ACCELERATING THE BREAKTHROUGH OF CLIMATE TECHNOLOGIES

DRIVING EXPONENTIAL GROWTH IN CLIMATE TECHNOLOGIES WITH POSITIVE TIPPING POINTS

Brochure

Systemiq, June 2025

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ACCELERATING THE BREAKTHROUGH OF CLIMATE TECHNOLOGIES
EXECUTIVE SUMMARY

History suggests that the adoption of a new technology can switch from a linear to an exponential pace when a tipping point is reached

A tipping point is a moment in time when a new technology becomes more competitive than incumbent technologies across three A's and Reinforcing Feedback Loops are in place

AFFORDABILITY | **ATTRACTIVENESS** | **ACCESSIBILITY**

Reinforcing feedback loops

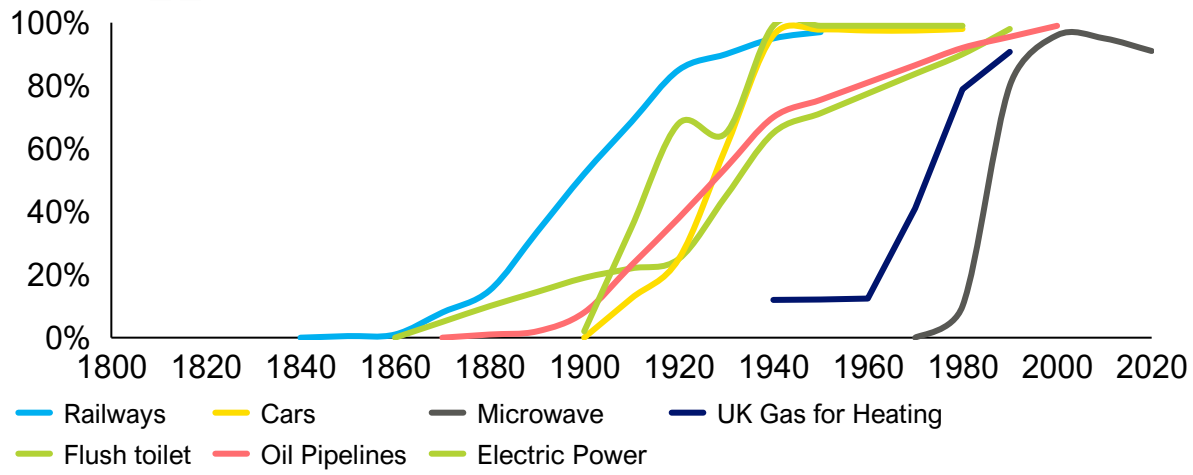
Systemiq's four step tipping point methodology to accelerate the breakthrough of climate technologies

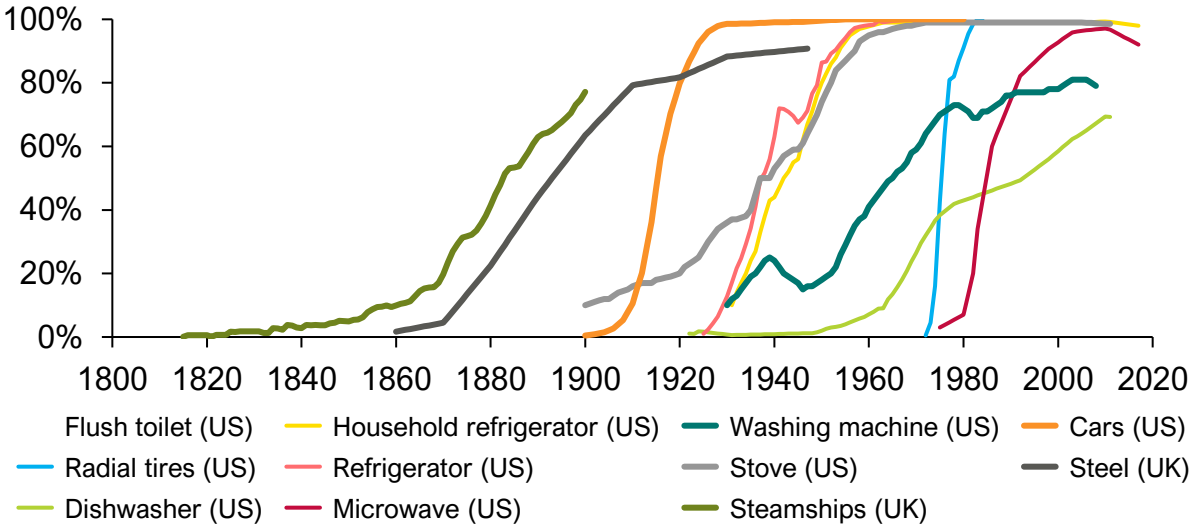
A	B	C	D
Select high impact tipping points & cascades	Identify (super) levers to overcome barriers to exponential growth	Create concrete action plan	Catalyse tipping points, and capture value from it

Example clients:

Eneco, ARC'TERYX, APM TERMINALS Lifting Global Trade, European Bank for Reconstruction and Development

Historic adoption curves of new technologies over time, (%)





For more information visit: https://www.systemiq.earth/tipping-points-technology-breakthrough/

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ABOUT SYSTEMIQ: OUR PURPOSE IS TO ACCELERATE SYSTEMIC CHANGE FOR A PROSPEROUS WORLD

Who we are

Founded in 2016, Systemiq is the world's first pure play **"systems-change" company** accelerating the transition to a net-zero, nature positive, and inclusive economy.

What we do

Systemiq **builds** ambitious coalitions to reshape our economy, **advises** leading companies on how to win the transition, **supports** governments and policy-makers drive change, **catalyzes** large-scale capital to accelerate action, and **incubates and invests** in innovative businesses.

How we work

We take a **diagnose – design – disrupt** approach to identify the root causes of inaction, design new approaches, expand the solution set, and work with all stakeholders to identify tipping points and scale solutions that tip the system. We work across **five platforms**:


Energy


Materials


Nature-Food


Finance


Cities

Quick facts:

- ~380 employees, ~20 partners
- HQ in London with 7 offices across Europe, Asia, and South America and a growing presence in North America
- Certified BCorp
- Diverse talent pool drawing from industry, consulting, banking, the public sector, non-profits, and academia
- 160 advisory and science-based thought leadership projects in 2023
- Coalition founder and leader, including:

The Food and Land Use Coalition

Circular Economy Initiative

Energy Transitions Commission

MISSION POSSIBLE PARTNERSHIP

BLENDED FINANCE TASKFORCE

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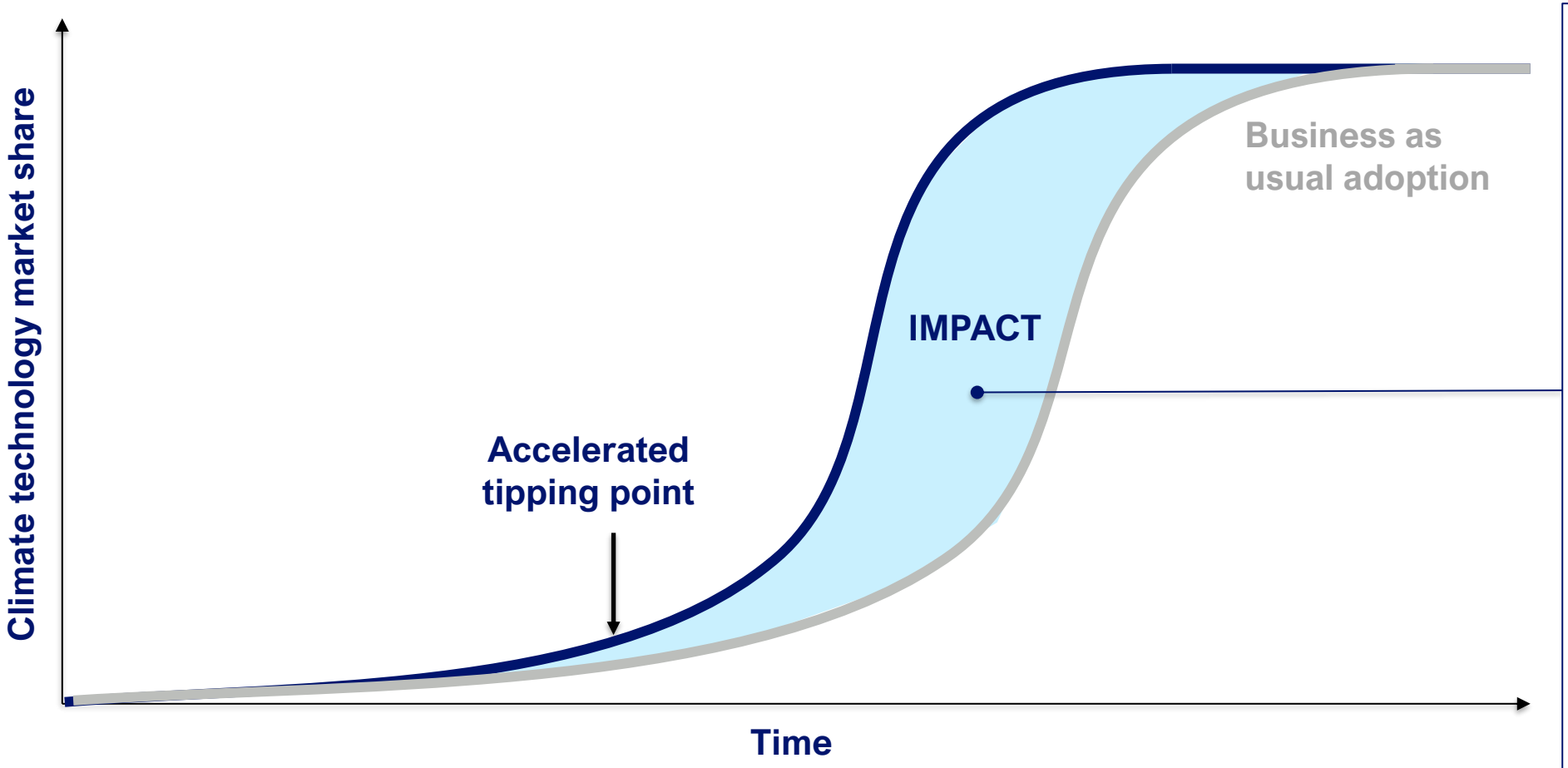
ACCELERATING TIPPING POINTS FOR CLIMATE TECHNOLOGIES FAST-TRACKS ECONOMIC IMPACT AND HELPS REDUCE CLIMATE CHANGE

Illustrative impact of accelerating a tipping point for a climate technology



Accelerating tipping points leads to impact:

- **Climate** from emission reductions and removals
- **Economic** from earlier, competitive, exponential uptake
- **Other** depending on the technology such as public health benefits, energy independence, biodiversity, material extraction etc.

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A TIPPING POINT TOWARDS EXPONENTIAL GROWTH REQUIRES TECHNOLOGY COMPETITIVENESS AND REINFORCING FEEDBACK LOOPS

A tipping point is a moment in time when a new technology becomes **more competitive** than incumbent technologies across the **three A's**

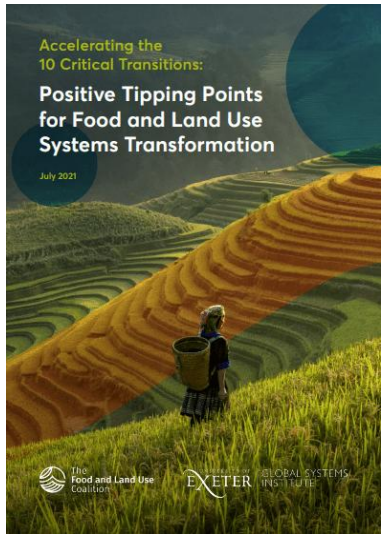
AFFORDABILITY | **ATTRACTIVENESS** | **ACCESSIBILITY**

and **reinforcing feedback** loops are in place, such as

Social contagion | Increasing returns to adoption | Information cascades

(Social-) Ecological positive feedbacks

History suggests that the **adoption of a new technology** can **switch** from a **linear to an exponential pace** when a tipping point is reached



2021 Report on positive tipping points for food and land use by:

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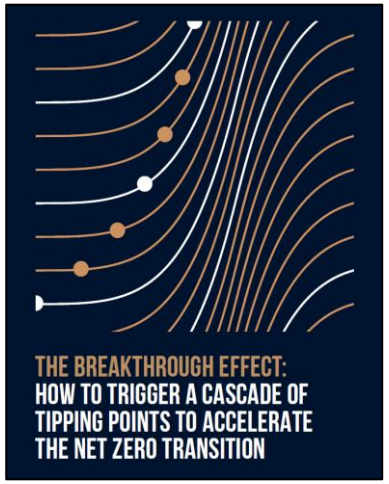
The Food and Land Use Coalition

University of Exeter



2023 Report on the breakthrough effect of tipping points by:

SYSTEMIQ

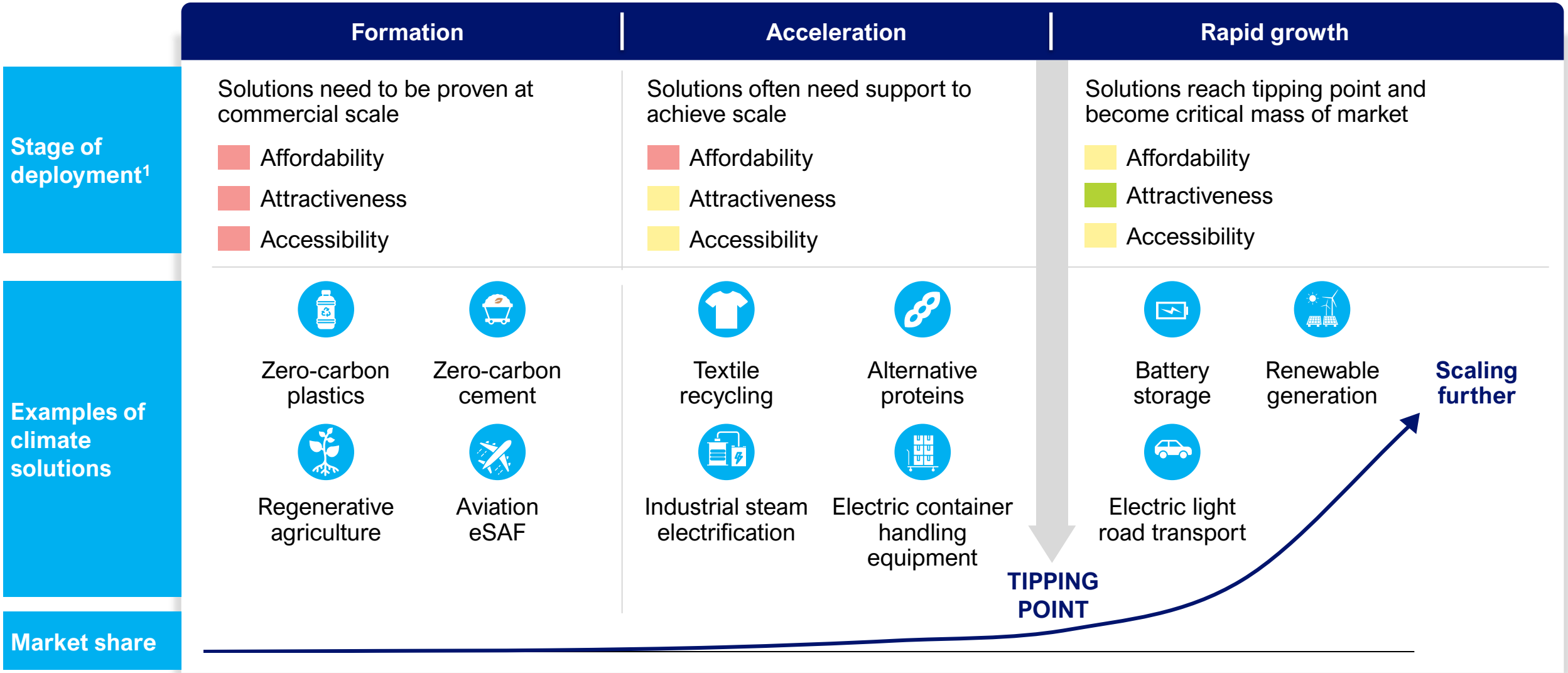
University of Exeter

(Link embedded in image)

Source: www.systemiq.earth/resource-category/breakthrough-effect/

CLIMATE TECHNOLOGIES NEED TO MOVE PAST A TIPPING POINT TO REACH EXPONENTIAL GROWTH

Illustrative overview, not exhaustive



1 Please note that the colouring in this row is an indication of the competitiveness against the conventional solution. Not all technologies will follow the same trajectory.

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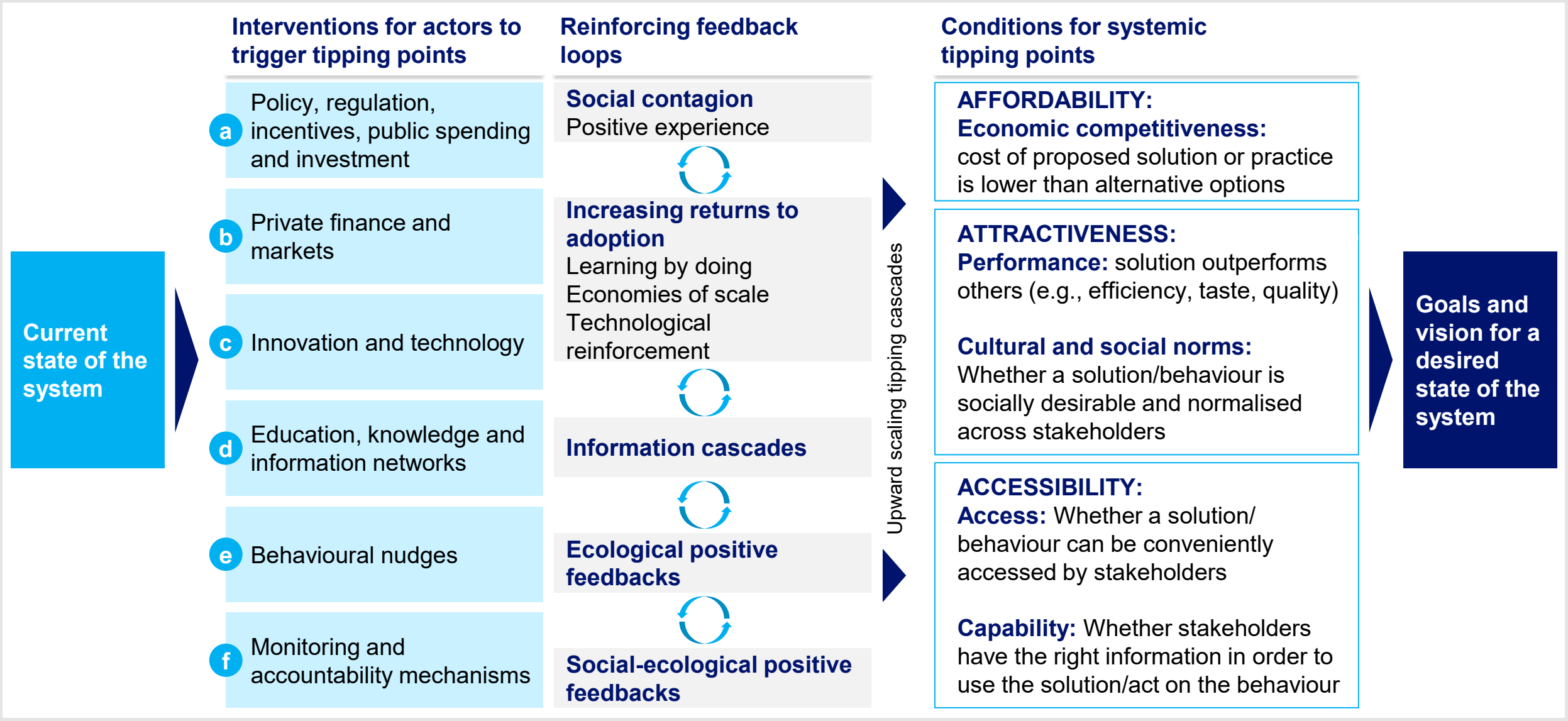
TARGETTED INTERVENTIONS CAN TRIGGER TIPPING POINTS



Please note: this framework does not include exogenous factors directly, but we recognise that they exist and can have fundamental impacts on the systems we are exploring here.
Source: Adapted from Food and land use coalition (2021)

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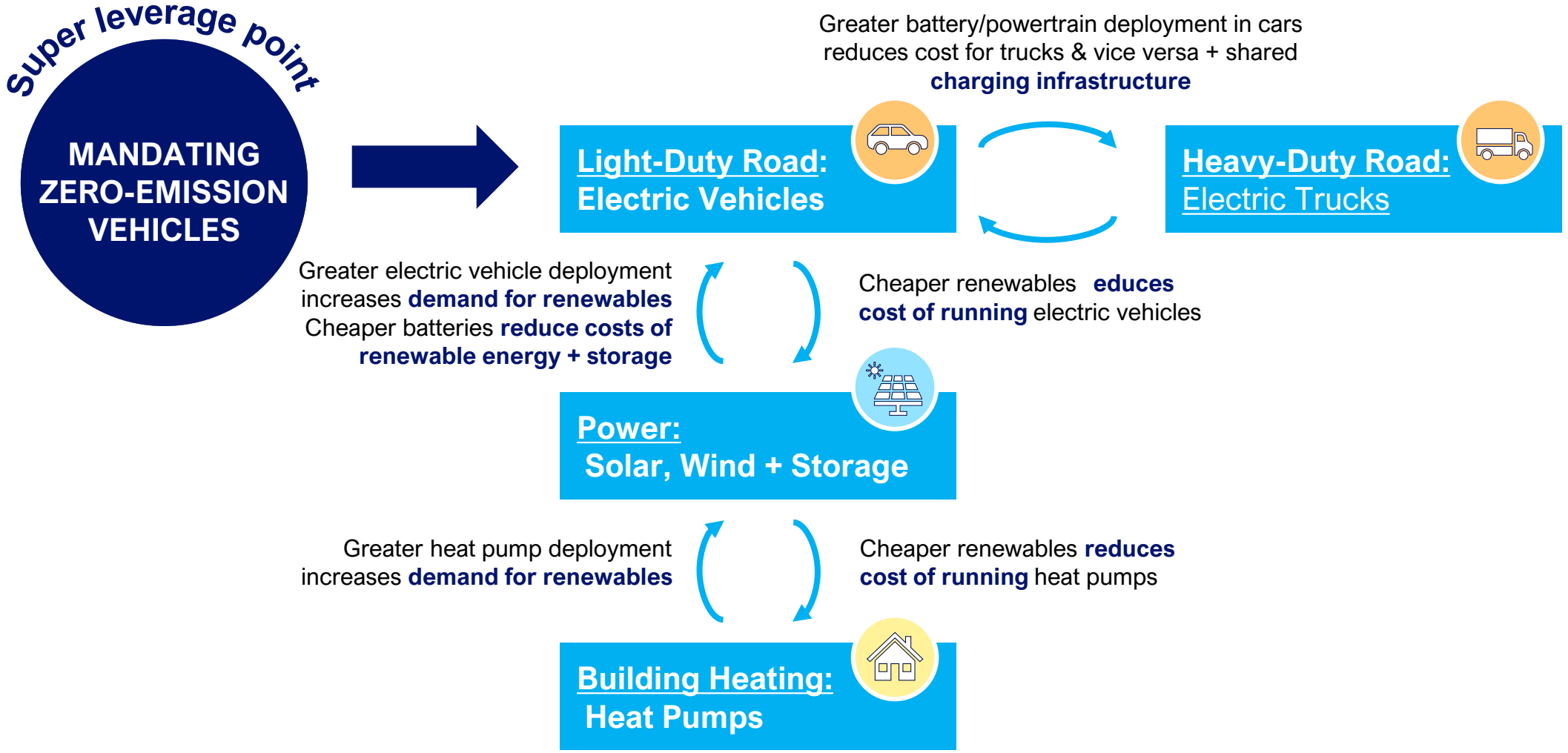
SUPER LEVERAGE POINTS CAN TRIGGER A CASCADE OF TIPPING POINTS

Example of a tipping point cascade



Source: Simplified overview from: The Breakthrough Effect (Systemiq 2023); https://www.systemiq.earth/resource-category/breakthrough-effect/

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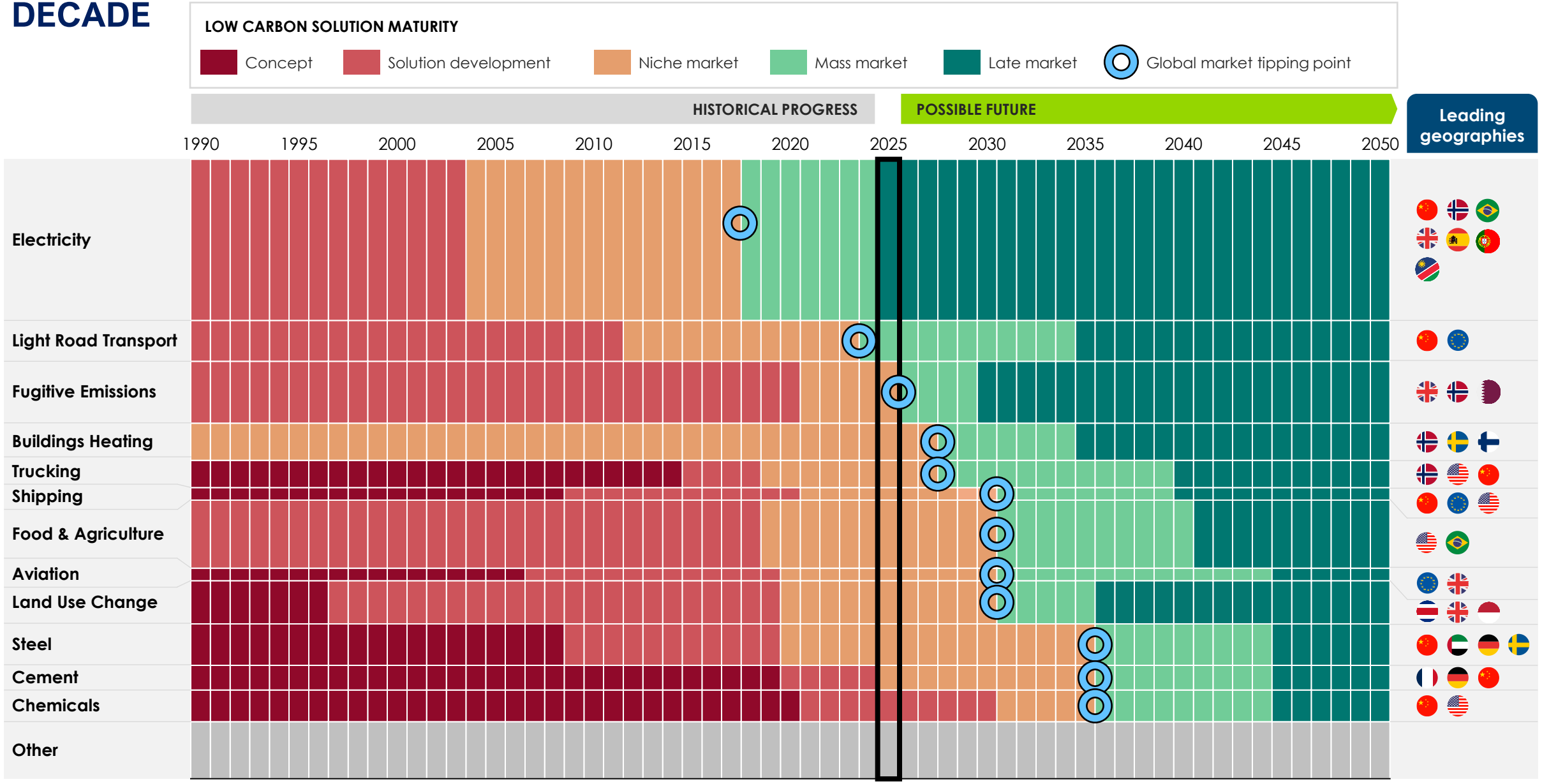
TECHNOLOGIES FOR ABOUT 45% OF EMISSIONS EXPECTED TO REACH A TIPPING POINT THIS DECADE



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Source: The decisive decade for climate technologies (ETC, Systemiq 2025) LINK

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SYSTEMIQ'S FOUR STEP TIPPING POINT METHODOLOGY TO ACCELERATE THE BREAKTHROUGH OF CLIMATE TECHNOLOGIES

A	B	C	D
Select high impact tipping points & cascades	**Identify (super) levers to overcome barriers to exponential growth**	**Create concrete action plan**	**Catalyse tipping points, and capture value from it**
Ordering of technologies that are closest or furthest away from exponential growth. Identification of **tipping point cascades**	**Identification of levers with an outsized impact** on accelerating technology uptake	**Implementation plan** based on **high-impact, concrete actions**	**Roll out of priority actions** to catalyse exponential growth
Example outcome • Selection of high-impact tipping points • Identification of tipping point cascades	**Example outcome** • Barriers towards a tipping point and levers to overcome these • Necessary conditions for the exponential scale up of a climate technology	**Example outcome** • Concrete actions to trigger tipping points, by actor or group of actors • Roadmap where and how actions can be implemented	**Example outcome** • Policy influencing • Corporate strategy roadmaps • Coalition building

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EXAMPLES OF OUR WORK BASED ON THE METHODOLOGY

Example organizations

What we have done

Corporate strategy

- Company decarbonization roadmap
- Market entry strategy

Investment strategy

- Portfolio alignment towards capturing value from exponential growth
- Investment strategy for outsized impact on triggering tipping points

Unlocking new market

- New market sizing
- Action planning to overcome new market failures
- Market making conditions and mechanisms
- Scenarios for market adoption of new technologies

Policy and regulation

- Policy & regulation framework for a technology tipping point
- Gap assessment of existing local policy & regulation

Collective action (corporates/others)

- Case for collective action
- Convening of stakeholders
- Consortium work programme development and execution

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CASE EXAMPLE: BATTERY-ELECTRIC CONTAINER HANDLING EQUIPMENT (BE-CHE) IS THE MOST COMPETITIVE TECHNOLOGY TO DECARBONIZE CONTAINER TERMINAL OPERATIONS

Container handling equipment (CHE) is currently diesel-powered – providing a 10-15 Mt decarbonization opportunity

Global fleet: 100,000-120,000 units across 940 container ports

Annual emissions[1]: 10-15 $MtCO_2e$

	**Terminal tractors**	~52,000 units ~3-4 MtCO2e
	**Straddle carriers**	~7,500 units ~1-2 MtCO2e
	**Reach stackers**	~9,300 units ~1-2 MtCO2e
	**Ship-to-shore**	~7,800 units ~2-3 MtCO2e
	**Rubber tyre gantry**	~21,300 units ~3-4 MtCO2e

A SELECT HIGH IMPACT TIPPING POINTS: Battery-electric CHE is more competitive than hydrogen-electric CHE

Potential clean CHE solutions	Status on tipping point dimensions[2]		
Solutions	**Affordability**	**Attractiveness**	**Accessibility**
Battery-Electric CHE (BE-CHE)	Estimated total costs of ownership (TCO) higher than Diesel-CHE	• No scope 1 emissions (and lower scope 2) • Quiet • Low vibration levels	Electricity infrastructure not in place, and operators / OEMs unsure which designs to invest in
Hydrogen-Electric CHE (HE-CHE)	Estimated average TCO higher than BE-CHE; expected to remain as technology develops	• No scope 1 emissions (and lower scope 2) • Quiet • Low vibration levels	Not accessible in next few years: prototypes not available yet, and projected green H2 volume far too low

BE-CHE is more competitive than HE-CHE in vast majority of use cases

Legend: Better than current | Several barriers | High barriers

(1) Scope 1 and 2; (2)This this can be high-level or granular and can be combined with step B
Source: Reaching a tipping point in container handling equipment (link

More information available on www.zepalliance.com

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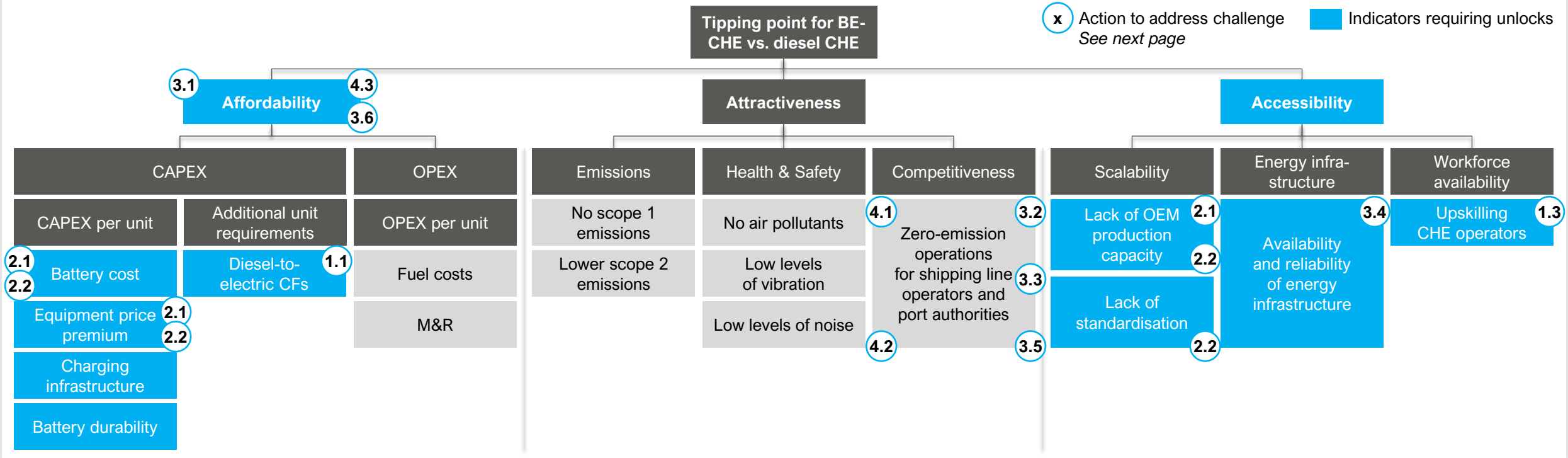
CASE EXAMPLE: AFFORDABILITY AND ACCESSIBILITY BARRIERS LEAD TO KEY LEVERS TO REACH A TIPPING POINT IN BE-CHE

B IDENTIFY HIGH IMPACT LEVERS: Tipping point 'tree' based on extensive stakeholder engagement and quantitative modelling



Levers			
	Technology learning effects	**Port authorities' concession renewal or extension practices**	**Standardisation & decoupling**
	Reduced charging downtime	**Establishment of green shipping corridors by shipping line operators**	**Power purchase agreements (PPAs)**
	Standardisation & decoupling	**Demand signals**	**Workforce training**

More information available on www.zepalliance.com

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CASE EXAMPLE: COLLABORATION BETWEEN ACTORS IS CRUCIAL FOR THIS TECHNOLOGY TO START SCALING EXPONENTIALLY

Actions requiring stakeholder collaboration

C CREATE CONCRETE ACTION PLAN: High level overview per stakeholder

Terminal operators

- 1.1 Re-invent operations to enable electrification
- 1.2 Develop terminal-level electrification roadmaps
- 1.3 Plan work-force training

Terminal operators & OEMs

- 2.1 Send strong demand signals
- 2.2 Develop technology standards

Port authorities & affiliated government entities

- 3.1 Introduce financial benefits for decarbonized concession bids
- 3.2 Require that bids for new concessions rely on decarbonised fleets
- 3.3 Extend concession durations for operators decarbonising their fleet
- 3.4 Enable infrastructure adjustments for decarbonisation
- 3.5 Introduce, or extend existing, clean air mandates for CHE
- 3.6 Provide direct financial support to secure first investments

Shipping line operators

- 4.1 Engage with customers to identify requirements for end-to-end zero-emission supply chairs
- 4.2 Include zero-emission CHE in green shipping corridor requirements
- 4.3 Financially compensate terminal operators for value-add of zero-emission CHE

NOTE: Actions 2.1, 2.2 and 3.4 were the focus of the ZEPA 2024 programme
More information available on www.zepalliance.com

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CASE EXAMPLE: THE ZERO EMISSION PORT ALLIANCE (ZEPA) COLLABORATES TO RESOLVE CORE BARRIERS TO AFFORDABILITY AND ACCESSIBILITY OF BE-CHE

D CATALYSE TIPPING POINTS: Convene action-oriented coalition

ZEPA launched in 2024 with 12 members, from across the value chain

PATRICK
KEMPOWER
AARHUS HAVN
APM TERMINALS
Lifting Global Trade
DP WORLD
SSA Marine
A Carrix Enterprise
SANY
Port of Rotterdam
ZPMC
CATL
INDUCTEV
ROCSYS
Autonomous charging

Results end of 2024

Projected Demand

Voluntary Design Standards

Power Infrastructure Roll-out

ZEPA = Zero Emissions Port Alliance
More information available on www.zepalliance.com

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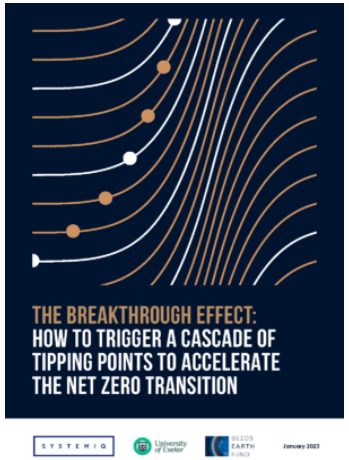
EXPLORE OUR WORK ON TIPPING POINTS SELECTED PUBLICATIONS

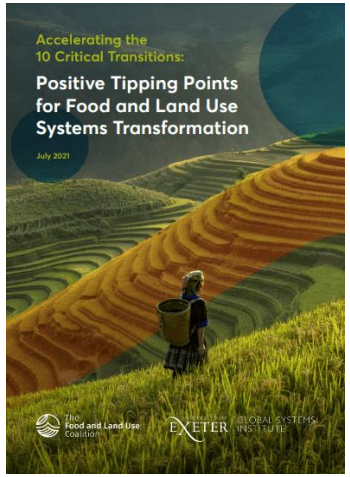
Tipping point framework



The Breakthrough Effect (2023)

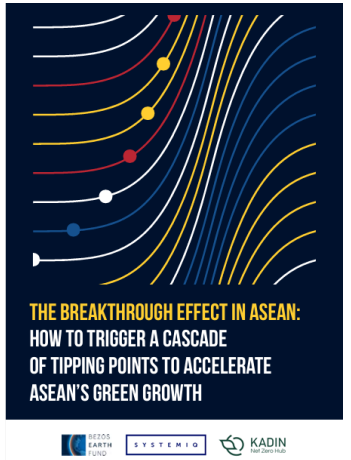
Defines three "super-leverage points" that could trigger a cascade of tipping points for zero-carbon solutions in sectors covering 70% of global greenhouse gas emission

Sectors and regions



Positive Tipping Points for Food and Land Use Systems Transformation(2021)

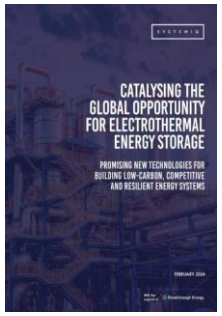
Finds that small, targeted changes in food and land use systems can trigger large, often irreversible, positive responses for people and the planet.



The Breakthrough Effect in ASEAN (2023)

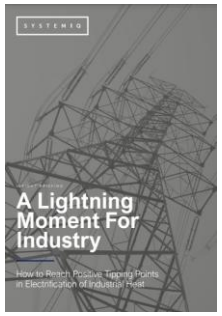
A regional follow up of the global Breakthrough Effect. Identifies two super-leverage points that could trigger a cascade of tipping points across a total of eight sectors that represent 50% of ASEAN's emissions

Technologies



Catalysing The Global Opportunity For Electrothermal Energy Storage (2024)

Lays out how a tipping point in the electrification of industrial heat could be achieved with electrothermal energy storage



A Lightning Moment for Industry (2024)

Lays out how industrial companies using under 400^{0}C heat can find the right pathway to switch to electrification ahead of the curve – thereby avoiding future infrastructure bottlenecks.

Reaching a tipping point in battery-electric container handling equipment (2023)

Describes how the electrification of port operations could be accelerated by deploying battery-electric container handling equipment

ZEPA
Zero Emission Port Alliance

The zero-emission port alliance (2024)

An industry-wide strategic alliance, dedicated to making battery-electric container handling equipment affordable and accessible. Systemiq holds the secretariat

The Textile Recycling Breakthrough (2025)

Showcases how polyester textile recycling tech nologies can breakthrough, with policy and other stakeholder ac tion

Note: click on image to follow link.
Source: https://www.systemiq.earth/tipping-points-technology-breakthrough/

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