Sustainable Transportation Systems on Islands

A Closer Look at Today's Situations and Future Pathways in Mauritius

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@ZfromtheSea

The Reiner Lemoine Institut gGmbH (RLI)

Overview

- Not-for-profit research institute
- 100% owned by Reiner Lemoine Stiftung (RLS)
- Based in Berlin, established in 2010
- Managing director: Dr. Kathrin Goldammer
- 25 research assistants + students

Alliance for Rural Electrification

SUSTAINABLE DEVELOPMENT SOLUTIONS NETWORK
A GLOBAL INITIATIVE FOR THE UNITED NATIONS

Mission

Scientific research for an energy transition towards **100 % renewable energies**

Reiner Lemoine
Founder of the Reiner Lemoine Foundation

Research fields at RLI

Transformation of Energy Systems	Off-Grid Systems	Mobility with Renewable Energy
“We analyze and optimize future scenarios with an energy supply largely based on renewable energy sources.“	“We support the development of sustainable energy supply for remote regions.“	“We study sustainable mobility concepts through sophisticated implementation and optimization of renewable energy systems.“

Research fields at RLI

REINER LEMOINE INSTITUT

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- Strategic planning
- Geographic Information System
- Energy System Modelling
- Decarbonoization Pathways

Agenda


Introduction
Islands and Transition
Methodologies
Results
Conclusion & Outlook

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Motivation for sustainable transport

GHG emissions of transport sector

El Hierro: 11.5 MW wind, 11.32 MW hydro, 11.36 MW diesel (Backup)

Graciosa (planned): 9 MW wind, 1 MW PV, 4.2 MW diesel (Backup), 3 MW NaS battery

Ikaria: 4.5 MW wind, 2.73 MW hydro, 1.04 MW PV, 15.85 MW diesel

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Island Studies and Transition

„Niches are locations where it is possible to deviate from the rules in the existing regime.“ - Geels 2004

System perspective:

- A closed system with clear boundaries
- Good case for economic modelling

Our view on islands vs “reality”

Mauritius

Source: Google Maps

Source: DLR

I.

Research questions

1. What can we learn from the current mobility pattern in Mauritius to identify key enablers and changes needed to leapfrog to a sustainable transportation system?

2. How fast, and what cost, could an island be covered with comprehensive infrastructure for electric charging?

3. How does an island's transportation network differ and how can these findings aid in acting as geographical laboratories to each other and coastal cities?

Current Work

- Data Collection
- Mapping the mobility and energy landscape

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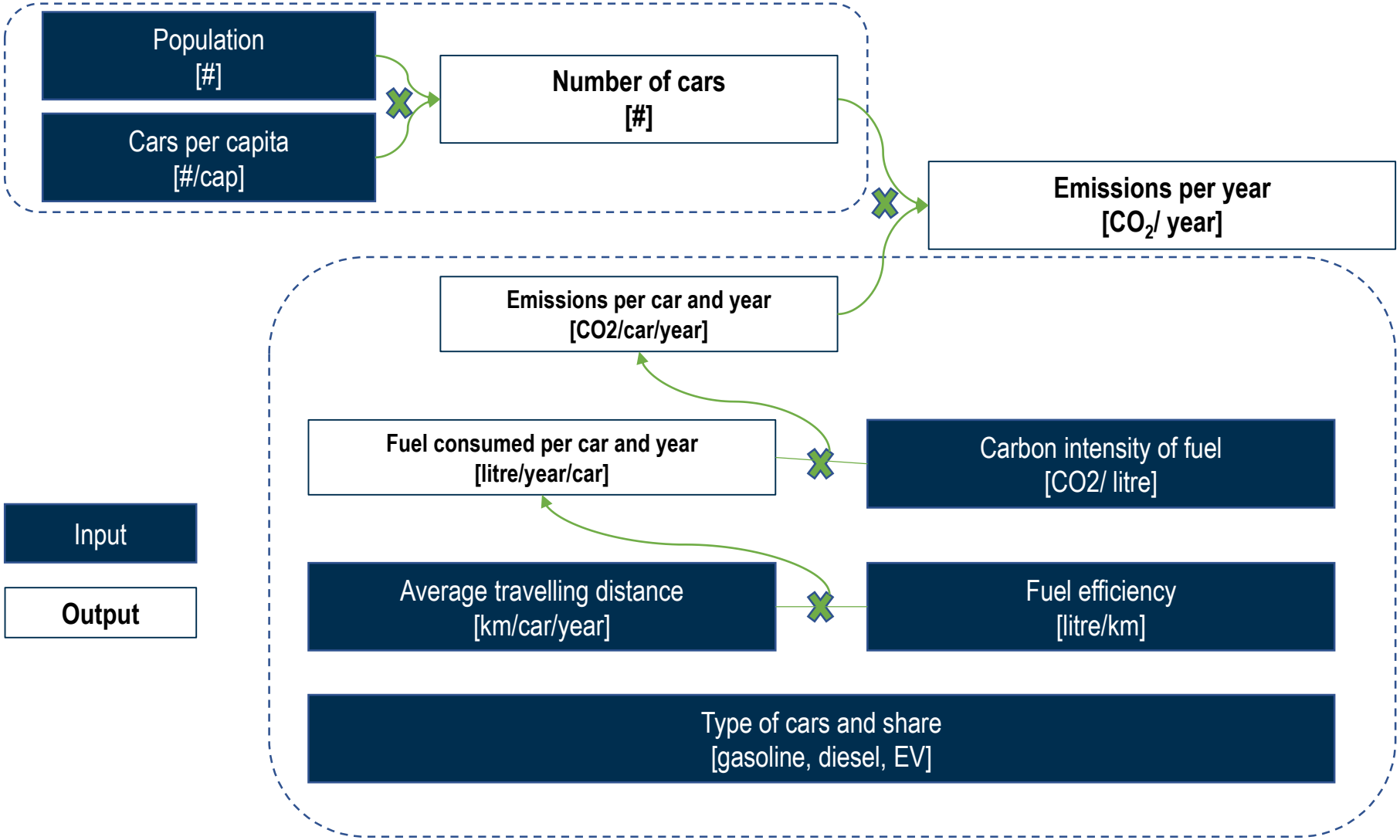
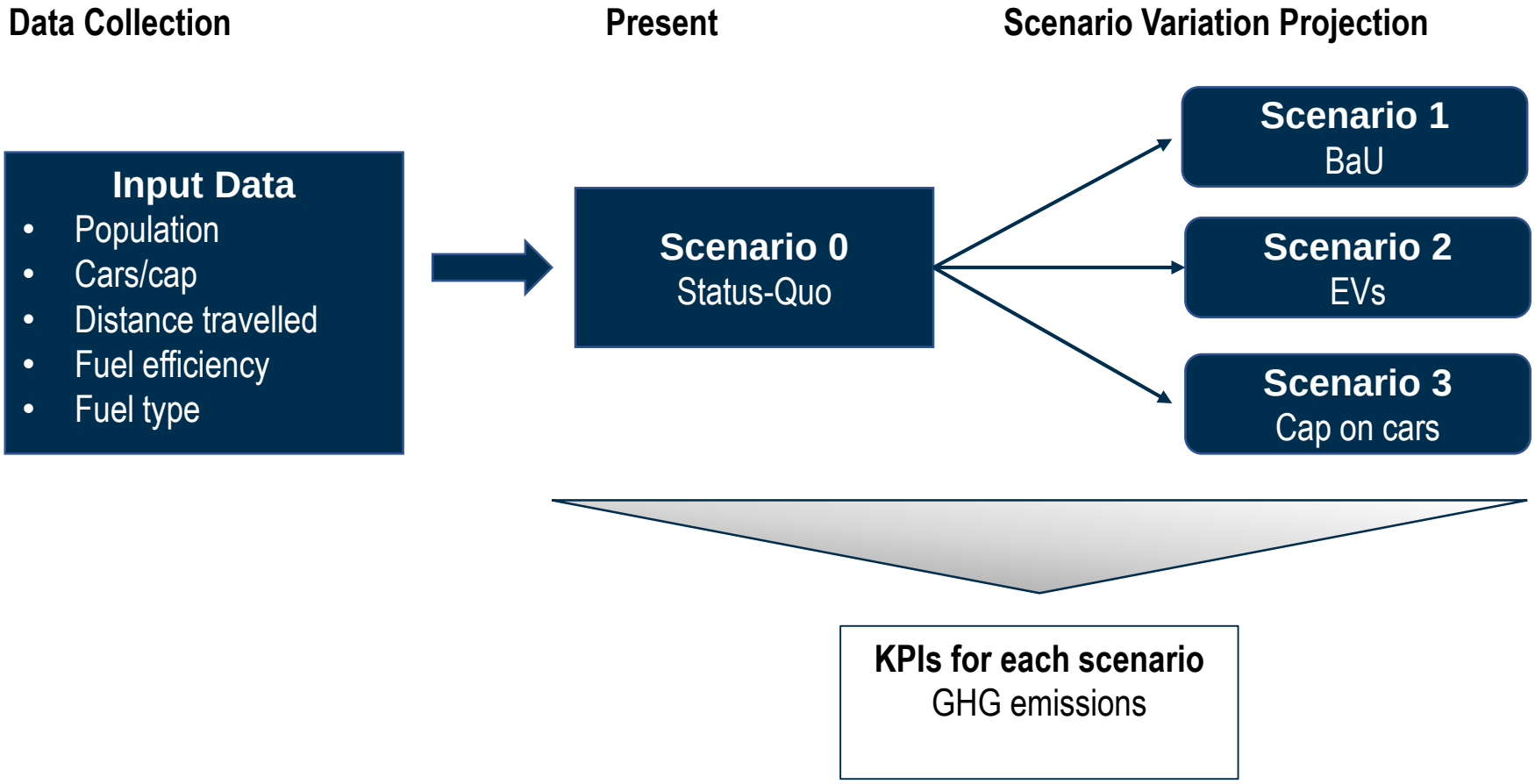
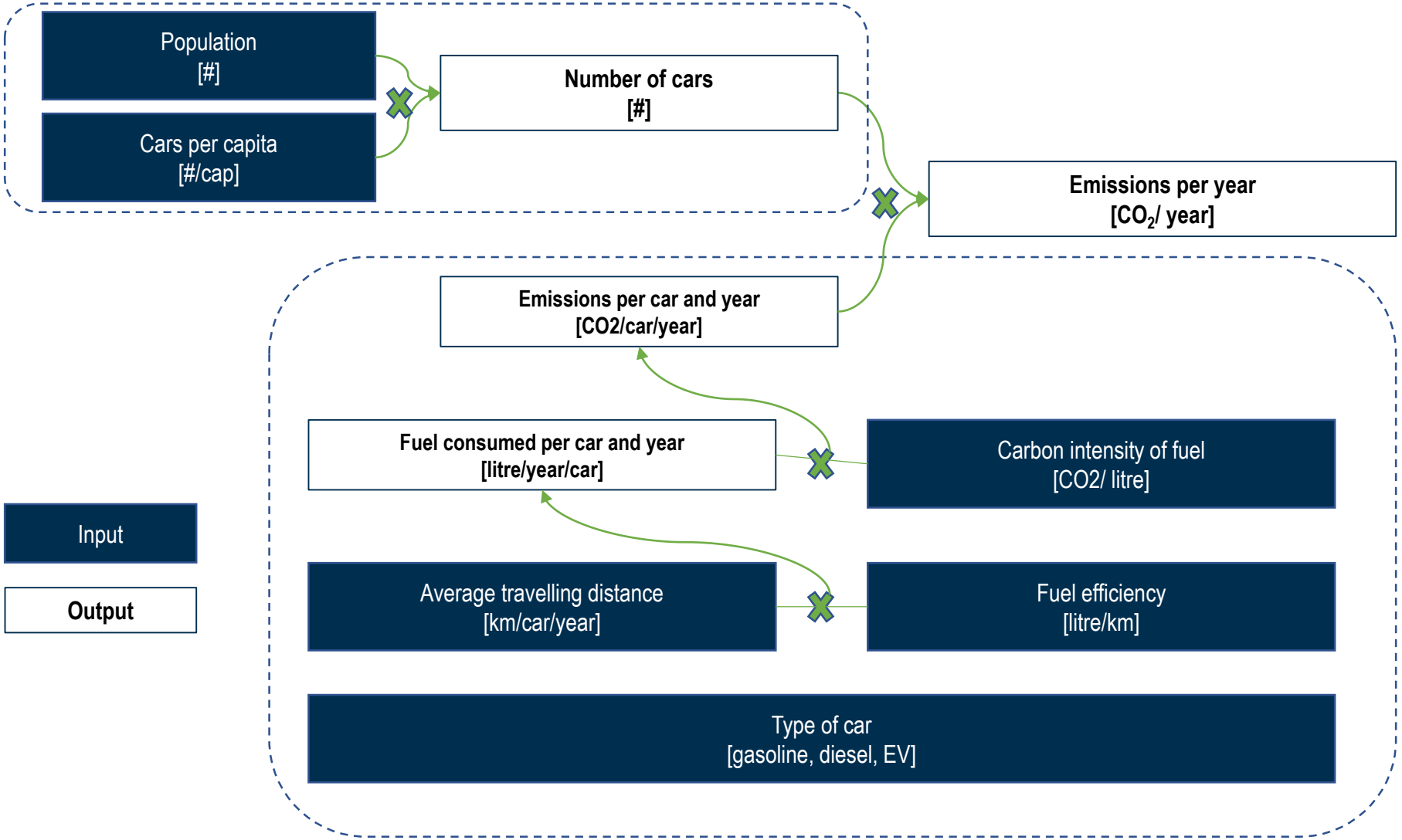
GHG emission calculation



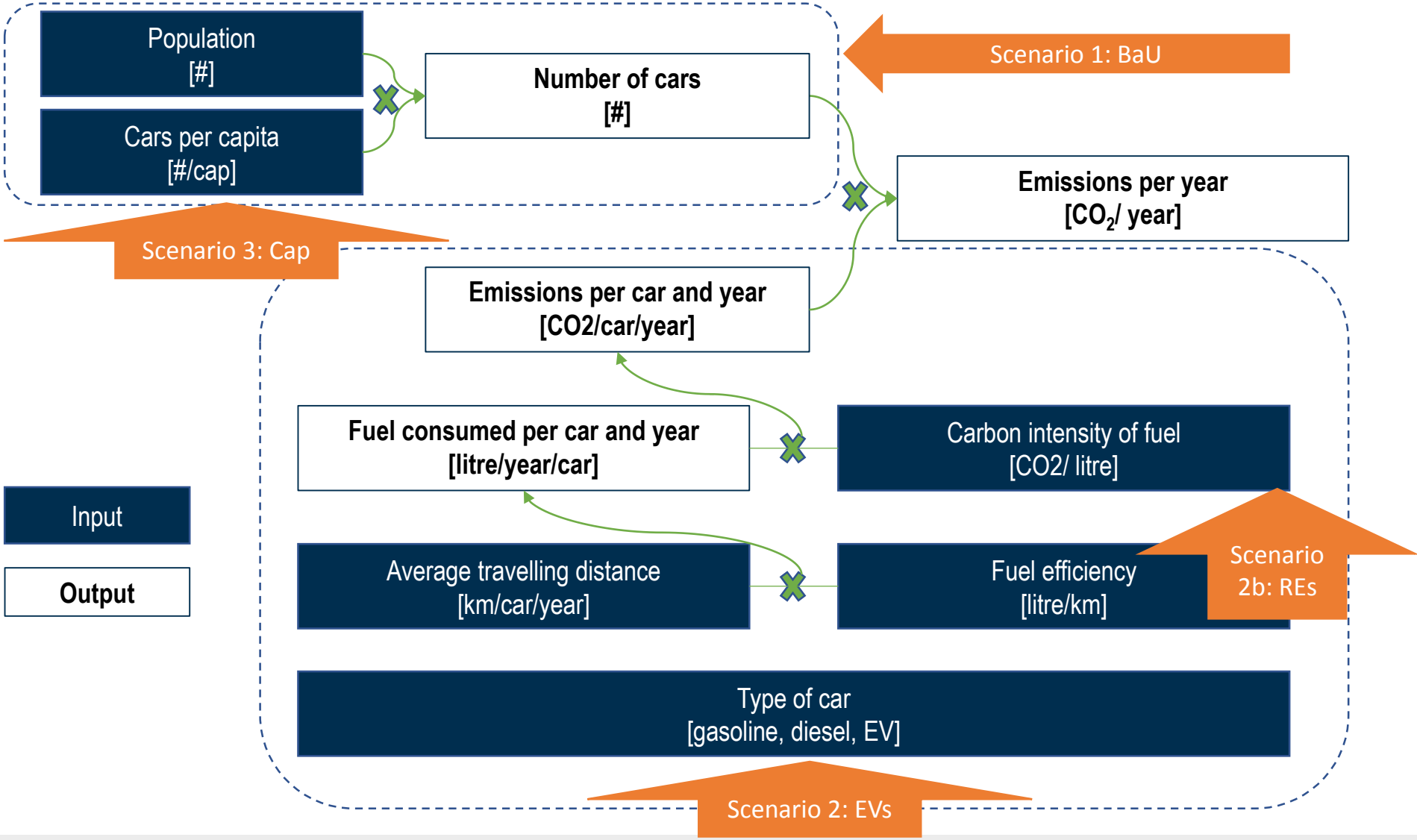
Scenario development



GHG emission calculation



GHG emission calculation



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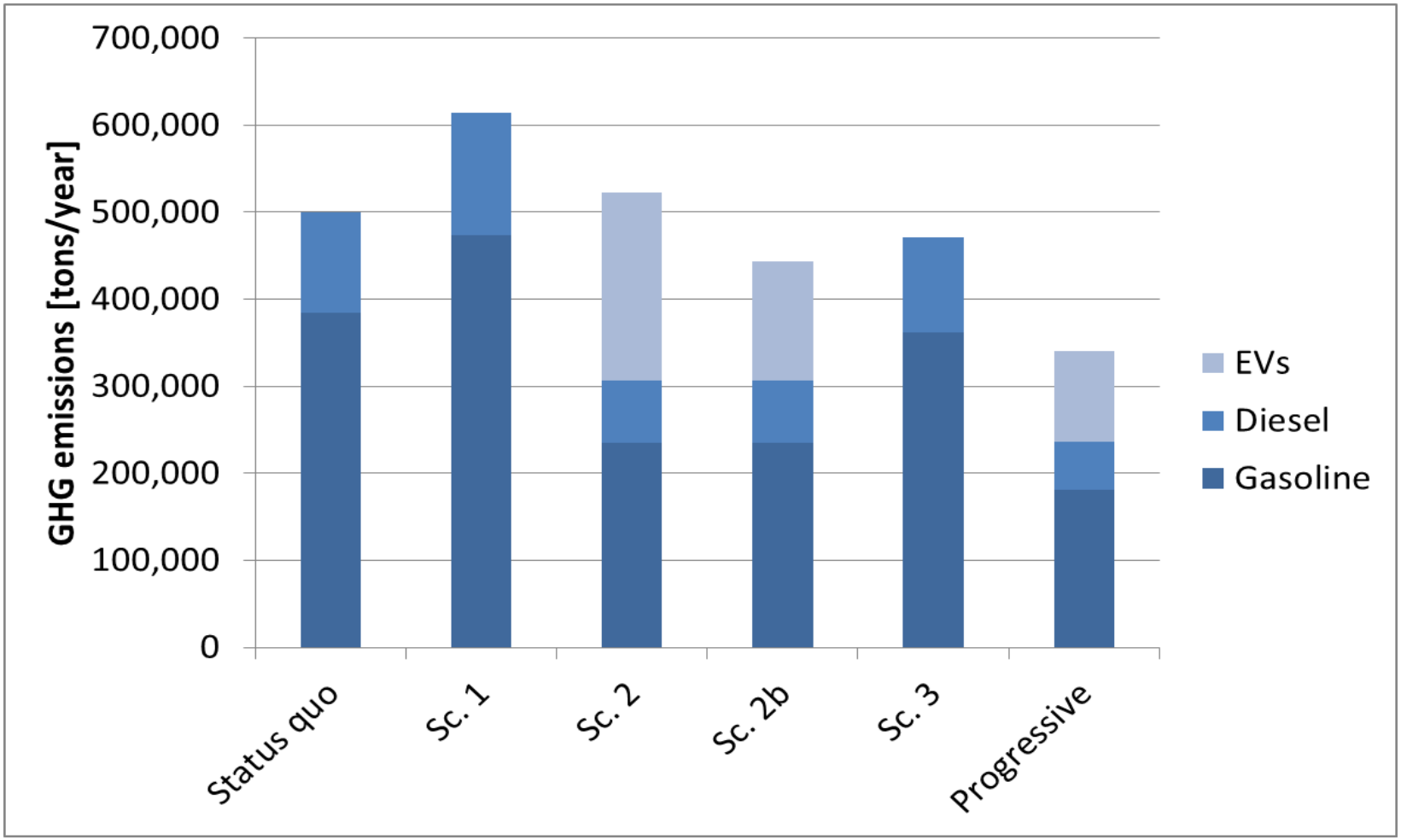
Input parameters

Parameter	Currently	Projection 2030 Scenario 1: BaU	Scenario variation
Population	1,264,613	1,494,215 (+1.4%/year)	-
Cars per person	0.4	0.52 (industrialized country)	Sc. 3: 0.4 (cap on cars)
Distance travelled	13.5 km/day	13.5 km/day	-

Input parameters

Parameter	Currently	Projection 2030 Scenario 1: BaU	Scenario variation
Fuel efficiency: Gasoline [litre/100km] Diesel [liter/100km] EV [kWh/100km]	 9.5 5.9 15	20% increase 7.6 4.7 12	-
Carbon intensity of fuel Gasoline [CO2/litre] Diesel [CO2/litre] Electricity [CO2/kWh]	 2.64 2.31 0.75	 2.64 2.31 0.75	Sc. 2b: RE-share increases from 21% to 50% 0.48
Mix of vehicles	70% gasoline 30% diesel 0% EV	70% gasoline 30% diesel 0% EV	Sc. 2: 35% gasoline 15% diesel 50% EV

Results: GHG emissions per year



Results: GHG emissions per year

Cars	Status quo	Sc. 1	Sc. 2	Sc. 2b	Sc. 3	Progressive
Gasoline	384,953	473,452	235,254	235,254	361,929	180,964
Diesel	114,629	140,384	71,258	71,258	109,628	54,814
EVs	-	-	215,504	136,395	-	104,919
Total	499,582	613,836	522,016	442,907	471,557	340,698

Discussion Scenario 2

Are EVs truly the silver bullet to a sustainable transport transition?

- 300,000 EVs using 740 kWh per year

This results in 220,000 MWh per year

10% increase of electricity demand

Discussion: Scenario 3

Is cap on cars the way to go?

How can an equitable and sustainable mobility transition be achieved?

- Light train system
- Policy changes

Decarbonization means **avoiding (or reducing)** the need for motorized transport modes; promoting a shift towards **efficient transport modes**; and **improving** performance of **vehicles and fuel**.

Policy + Behavioral Changes Needed

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- BaU pathway: 23% increase in emissions at 613,000 tons of CO_2 equivalent.
- Adding electric vehicles to the fleet by 50% also drives the emissions up to 522,000 tons of CO_2 equivalent; mostly due to the current energy mix.
- Half of fossil fuel power generation with renewable energy sources results in a decrease of emission by 11%. A cap on cars at the current level influences the carbon emissions by reducing the total by 28,000 tons.
- Even applying the most progressive scenario of combining a cap on cars with both EVs in the fleet and an energy mix based on 50% renewable energy sources leads to CO_2 emissions reduction by only 32%.
- Considering the **substantial efforts in infrastructure and policy** behind this scenario, the reduced level of emissions is considerably less.

Conclusion and Outlook

Source: Aruba Innovation Summit 2018, Twitter

Next Steps

- Analyse No_x, noise and air pollution emission and public transportation dataset
- In-depth scenario modelling
- Comparison with other SIDS

Thank you for your attention!

Questions & Answers

Acknowledgements

“In a sea of difficulties, there is always an island of possibilities.” **German Proverb**

License

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