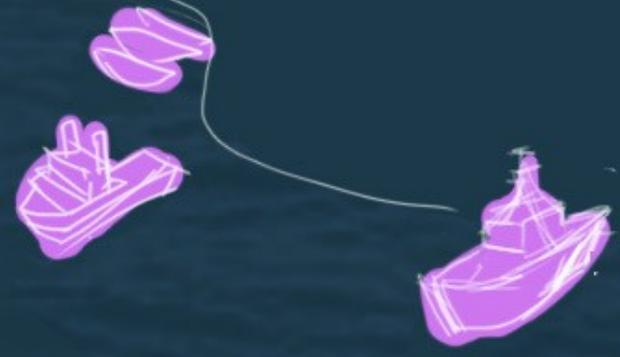


Truck Tractor

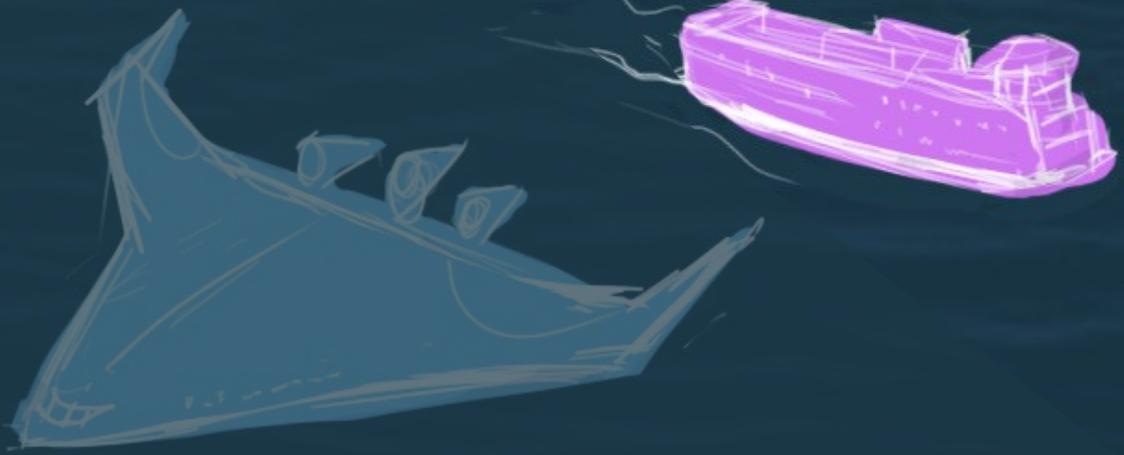


Regional Jet





75% Large scale adoption
of biofuels by OGVs
reductions



BATTERY ELECTRIC

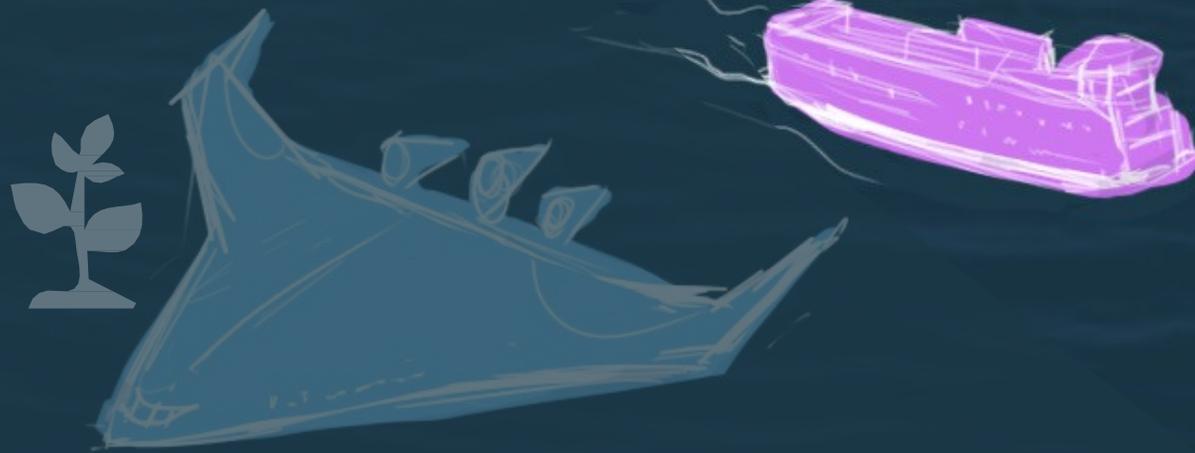


Recreational and smaller vessels switch to battery electric

HYDROGEN FUEL CELLS



Hydrogen Fuel Cells for harbor craft and larger vessels

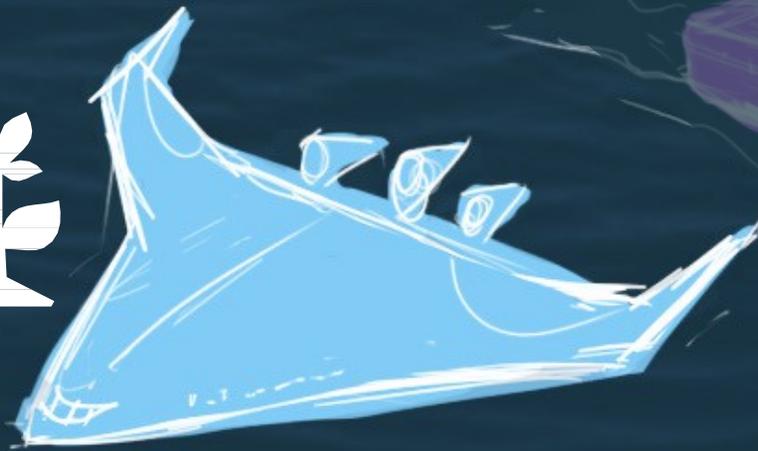




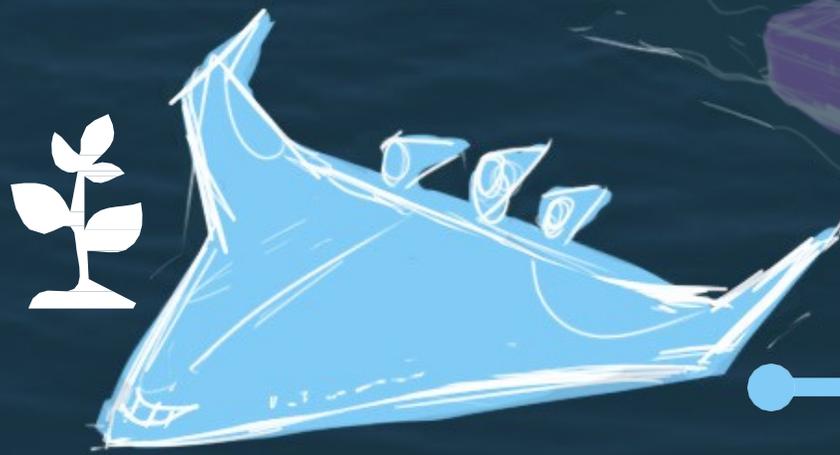
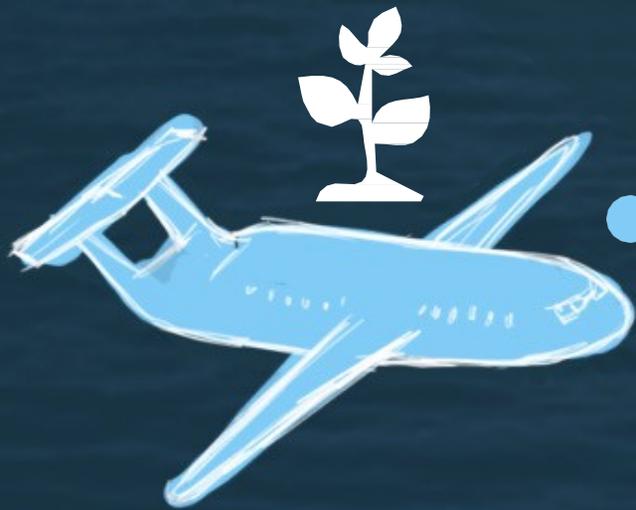
Short Sea Shipping along coast (decrease freight traffic for road and rail)

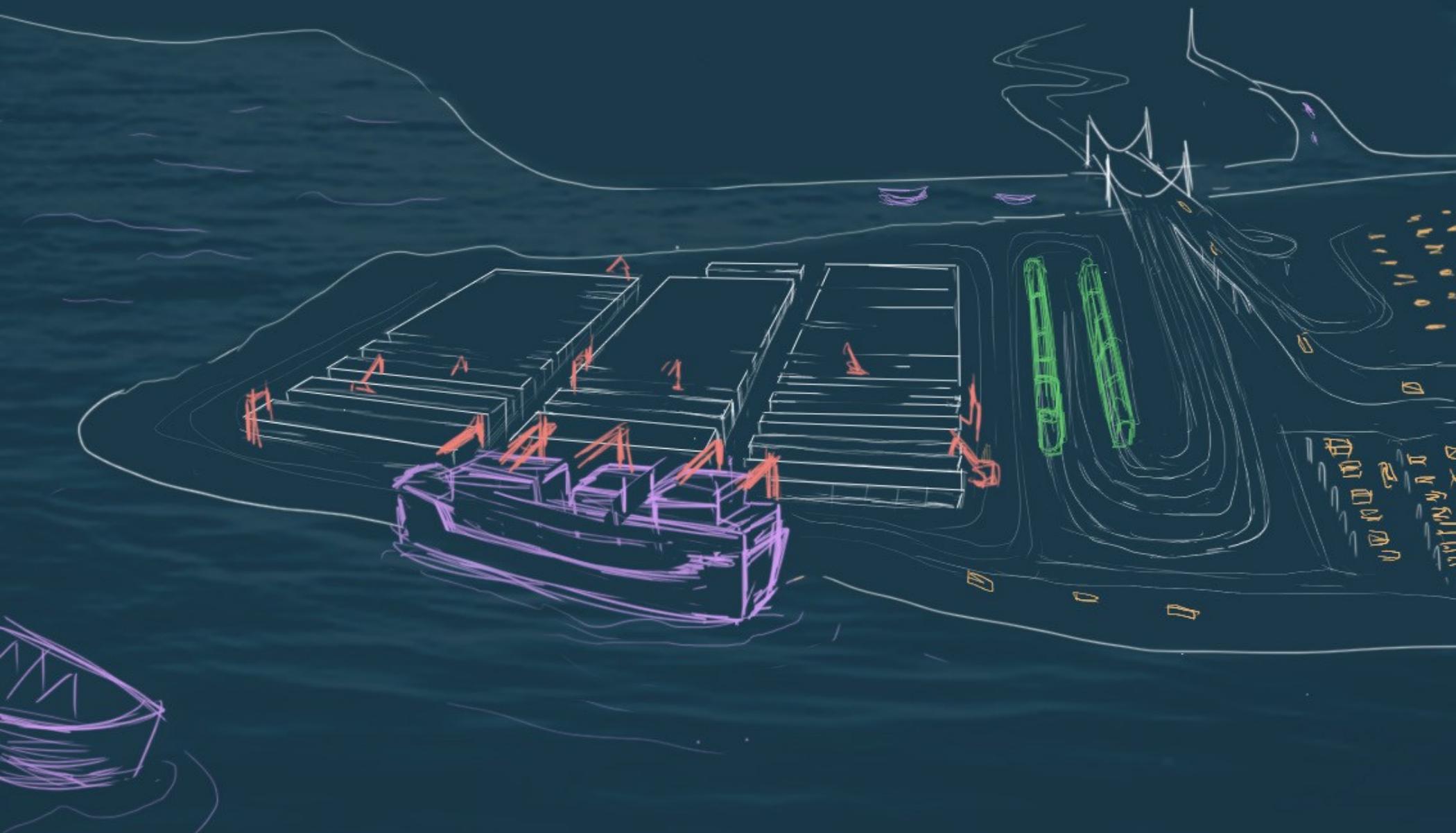


75% Biofuel Blend



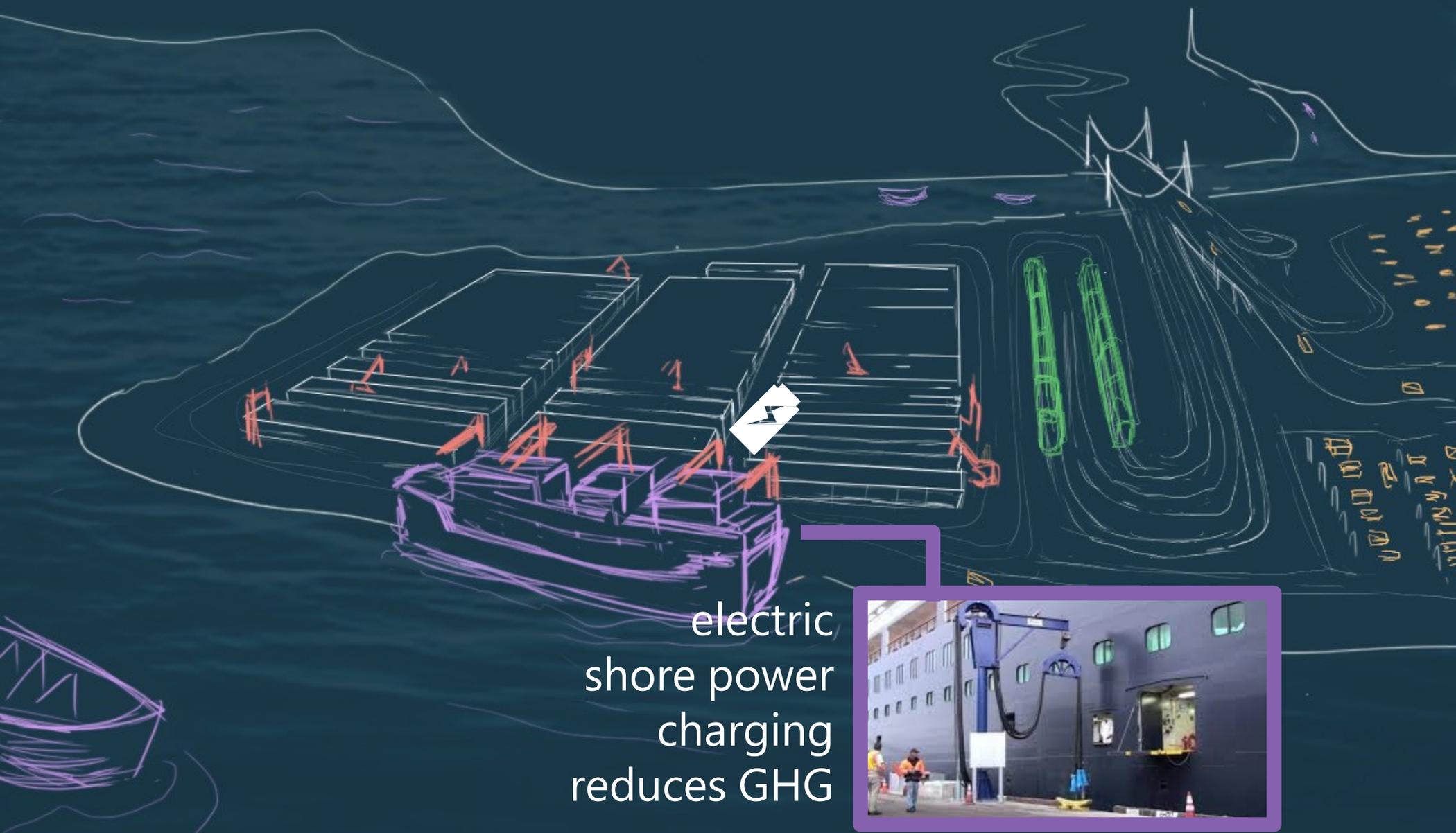
Emission reductions through improved designs





Fewer idling ships & Trucks
due to efficient operational
strategies



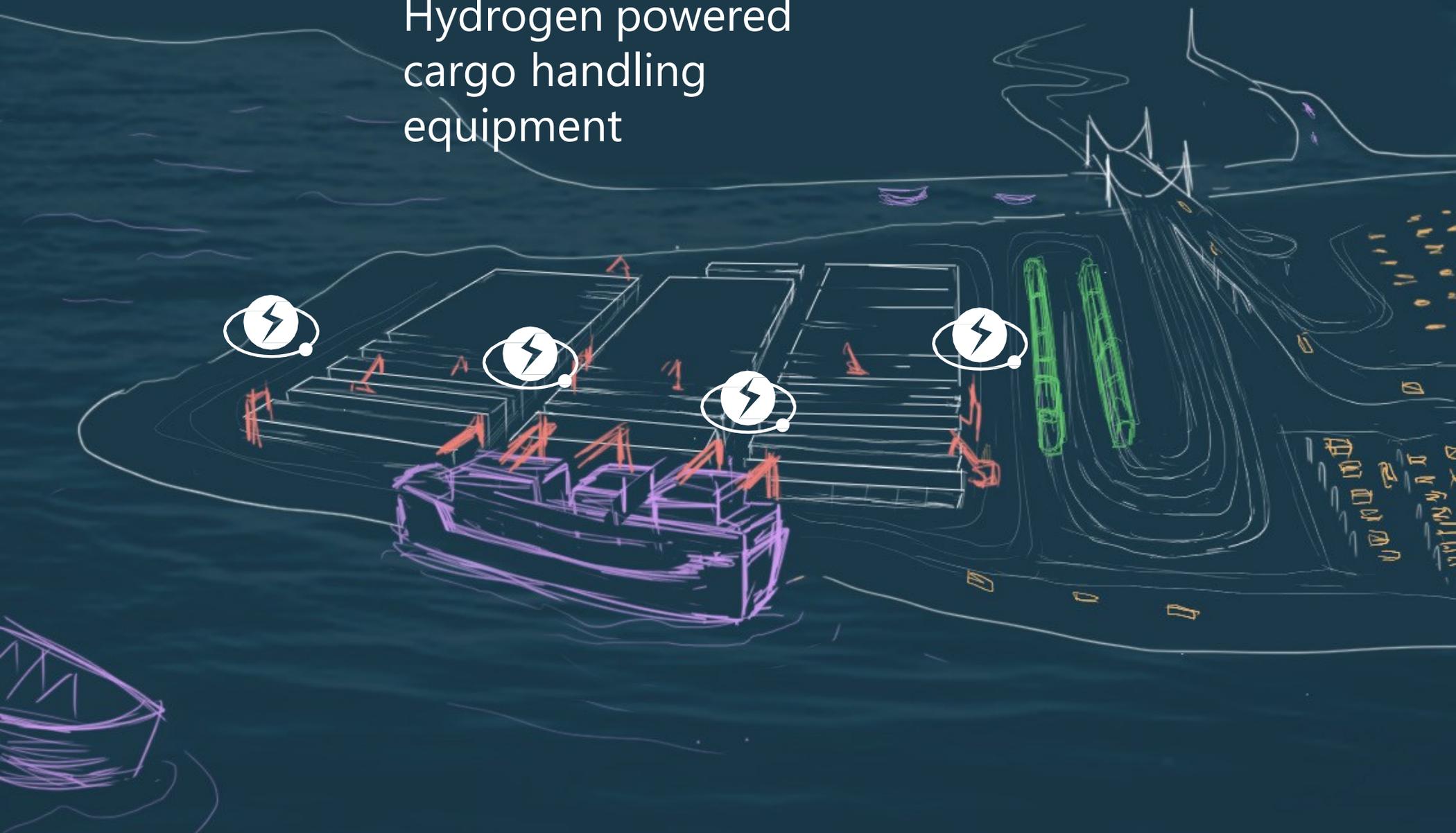


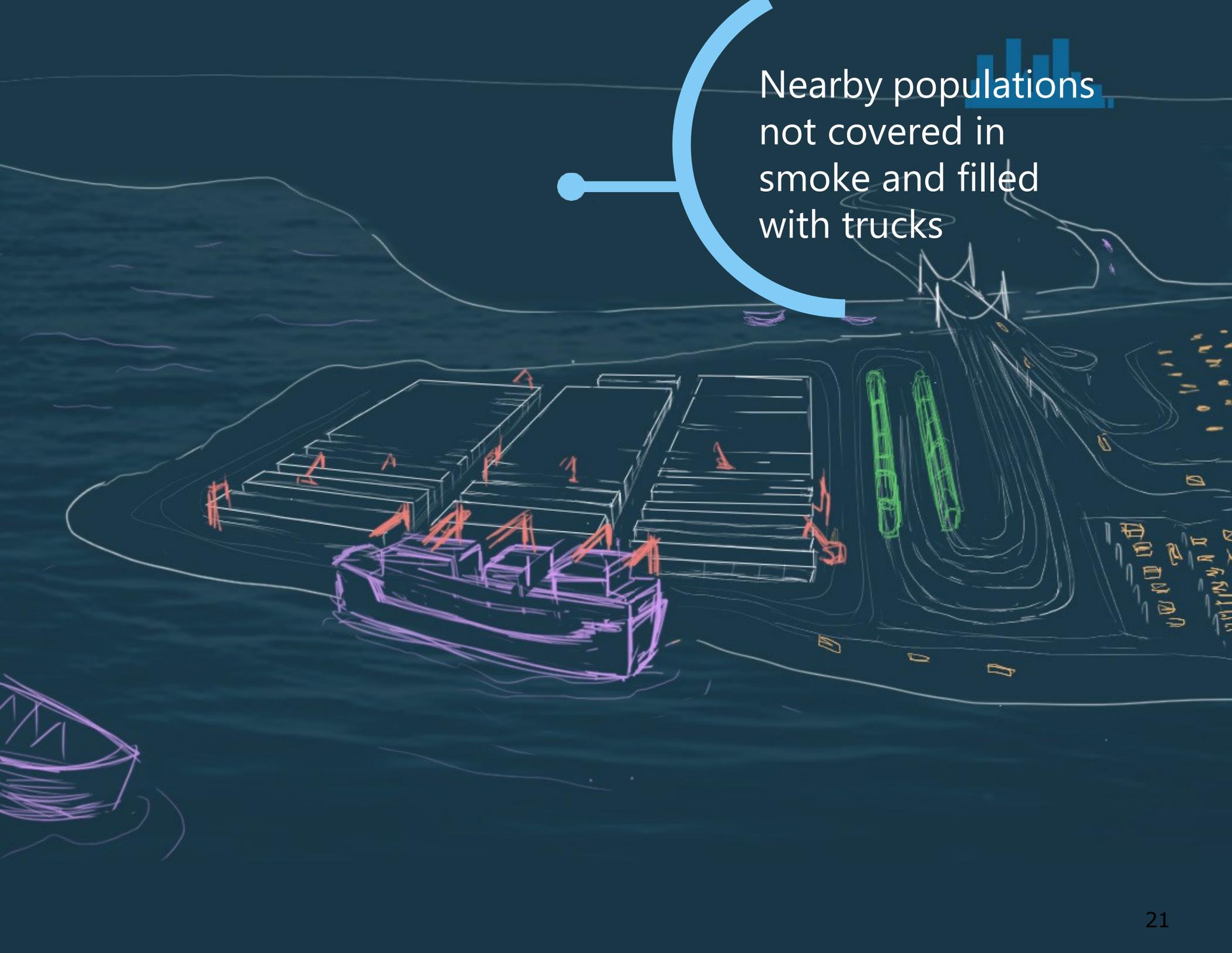
electric
shore power
charging
reduces GHG





Hydrogen powered cargo handling equipment

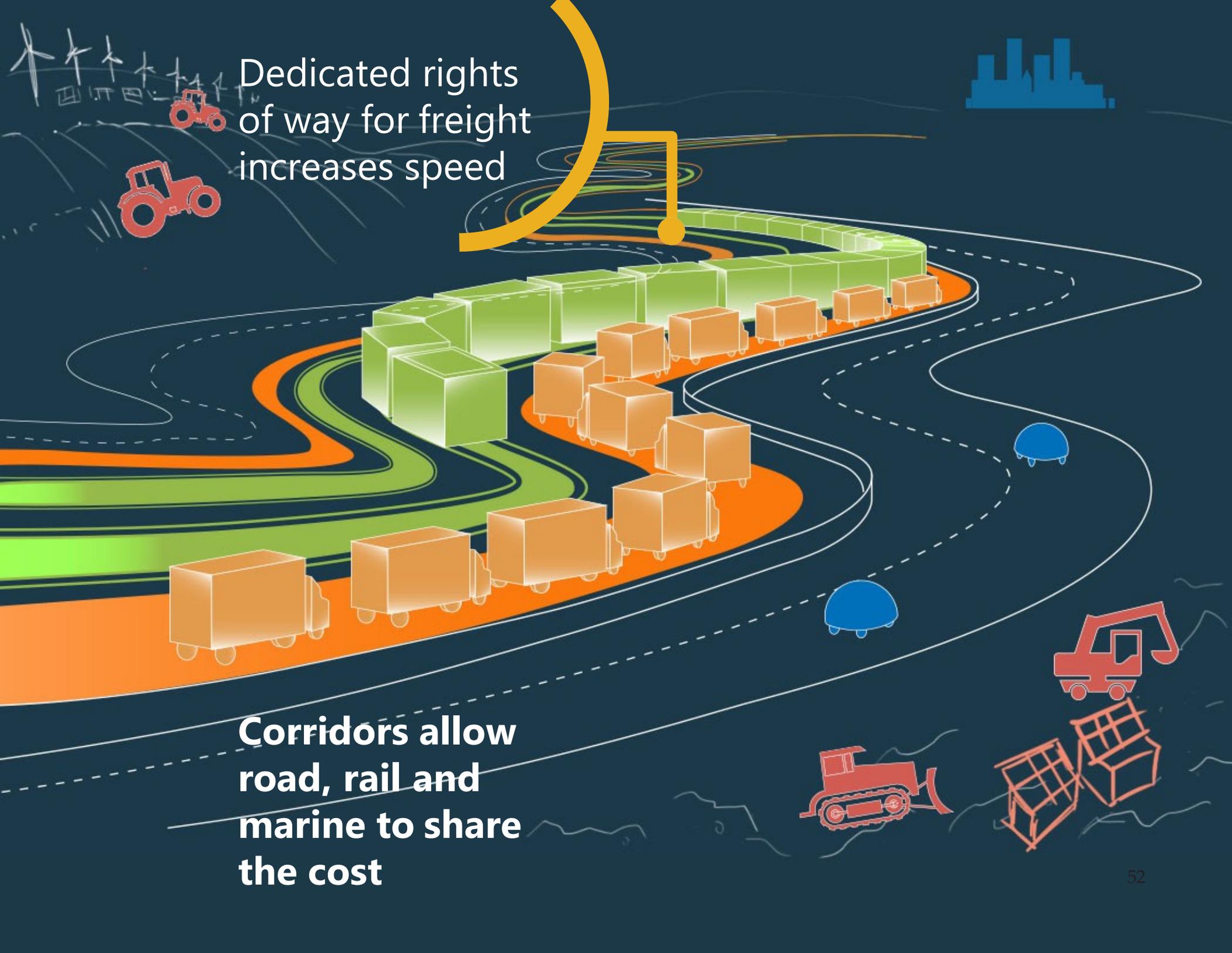




Nearby populations
not covered in
smoke and filled
with trucks



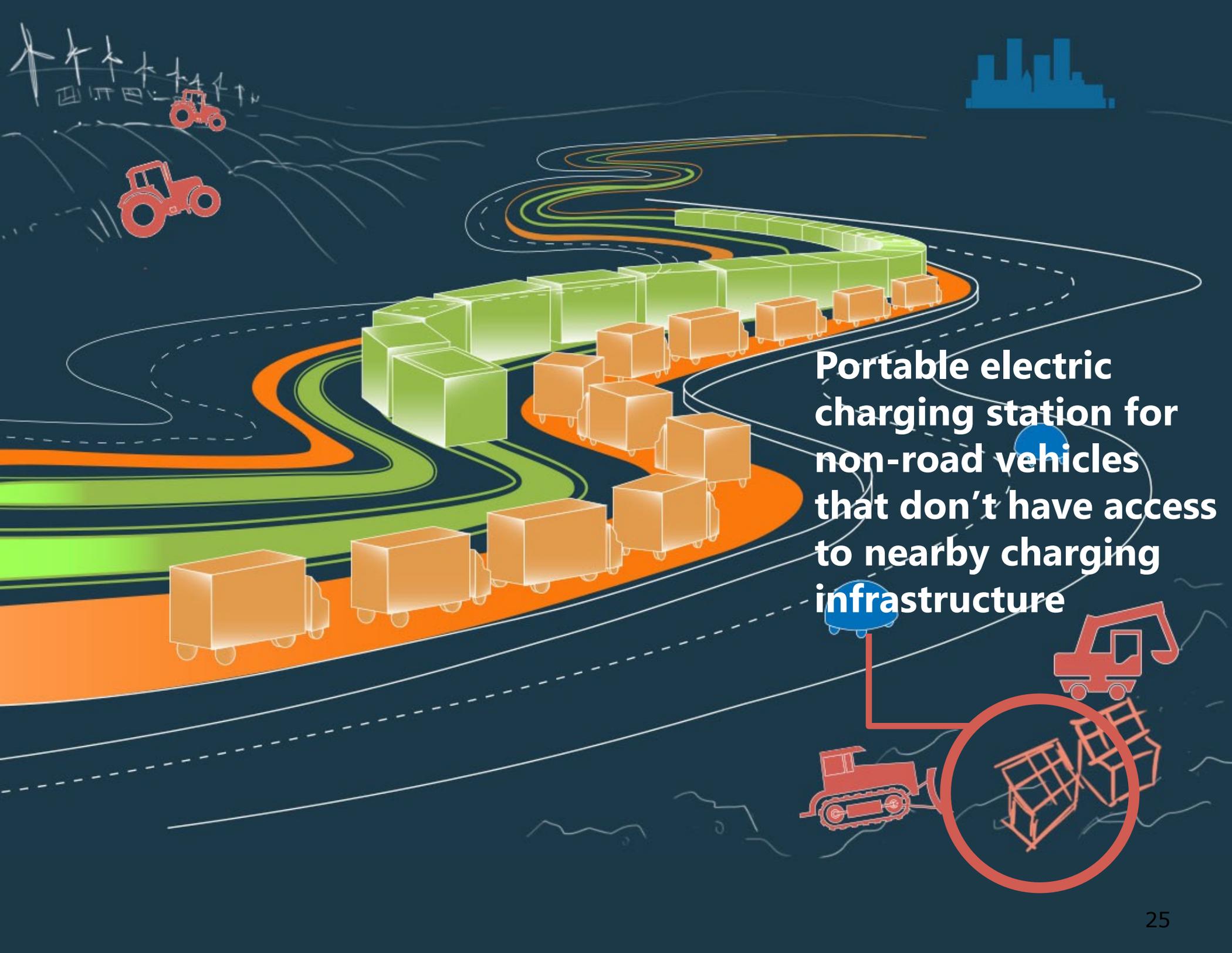
Dedicated rights of way for freight increases speed



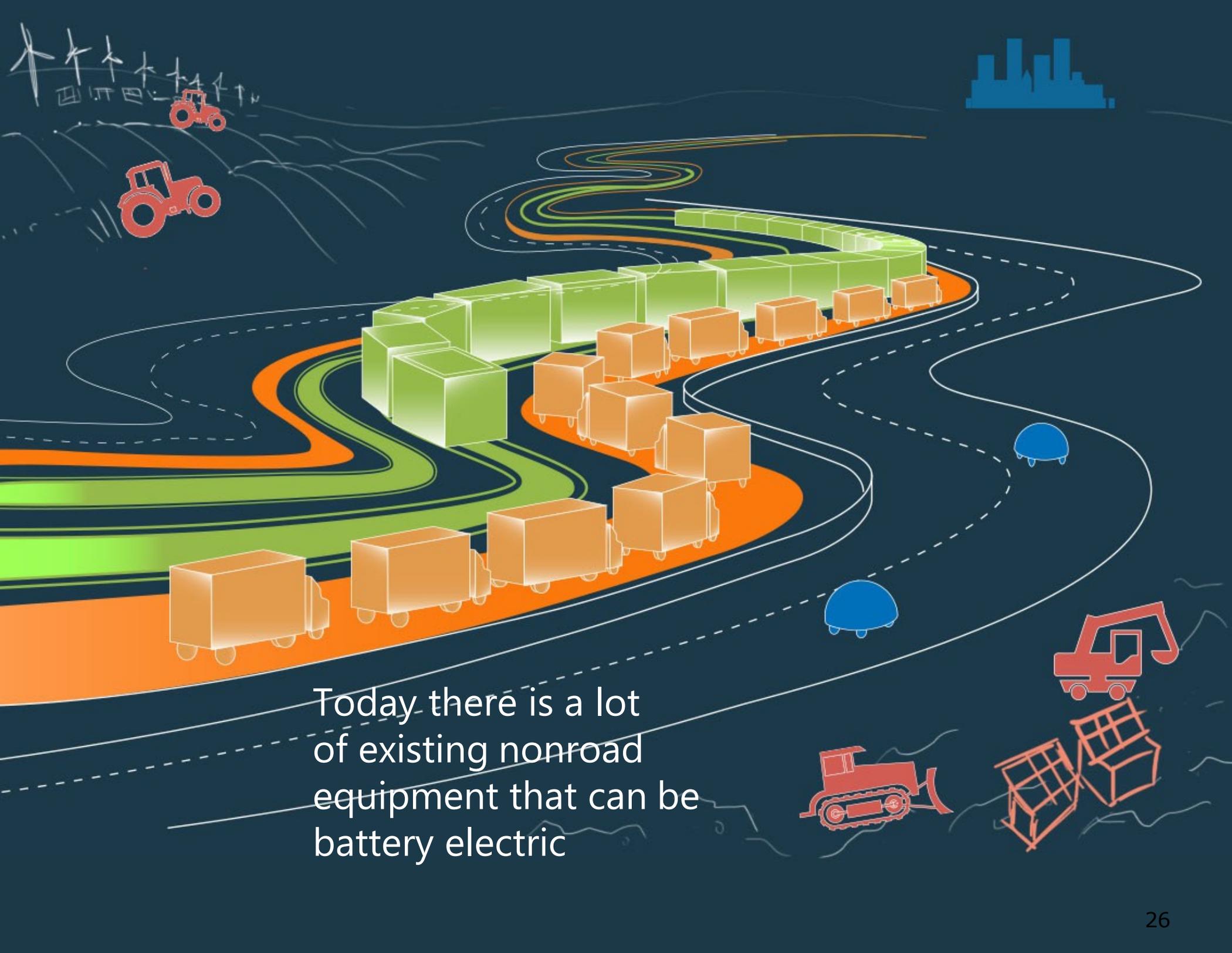
Corridors allow road, rail and marine to share the cost



Vehicle to vehicle communication:
LIDAR leads to vehicle autonomy
and less congestion

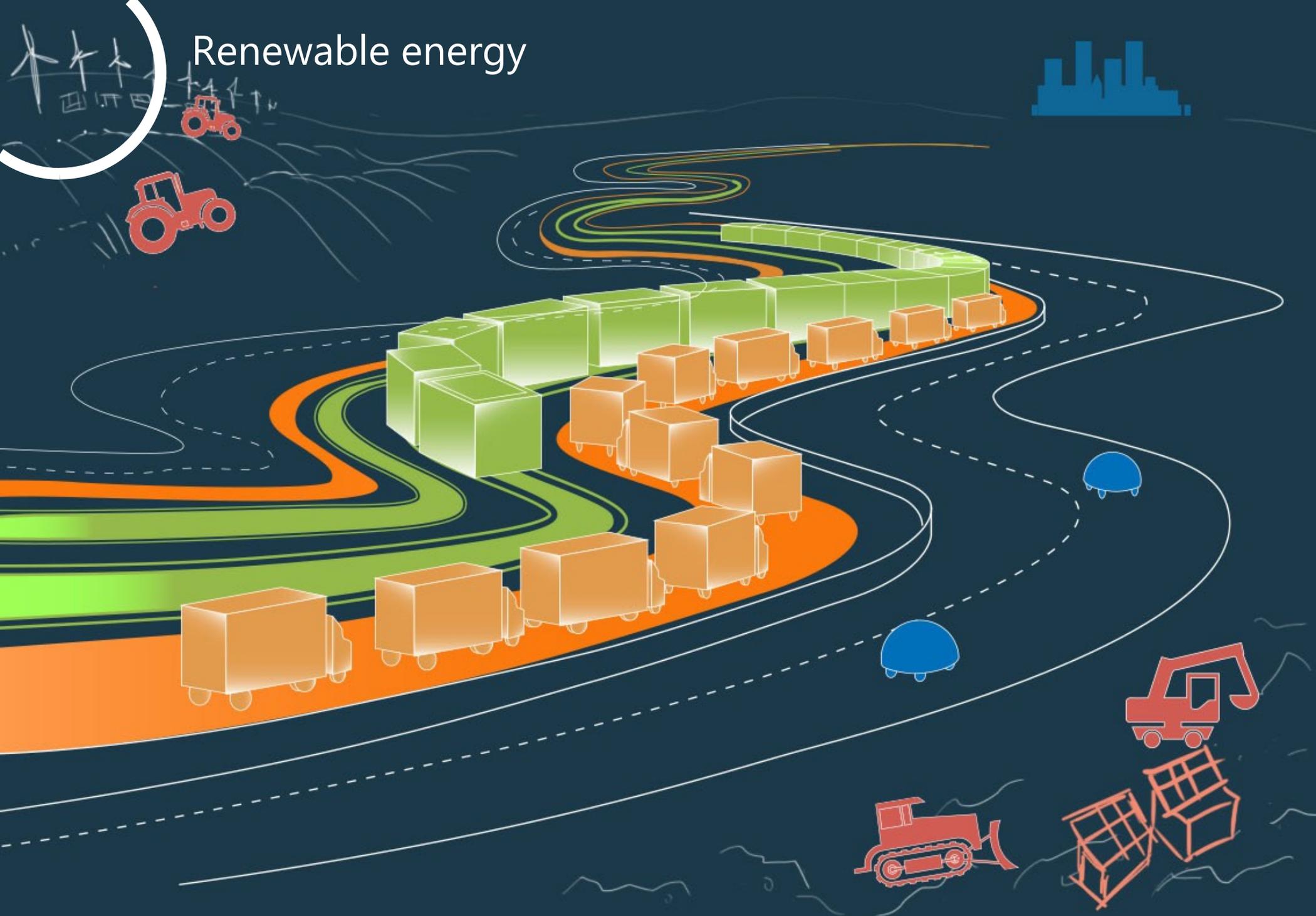


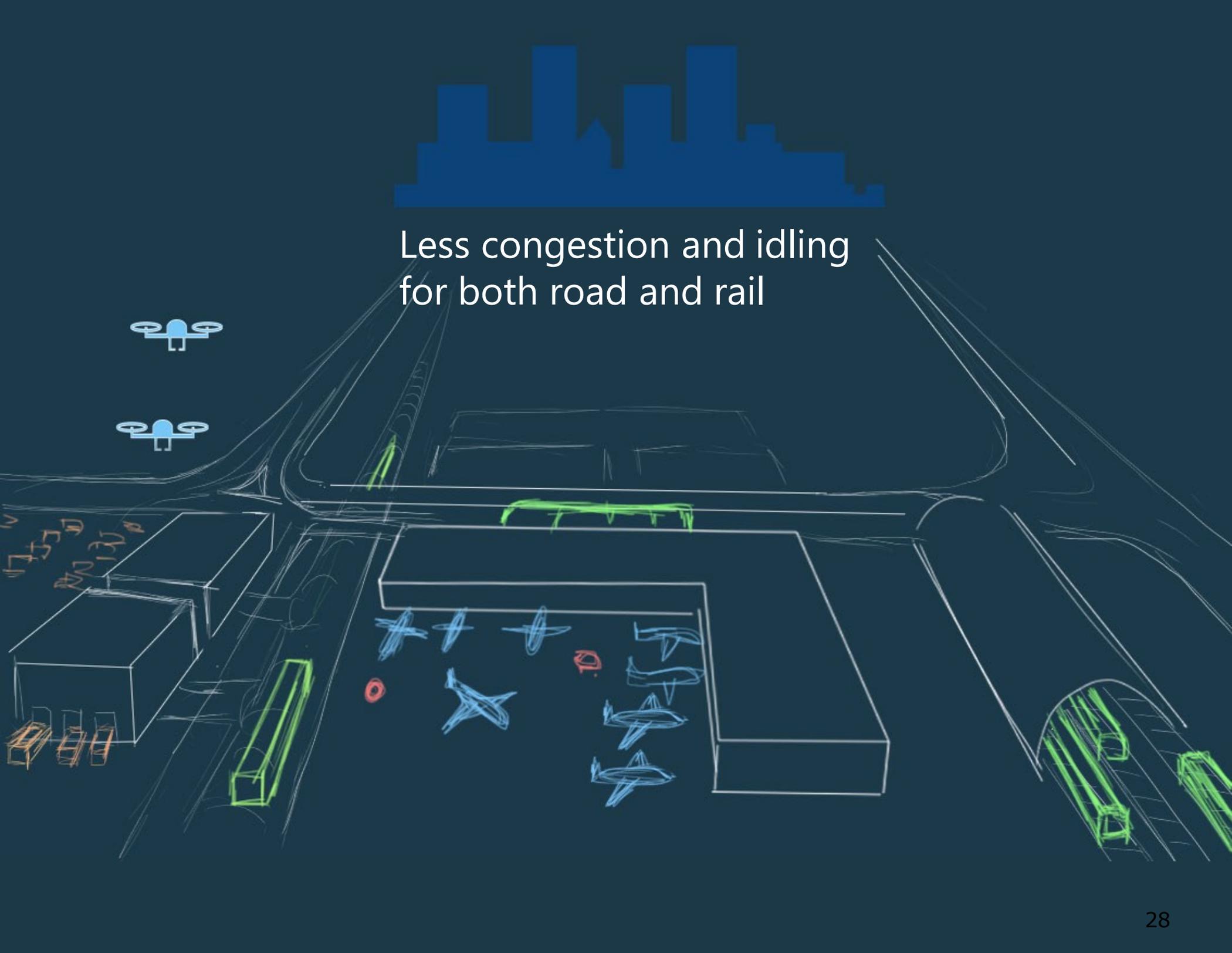
Portable electric charging station for non-road vehicles that don't have access to nearby charging infrastructure



Today there is a lot of existing nonroad equipment that can be battery electric

Renewable energy

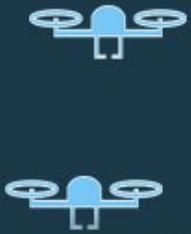


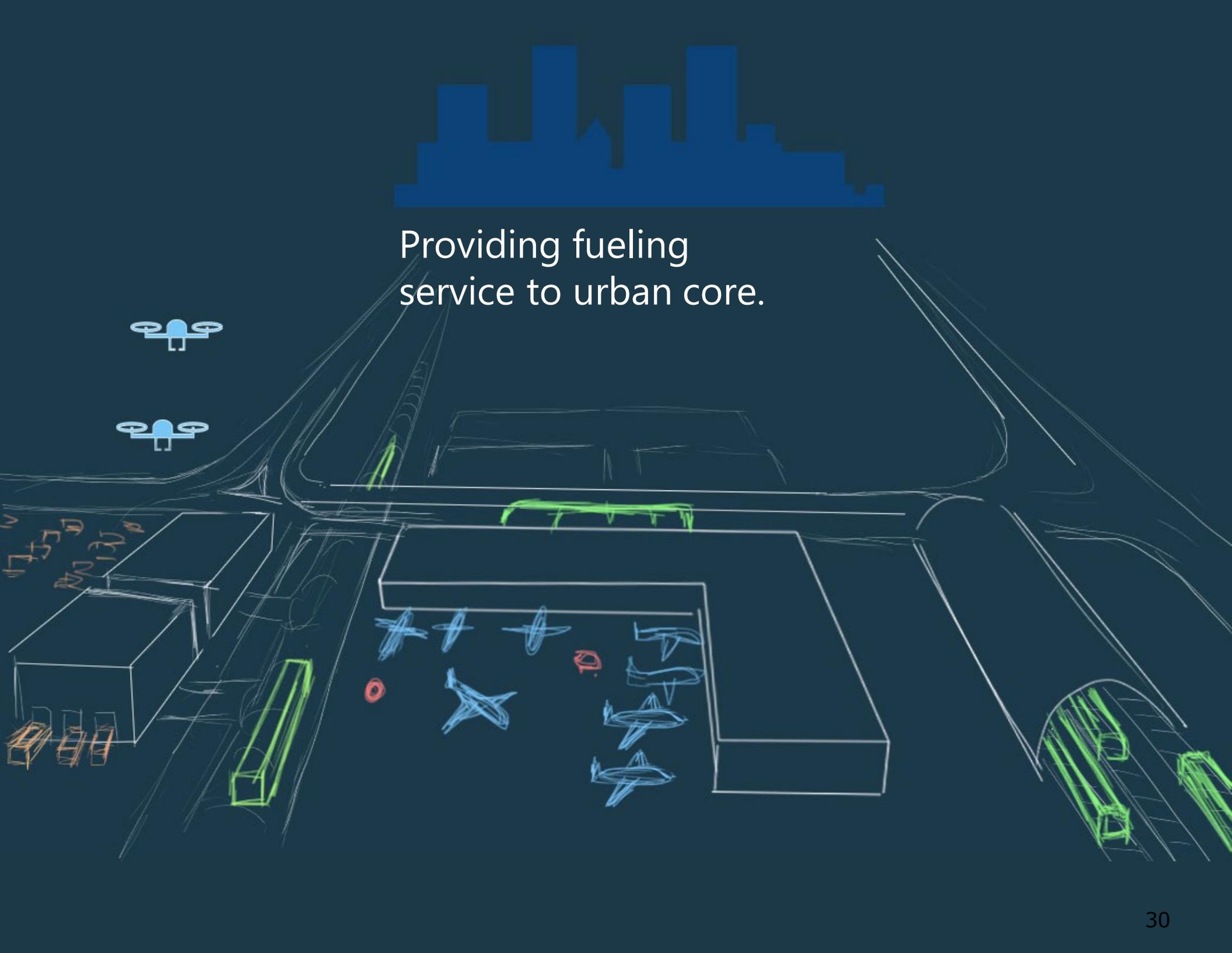


Less congestion and idling
for both road and rail



Hyperloop and high speed rail moves people and cargo between regional hubs



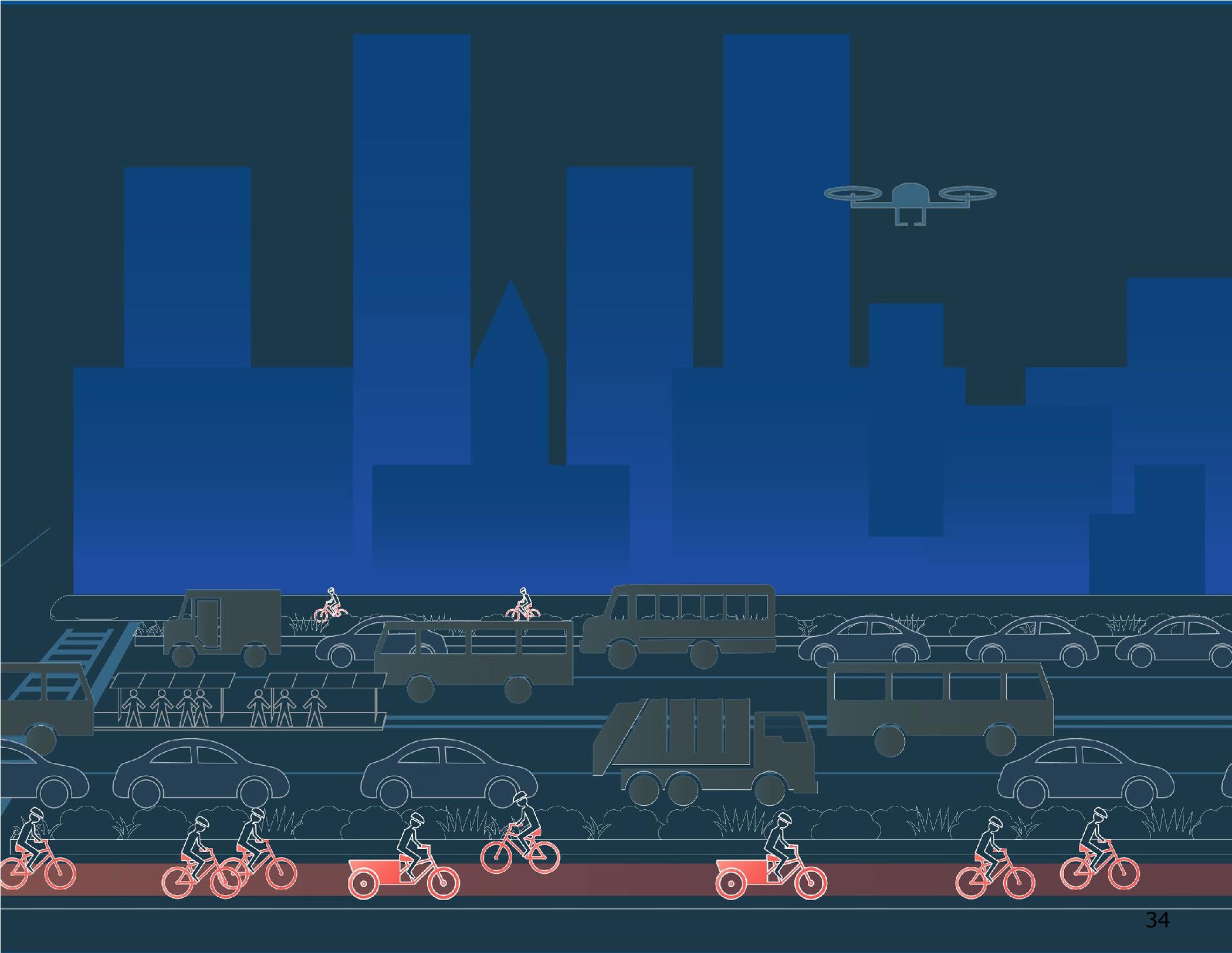


Providing fueling
service to urban core.

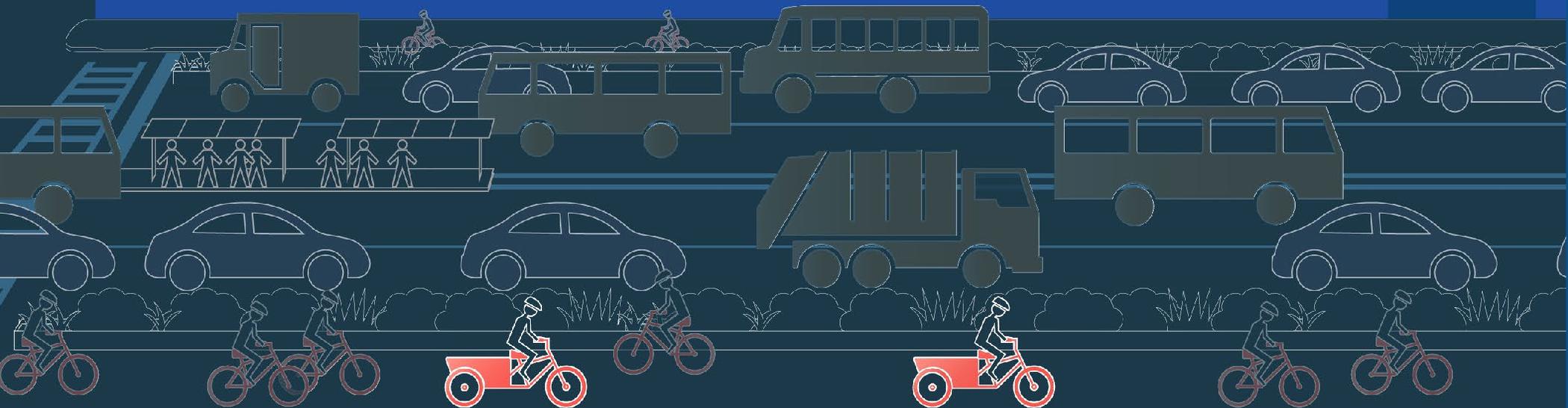








3D printing





WHAT CAN THE WORLD LOOK LIKE IN 2050?

