Robust Decision Making

Planning for a Future We Can't Predict

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"The views expressed in this material do not necessarily reflect the UK government's official policies."

University Partnership:

BEFORE WE BEGIN

01

How many scenarios does your long-term plan consider?

1? Maybe 3? Is that enough to capture deep uncertainty about technology costs, climate impacts, and political cycles?

02

How do you capture what stakeholders actually need from the analysis?

Do they help define success metrics — or do they just review a model they didn't build and can't challenge?

03

How do you know your strategy holds if the future surprises you?

What happens to your plan when a key assumption turns out to be wrong — as it always does?

These are not rhetorical questions — they are the design criteria for Robust Decision Making

THE PROBLEM

How most long-term planning still works

The Forecast

Best / Base / Worst
1–3 scenarios
Optimise for the middle

The Model

Expert-built
Peer-reviewed
Fixed assumptions

The Output

A plan optimal
for ONE future
Presented to
stakeholders

Optimised for ONE future

Performs brilliantly in the base case. Fails when reality diverges — and it always diverges.

No robustness test

There's no built-in way to find the conditions that break your strategy.

Stakeholders validate, not co-create

When experts build alone, stakeholders challenge. When they build together, they defend.

Deep uncertainty treated as risk

Assigning probabilities to deeply uncertain outcomes gives false precision.

The plan isn't wrong because the model is bad — it's wrong because the world was never that predictable.

DEEP UNCERTAINTY

The uncertainty isn't a gap in the analysis. It IS the analysis.

10×

range in solar PV costs over 30 years

Technology

2–10×

range in projected fuel prices by 2050

Commodity

±3°C

spread in warming by 2100 across models

Climate

?

political cycles, behavioural tipping pts

Governance

We cannot assign reliable probabilities to these ranges. Choosing one "most likely" future and optimising for it is not analysis — it is a bet.

"Rather than seek the optimal strategy for the most likely future, seek the strategy that performs acceptably well across the widest range of plausible futures."

— Lempert, Popper & Bankes (2003)

Robust Decision Making (RDM)

"A risk analysis approach that identifies strategies that perform well across a wide range of plausible futures — even in the face of deep uncertainty."

Co-created with stakeholders

Reflects the objectives, concerns and local knowledge of government, civil society and private sector

Scenario-based exploration

Runs thousands of simulation futures rather than betting on a single forecast

Robust — not optimal

Finds strategies that perform well across ALL plausible futures, not just the most likely one

Multi-metric evaluation

Assesses emissions, costs, jobs, energy security and co-benefits simultaneously

INTELLECTUAL LINEAGE

- **1962** — Kahn & Wiener — military planning under deep uncertainty
- **2003** — Lempert et al. — RAND 'Shaping the Next One Hundred Years'
- **2010** — Walker et al. — Decision Making under Deep Uncertainty framework
- **2013** — World Bank, IADB, 2050PP, AFD
- **2016+** — Costa Rica first. Then 10 additional countries in LAC (University of Costa Rica // Climate Lead Group)
- **2025+** — Implementation in Uganda (AFD) and Botswana (2050PP) – Loughborough University

Combined economic benefits identified across LAC: over US$2.7 trillion by 2050 | Source: IDB 2023

THE CORE LOGIC

Explore · Discover · Design

EXPLORE

Run thousands of futures

- Define X, L, R, M with stakeholders (XLRM workshop)
- Generate 1,000+ simulated futures
- Evaluate every strategy against every future

→

DISCOVER

Find what makes strategies fail

- PRIM peels away 'good' futures to find failure clusters
- Identify which uncertain factors break the strategy
- Visualise the 'vulnerability space'

→

DESIGN

Build strategies that are robust

- Search for policy combos robust across ALL clusters
- Stakeholders challenge → new scenarios added → re-run
- Output: strategies with explicit robustness conditions

Key insight: you don't search for THE best strategy — you search for strategies that cannot be easily broken

Workshop 1: XLRM: Co-creating the Problem Space

We convene government ministries, private sector, civil society and researchers to map the planning landscape:

X

Exogenous Uncertainties

- Technology cost evolution
- Fuel & commodity prices
- Climate event frequency
- Social behaviour & demand
- Political & regulatory cycles

L

Policy Levers

- Renewable energy targets
- Electromobility standards
- Land use & forestry policy
- Industrial efficiency standards
- Carbon pricing mechanisms

R

Relationships / Models

- OSeMOSYS energy system model
- LEAP national energy model
- GHG inventory tools
- Macroeconomic impact model
- Co-benefit estimation tools

M

Metrics of Success

- CO_2-eq emissions by 2050
- Net economic benefit ($)
- Jobs created / displaced
- Energy access & security
- Health & ecosystem co-benefits

Every disagreement in the room becomes a new scenario to test — dissent strengthens the analysis.

SCENARIO DISCOVERY

From futures to vulnerability

1

Generate futures

Run 100,000+ X×L combinations through CLEWS++

2

Score every future

Pass/fail on emissions, fiscal balance, energy access

3

Identify failure clusters (PRIM)

Peel away 'good' futures to expose the vulnerability space

4

Interpret with stakeholders

'Strategy fails if solar stays costly AND carbon price stays low'

5

Iterate and redesign

New scenarios added; model re-run; vulnerability shrinks

100k+

simulated futures per country

500+

simulations per scenario

PRIM

Patient Rule Induction Method (1999)

3–5×

stakeholder feedback rounds

The 10-Step RDM Guide

Climate Lead Group

1 Project Set-up
Define objective, Terms of Reference, team (Government + Funder + Implementer)

2 Planning
Work plan, activity schedule, bibliographic research, modelling tool selection

3 Workshop 1: Problem Framing
Co-create the XLRM matrix with multi-stakeholder groups

4 Scenario Creation
Build plausible future scenarios from XLRM uncertainties

5 Stakeholder Engagement
Bilateral meetings to refine assumptions and deepen ownership

6 Exploratory Modelling
Run scenarios, identify vulnerabilities, discover robust strategies

7 Workshop 2: Results Integration
Present findings to stakeholders, collect feedback, refine strategies

8 Improve Results
Address new concerns raised by stakeholders in iterative analysis

9 Workshop 3: Final Validation
Validate robust strategies with the full stakeholder group

10 Final Results and Report
Produce the climate strategy

Steps 1–2: FOUNDATION | Steps 3–5: CO-CREATION | Steps 6: MODELLING | Steps 7–8: INTEGRATION | Steps 9–10: DELIVERY

From Analysis to Action: LAC's Track Record in Finance Mobilisation

RDM has built the evidence base for billions in climate investment across LAC

Climate Lead Group

CR Costa Rica — National Decarbonization Plan

- First and most mature RDM application in the region
- Cost-benefit analysis under uncertainty for the National Decarbonization Plan 2018-2050
- Led by the Directorate of Climate Change (DCC), supported by IDB
- **Quantified net benefits of $41 billion by 2050**
- Government ownership of the modelling process was key to credibility

$2.4B in climate finance attributed to the RDM-backed LTS process (IDB, Green Climate Fund, bilateral donors)

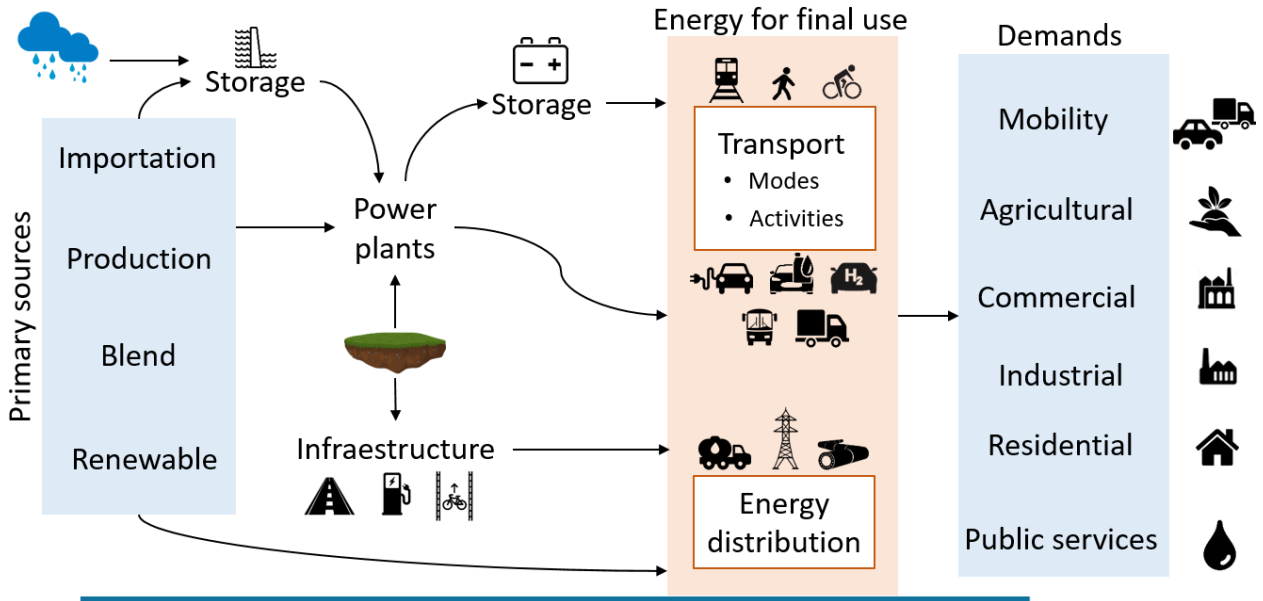
DO Dominican Republic — Low-Carbon Strategy

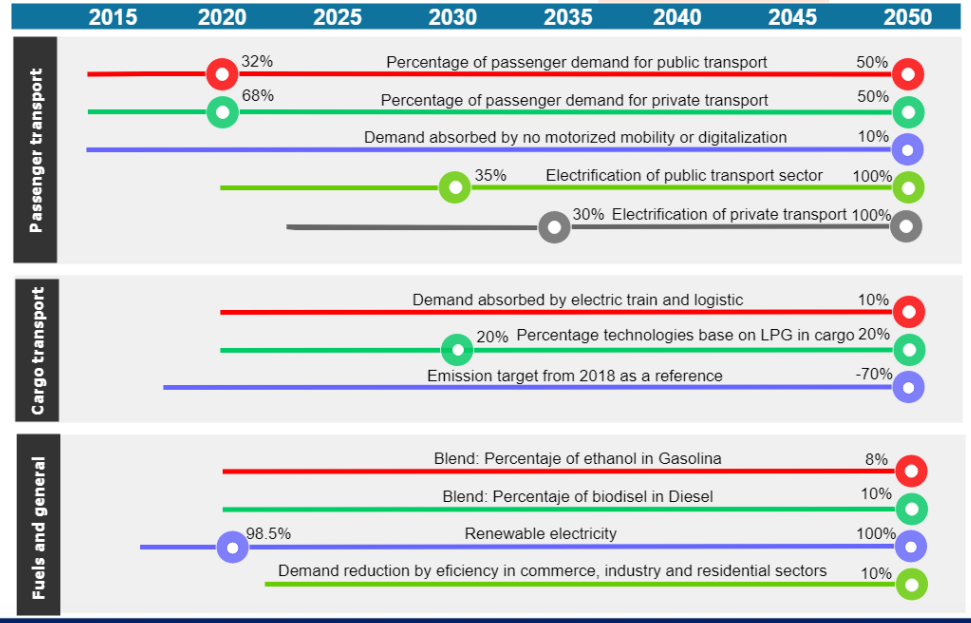
- Full national LTS covering all emitting sectors
- 101 simulated futures per scenario — complete uncertainty coverage
- Three co-creation workshops with 80+ stakeholders from 12 sectors
- **Strategy outperforms BAU in 100% of simulated futures**
- Support from World Bank; results used to update NDC targets

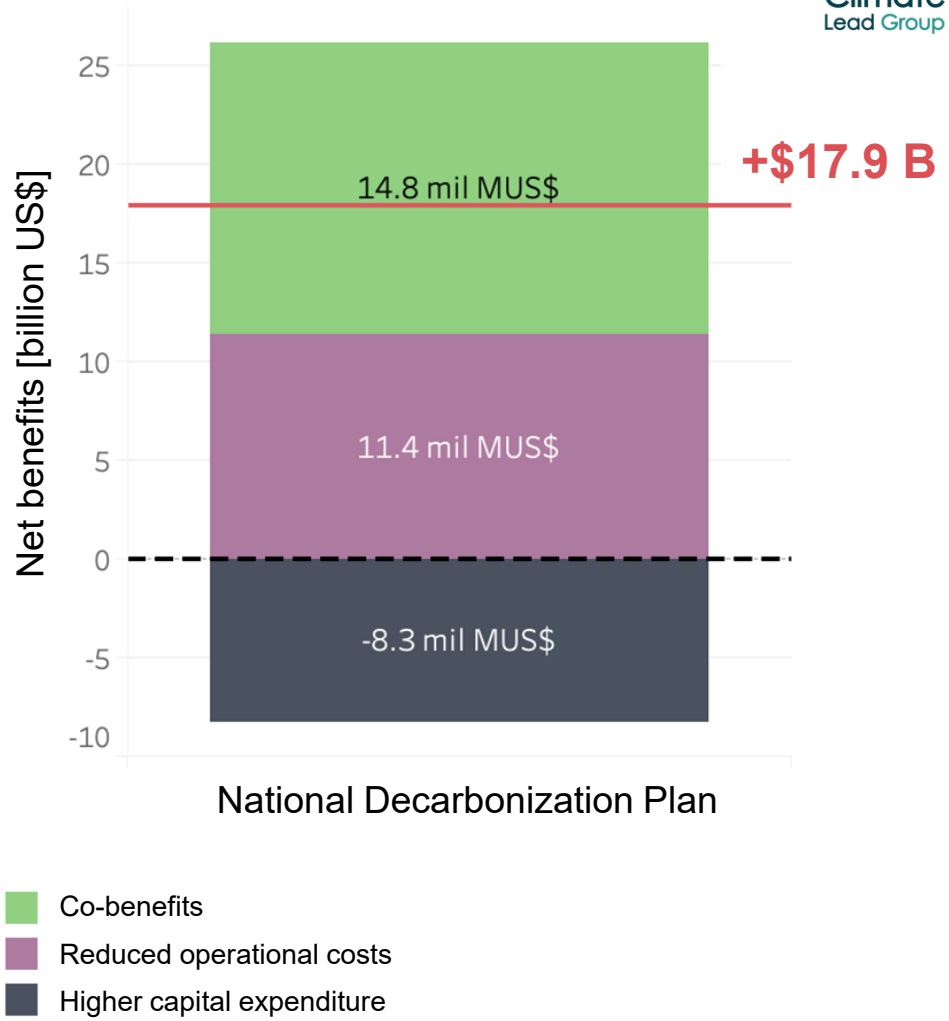
$96B–$133B net economic benefit by 2050, across ALL 101 futures (World Bank / MEPyD, 2024)

Combined LAC impact: US$2.7 trillion in net benefits identified · 7 Long-Term Strategies supported · Botswana & Uganda underway

RDM in Costa Rica

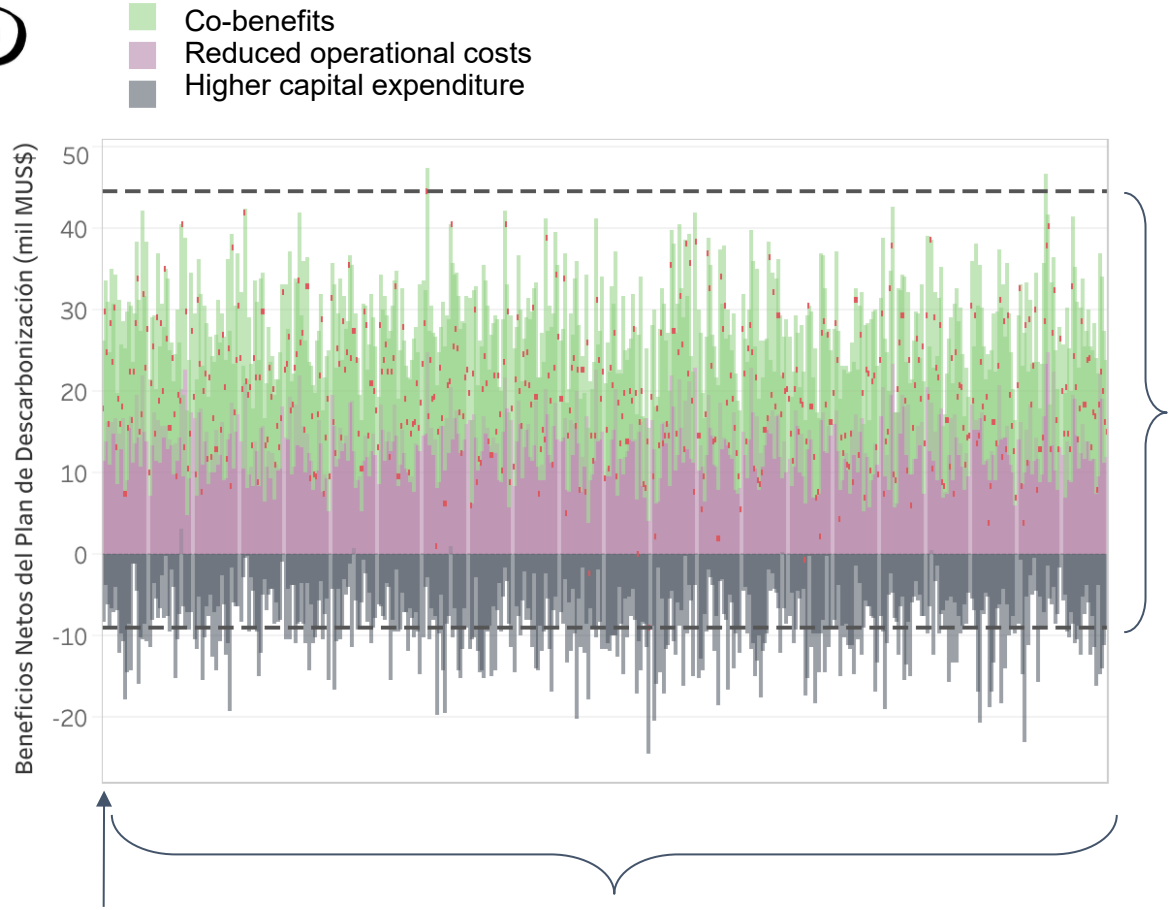






Co-benefits: Improved health (less pollution), More productivity (less traffic), Lower health costs (fewer accidents)

Uncertainty leads to a wide range of emissions and cost outcomes



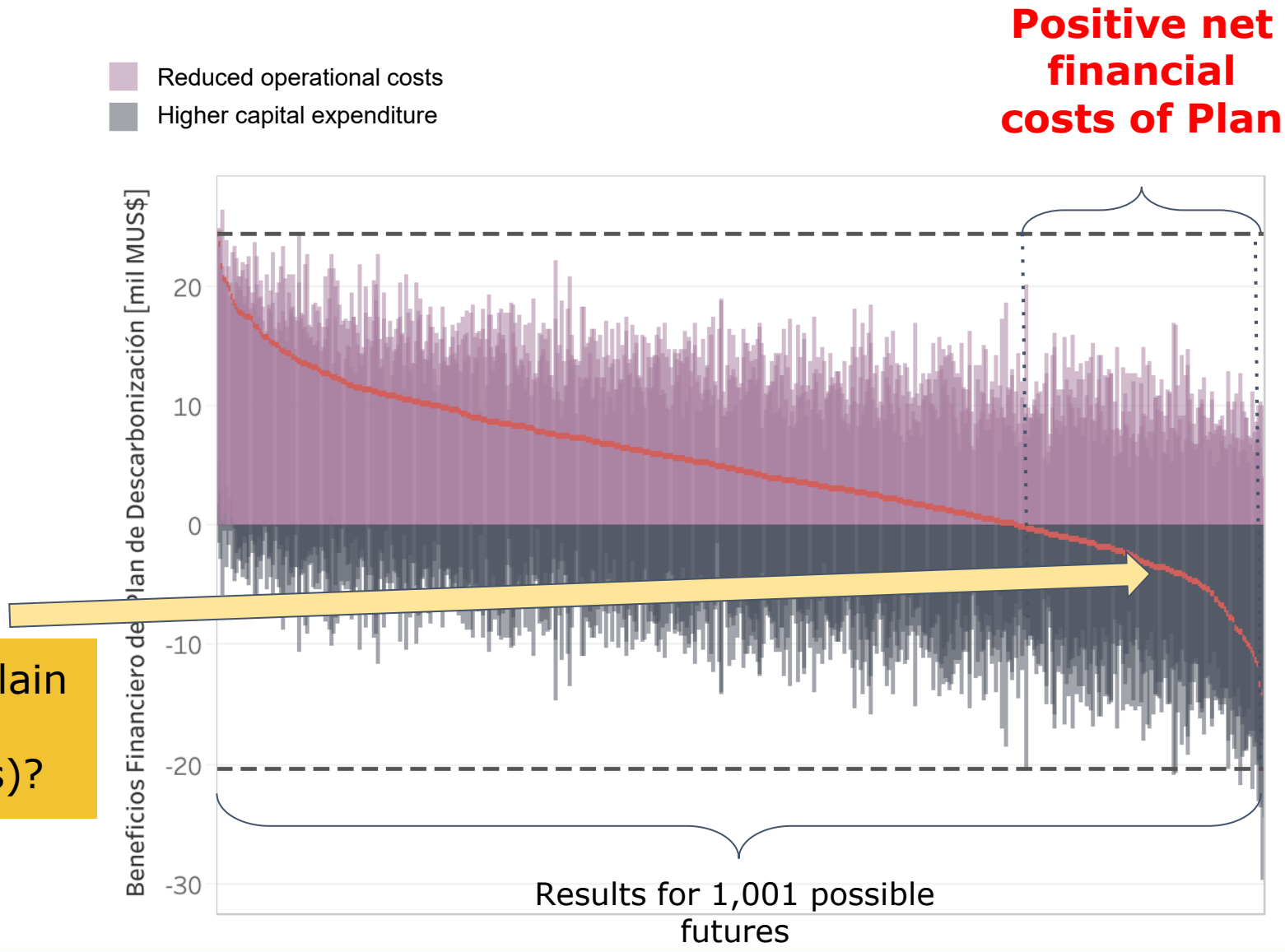
The plan brings economic benefits in most of the futures

Result for baseline assumptions

Results for 500 of 1,000 plausible futures

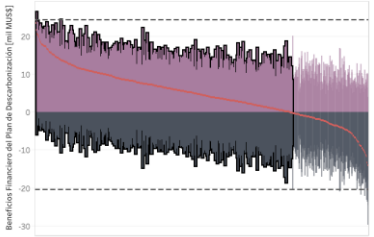
X: Uncertainties
Costs of technologies Efficiencies of technologies Demand for private, public, and freight transportation Availability of renewable resources
L: Policies
Transportation policies

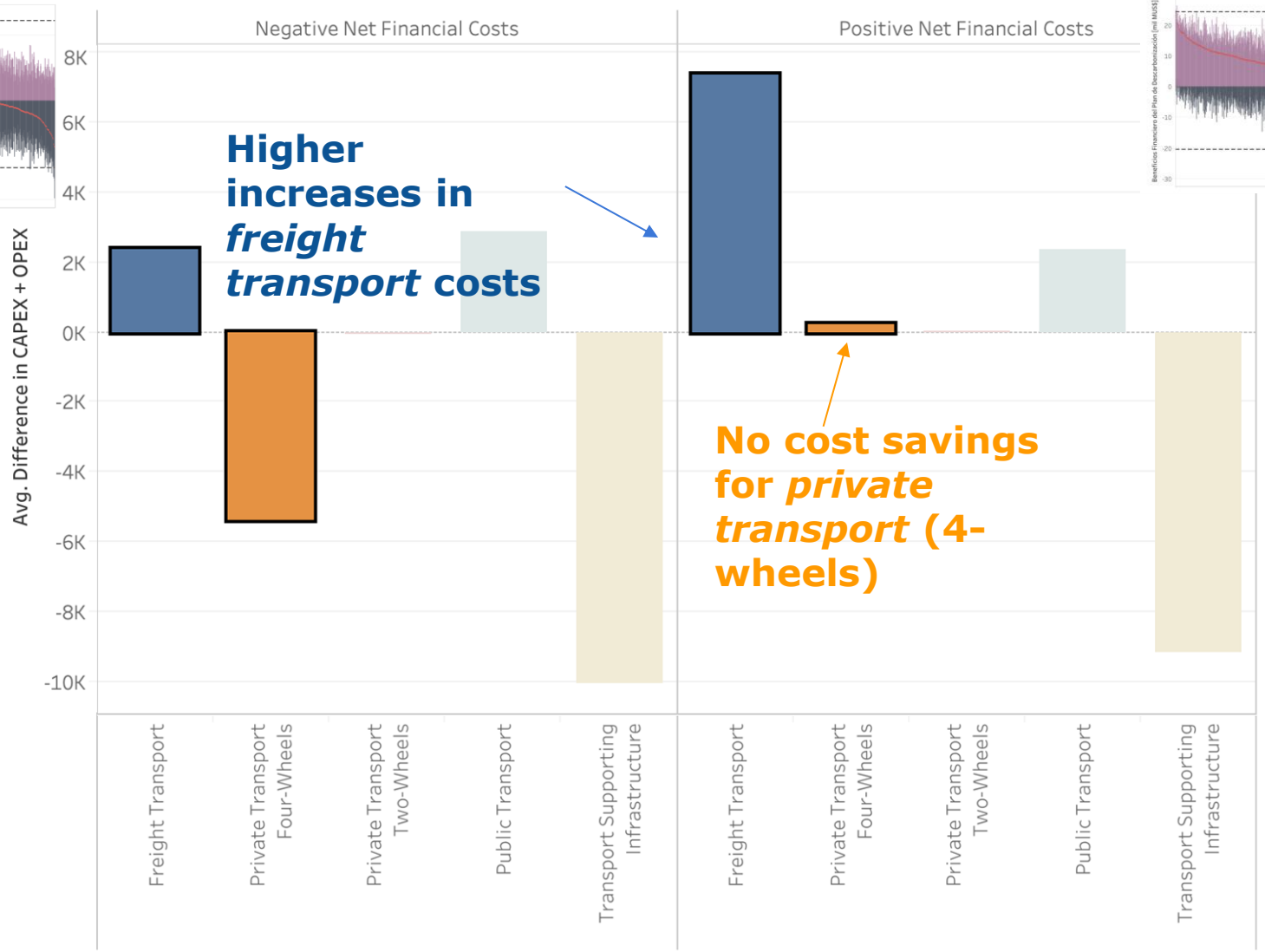
In some futures, increased capital costs are higher than reductions in operating costs

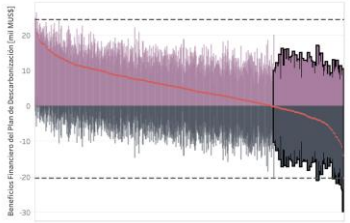


What factors explain these outcomes (23% of all cases)?

Net financial costs driven by costs in the freight and private transport sub-sectors







Scenario discovery identifies key drivers of net financial costs

Vulnerability:

- Change in cost of electric private vehicles **> -43%**

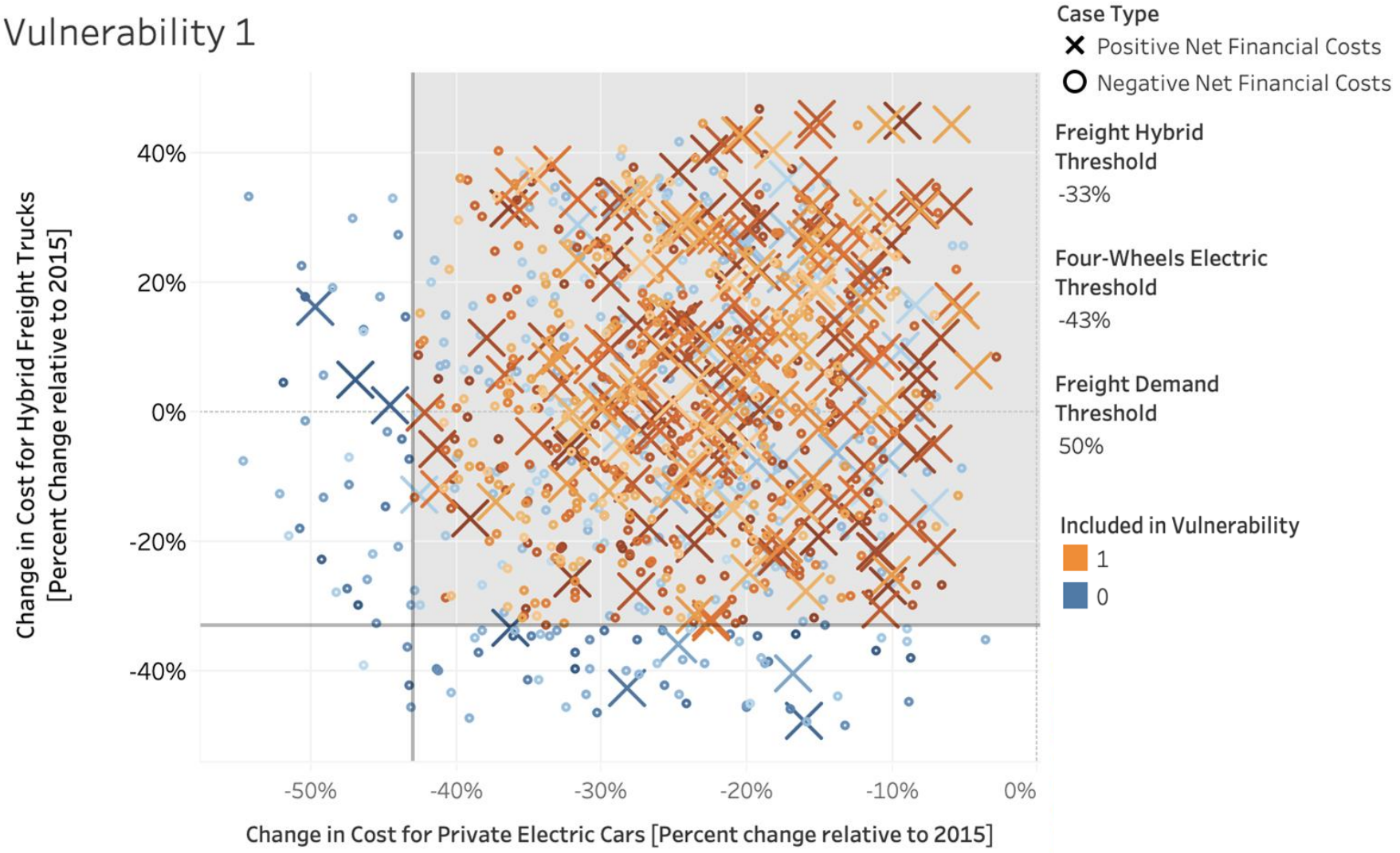
  AND

- Change in cost of hybrid heavy freight transport **> -33%**

  AND

- Change in demand for heavy freight **> 50%**

Explains 85% of positive net financial costs (Xs)



Scenario discovery further assesses conditions that could counteract the vulnerability

Three key concurrent conditions:

- *Heavy freight demand* not too high (growth below 180%)

AND

- Lower *cost of hydrogen heavy freight vehicles* (cost reductions below 16%)

AND

- *Costs of four wheel carbon-based private vehicles not too low* (costs reductions not higher than 14%)

Now Implementing in Africa: Botswana and Uganda

Applying RDM to build evidence, mobilise finance and strengthen national capacity in Sub-Saharan Africa

BW Botswana — Long-Term Strategy

Focus: Developing Botswana's first comprehensive Long-Term Strategy (LTS) to 2050

Approach: RDM co-creation with government ministries, private sector and civil society

Modelling: CLEWS++ integrated framework: energy, land use, water and emissions pathways

Uncertainty: Stress-testing across diamond price, electricity demand and climate scenarios

Capacity Building

Training national modellers in OSeMOSYS / CLEWS++ so teams can independently extend models and support future policy studies

UG Uganda — NDC 3.0 Development

Focus: Co-creating Uganda's NDC 3.0 — aligned with the National Development Plan IV (2025–2030)

Approach: Multi-stakeholder workshops linking mitigation measures to development priorities

Modelling: CLEWS++ (OSeMOSYS-LEAP) quantifying co-benefits across energy, AFOLU and waste

Partners: Ministry of Water & Environment, Makerere University Business School, AFD, World Bank

Capacity Building

Joint delivery with Makerere University; training government analysts on CLEWS++ scenario design, RDM methods and results communication

What RDM Delivers for Decision-Makers

Moving from “what’s the best plan?” to “under what conditions does our plan succeed?” — a fundamentally more useful question for national climate strategy.

NDC / LTS targets grounded in evidence

Instead of aspirational round numbers, RDM produces specific thresholds (e.g., “RE 70–80%”) that are computationally verified to deliver the best outcomes across hundreds of futures. Targets become defensible in international reporting.

Investment priorities backed by trade-off analysis

Decision-makers see not just “this action costs X” but “this action delivers net benefits in 85% of futures even when fuel prices double.” Enables smarter allocation of limited public and donor resources.

Risk-aware strategies that survive surprises

Traditional least-cost plans break when assumptions change. RDM-tested strategies are designed to perform well across a wide range of GDP growth, fuel prices, and technology costs — the factors governments cannot control.

National ownership through participatory design

Stakeholders define the uncertainty ranges, validate the models, and co-create the robustness conditions. The result is not an external consultant’s recommendation — it’s the country’s own evidence-based strategy.

Climate Compatible Growth

UKaid from the British people

"The views expressed in this material do not necessarily reflect the UK government's official policies."

University Partnership:

University of Cambridge
The Open University
Climate Parliament
University of Strathclyde Glasgow
University of Oxford
Centre for Global Equality
UCL
Loughborough University
STEER – Centre for Sustainable Transitions: Energy, Environment and Resilience
KTH Vetenskap och Konst
Imperial

Thank you

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