



DEVELOPMENT WITHOUT DEPLETION

Engineering prosperity and preserving natural capital

THE CENTRAL QUESTION

Can the world deliver the energy, water, cooling, food and infrastructure required for human development without financing prosperity through the liquidation of natural capital?

Annual Report of the Marquette S-Lab | Governance + Sustainability

State of the Sustainable Economy | 2026

Building something durable

Last year, this report examined the sustainability recession and the collision between rising artificial-intelligence demand and an energy system that was not being built fast enough. This year we take one step back and ask a more fundamental question: what exactly is sustainability meant to sustain?

The answer cannot be economic stagnation. Hundreds of millions of people still lack electricity, billions lack clean cooking or safe water, and much of the developing world needs more housing, transportation, cooling, industry and infrastructure. Development is not an optional preference of wealthy societies. It is a moral and political imperative.

But growth that consumes forests, aquifers, soils, biodiversity and a stable climate without recognizing the loss is not durable development. It is asset liquidation reported as income. Gross domestic product can rise even as the natural foundation of future prosperity shrinks. The central challenge is therefore not development versus nature. It is development without depletion.

This report rejects two easy answers. Degrowth mistakes scarcity for stewardship and offers no credible path for countries that still need far more energy and productive capacity. Cornucopianism makes the opposite mistake: it assumes that technology can substitute for every ecological function and that prices will always reveal damage before it becomes irreversible. Both positions avoid the harder work of engineering abundance within ecological limits.

That harder work is where S-Lab belongs. Engineering expands what is possible. Finance determines what can scale. Governance determines whether projects are credible, durable and fair. The progress of W+E Forward - from an S-Lab spin-off to a transaction linking Carbon X, AT&T connectivity and measurable methane abatement - illustrates what practical sustainability can look like. S-Lab is also testing the case for a Carbon Markets R&D Hub and examining the questions that would have to be answered before a credible water-credit protocol could be developed.

Our conclusion is constructive but clear-eyed. A richer world does not have to be a diminished world. Yet durable change will not rest on permanent political consensus. Political will can open a window, bounded public policy and international cooperation can reduce barriers, but cost, performance and reliable demand determine what ultimately scales. Avoiding depletion will also require societies to value natural capital before it is lost, build far more infrastructure than current politics appears ready to permit, and judge sustainability by delivered outcomes rather than labels.

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A practical agenda for prosperity and stewardship

01	The central question Why development and natural capital must be considered on the same balance sheet.
02	The age of energy addition Clean energy is expanding rapidly, but fossil demand is not yet being displaced at the required scale.
03	What actually drives substitution Cost, political will, bounded public policy and realistic international coordination.
04	Why degrowth is the wrong answer The useful critique, the category error and the development reality.
05	Engineering abundance Energy, cooling, water, food and cities as solvable design and infrastructure problems.
06	Where engineering stops Natural assets that are costly, uncertain or impossible to replace.
07	Finance and governance How capital allocation, measurement and durable rules convert technology into outcomes.
08	S-Lab in action W+E Forward, the AT&T transaction and emerging carbon- and water-market research.
09	Recommendations Eight principles for businesses, investors, universities and policymakers.

Key findings

- Development is non-negotiable. The world still needs much more energy, water, cooling, housing, mobility and productive capacity.
- The dominant global pattern remains energy addition, not yet a global transition in which one energy system displaces another. Clean technologies are growing rapidly, but oil, gas and coal demand all increased in 2025.
- Durable substitution is driven by cost, performance and reliable demand. Political will, bounded industrial policy and international coordination can accelerate it, but all are volatile and constrained by national interest.
- Degrowth correctly challenges waste and the limits of GDP, but fails as a global development strategy and risks freezing today's inequality in place.
- Engineering can push the frontier outward but cannot recreate every lost ecosystem or species. Natural capital must be treated as a stock and protected through an avoid-minimize-restore-compensate hierarchy.
- W+E Forward shows how measurable outcomes, corporate demand, connectivity and finance can form a credible transaction, while proposed carbon- and water-market research extends that model cautiously.

Development and natural capital belong on the same balance sheet

Natural capital is the stock of forests, water, soils, minerals, biodiversity and ecosystem functions that supports economic activity and human life. A World Economic Forum-PwC analysis estimated that more than half of global GDP is moderately or highly dependent on nature and its services. Yet these assets are often absent from financial accounts until their degradation appears as higher costs, lower productivity, litigation, migration or physical loss.¹

The accounting problem is straightforward. A country can raise GDP by cutting a forest, pumping an aquifer or exhausting a fishery. The income is recorded; the decline in the underlying asset often is not. A company can report strong margins while relying on free water, stable weather, pollination, flood protection or waste assimilation that it neither owns nor maintains. In both cases, current income can be overstated because the balance sheet is incomplete.

The development problem is equally straightforward. The World Bank estimates that 847 million people lived in extreme poverty in 2024 under its updated international poverty line of \$3.00 per day, and progress has slowed sharply. Low-income countries need faster, more inclusive growth, while wealthier economies must reduce the carbon and natural-resource intensity of that growth. A universal prescription of economic contraction ignores these radically different starting points.²

655M people still lack access to electricity ³	2.0B people still lack access to clean cooking ³
>50% of global GDP is moderately or highly dependent on nature and its services ¹	ALL major energy fuels and technologies grew in 2025 ⁴

A better definition of sustainable development

Sustainable development should not mean minimizing economic activity. It should mean increasing human capability while preserving or rebuilding the assets that make future capability possible. The relevant question is not whether GDP rises or falls in a given year. It is whether total wealth - produced, human, social and natural - is being expanded or depleted.

S-LAB THESIS

The objective is more human value per unit of carbon, land, water and material use - while placing firm limits around natural assets that are irreplaceable or close to irreversible loss.

The age of energy addition

The global energy system is changing, but the word transition implies a cleaner substitution than the data show. In 2025, every major fuel and technology grew. Solar photovoltaic power supplied more than one-quarter of the increase in global energy demand, natural gas supplied 17 percent, and annual renewable-capacity additions reached a record 800 gigawatts. Yet oil, gas and coal demand also increased, and energy-related CO2 emissions rose by approximately 0.4 percent.⁴

This is not evidence that clean-energy investment has failed; rather, its impact to date has largely been additive. The IEA estimates that technologies deployed since 2019 avoided fossil-fuel demand equal to roughly 7 percent of annual global use and prevented about 3 billion metric tons of CO2 emissions in 2025. Without that buildout, the system would be materially more carbon intensive. But avoided growth is not the same as absolute displacement.⁴

THE DISTINCTION THAT MATTERS

Clean technologies are winning large shares of new demand. They are not yet shrinking the global fossil system fast enough to meet climate objectives.

Why the transition narrative keeps failing the development test

Energy demand grows when people become wealthier, cities expand, industry deepens, cooling spreads and digital infrastructure scales. That demand is not a policy error. It is the physical expression of development. Where grids are weak, capital is scarce and reliability is paramount, countries will build the energy system they can finance and operate - often a mixture of renewables, hydro, gas, coal, diesel replacement and distributed systems.

The correct objective is therefore not to suppress demand. It is to build clean supply faster than total demand grows, then electrify end uses when electricity is genuinely cheaper, reliable and convenient. This requires transmission, distribution, storage, firm generation, permitting, finance and institutional capability. It is a construction agenda, and not yet a global transition in the strict sense.

Energy abundance is a sustainability condition

The 2026 SDG 7 report estimates that 655 million people still lack electricity and two billion lack clean cooking. More than 560 million of those without electricity live in Sub-Saharan Africa. Asking these populations to accept energy scarcity is not climate policy; it is the preservation of poverty.³

The sustainable path is abundant, increasingly low-carbon electricity combined with cleaner fuels where electrification is not yet practical. That may raise energy use even as it lowers emissions per unit of human benefit. It also demands differentiated expectations: affluent economies should move first and faster on efficiency and decarbonization, while developing economies require capital and technology that do not impose a large growth penalty.

Cost and performance determine what endures

A cleaner technology does not displace an incumbent merely because policymakers prefer it or investors can describe its environmental benefits. Durable substitution occurs when the new system becomes cheaper, more reliable, easier to finance, more convenient or materially less risky. Environmental preference may create an early market. Cost and performance create a mass market.

Political will still matters. It can establish boundaries, authorize infrastructure, support research and create temporary openings for investment. But political support is inherently unstable. Elections, fiscal pressure, public resistance and geopolitical shocks can reverse policy long before capital-intensive systems reach maturity.

THE DURABILITY SEQUENCE

Political will can open a window. International coordination can widen the opportunity where interests overlap. Carefully bounded public policy can reduce barriers. Cost, performance and reliable demand determine what survives.

Industrial policy: a limited tool with substantial risks

LEGITIMATE PUBLIC ROLE

- Fund foundational research and shared infrastructure whose benefits cannot be fully captured by one investor.
- Reduce first-of-a-kind and coordination risk where a credible path to competitive scale exists.
- Set measurable performance, safety and claims standards, then allow technologies to compete.
- Use transparent, time-limited support with clear exit criteria and exposure to market discipline.

RECURRING GOVERNMENT FAILURE

- Officials cannot reliably identify long-term commercial winners or anticipate every system interaction.
- Subsidies can invite capture, preserve weak firms and lock capital into politically favored technologies.
- Mandates can outrun grids, supply chains, permitting capacity or consumer willingness to pay.
- Policy volatility can strand projects, raise financing costs and undermine the investment it sought to encourage.

International coordination without illusion

International cooperation remains important because climate, energy systems, supply chains and natural capital cross borders. Common measurement, interoperable standards, shared research, infrastructure finance and reciprocal market access can lower costs and enlarge markets. Yet the realist constraint cannot be wished away: states view energy and resources through security, sovereignty, development and strategic competition. They care about relative gains, distrust free riders and will not reliably sacrifice resilience or competitiveness on the assumption that rivals will do the same.

The practical response is not to abandon coordination, but to design it for incomplete participation. Narrow agreements around methane, shipping, refrigerants, nuclear safety, water basins, supply-chain data and market integrity are more credible than a single comprehensive bargain. Coalitions, bilateral arrangements, commercial contracts and common accounting can deliver progress where interests overlap, while differentiated obligations recognize that poorer countries cannot accept permanent limits on development.

REALIST DESIGN PRINCIPLE

International institutions can help verify commitments and reduce friction, but cannot manufacture alignment where national interests diverge.

Degrowth gets the diagnosis partly right - and the prescription wrong

Degrowth is not a single program. In its strongest academic form, it argues that affluent economies should deliberately reduce material and energy throughput while reorganizing institutions to protect well-being. Its critique deserves to be taken seriously: GDP is not the same as welfare; resource efficiency can be offset by rebound effects; and some forms of consumption create little social value while imposing large environmental costs.¹³

The problem begins when a critique of affluent excess becomes a general theory of development. The world still contains deep deficits in energy, housing, sanitation, transportation, health care and productive infrastructure. A strategy centered on less output cannot credibly explain how low-income countries will create jobs, finance public services, build resilient cities or escape dependence on subsistence agriculture.

It also risks freezing the current distribution of global wealth. Rich countries already possess the infrastructure, capital stock and institutional capacity that poorer countries are told not to replicate. The moral asymmetry is obvious: those who benefited from two centuries of resource-intensive development would retain the assets, while late developers would be asked to remain materially constrained.

The useful core of the argument

- Measure well-being and total wealth, not GDP alone.
- Reduce waste, planned obsolescence and environmental damage that creates no durable benefit.
- Shift tax and regulatory systems away from productive work and toward pollution, congestion and depletion where measurement is credible.
- Accept that high-income consumption patterns need not be the template for every country.

The category error

The category error is to convert lower resource intensity into a target of lower economic activity. The better objective is to grow the services people value - health, mobility, comfort, nutrition, communication and security - while reducing the physical throughput required to deliver them. That is an engineering and governance challenge. It is not a mandate for contraction.

A CONSTRUCTIVE ALTERNATIVE

Development without depletion: faster human progress, lower resource intensity, explicit protection of irreplaceable natural assets and no presumption that poverty is environmentally virtuous.

Engineering moves the frontier

Many sustainability debates are framed as moral choices between consumption and restraint. In practice, a large share of the problem is technical: how to provide more electricity, cooling, water, food, housing and mobility with less carbon, land, water and material intensity. Engineering does not erase trade-offs, but it changes their shape and often makes apparent scarcity avoidable.

The strongest sustainability strategy combines three rules: scale useful services, drive resource intensity down, and protect the natural assets for which substitution is costly, uncertain or impossible. The table below summarizes the practical agenda.

Domain	Development objective	Engineering levers	Natural-capital guardrail
Energy	Reliable, affordable power	Grids, renewables, nuclear, storage, efficiency, gas with stringent methane controls	Carbon, land and water intensity; local siting impacts
Cooling	Health, productivity and livability	Passive design, efficient heat pumps, district cooling, thermal storage	Clean electricity, low-impact refrigerants, urban heat management
Water	Safe supply for homes, farms and industry	Metering, leak control, reuse, desalination, smart irrigation	Basin limits, aquifer recharge, watershed and wetland protection
Food	More nutrition with less loss	Crop science, precision agriculture, cold chains, soil analytics	Soil health, biodiversity, water quality and land-conversion limits
Cities	Housing, mobility and resilience	Efficient buildings, transit, flood control, resilient materials	Avoided floodplains, heat-island reduction, habitat connectivity

ENGINEERING IS NOT PERMISSION

A seawall can protect a city, a treatment plant can clean water and air conditioning can save lives. None of them restores a lost species, a collapsed reef or an exhausted aquifer. Engineering expands options; it does not eliminate ecological limits.

Build the system that electrification requires

Electricity is the platform technology of modern development. It powers communication, refrigeration, water treatment, cooling, industry, health care and increasingly transportation and heating. But electrification succeeds only when power is available, affordable and dependable. A brittle grid powered by aspirational targets is not sustainable.

The practical portfolio is broad. Renewables and batteries should continue to scale where economics and system conditions support them. Transmission and distribution must be built before new load arrives. Existing nuclear plants should be preserved where safe, and new nuclear should compete as costs and delivery improve. Hydro and geothermal matter where geography cooperates. Natural gas will remain a reliability resource in many systems, which makes methane measurement and abatement a near-term priority.

Sequence matters

- Clean the power supply while adding capacity; do not electrify faster than the grid can serve reliably.
- Price reliability and flexibility, not only nameplate capacity.
- Accelerate permitting and interconnection while preserving clear environmental review and local accountability.
- Use distributed systems for access and resilience, but recognize that industry and cities still require large, stable grids.
- Treat methane control as high-value climate first aid because reductions can be measured and delivered now.

Cooling is health infrastructure

Cooling is often discussed as a consumer luxury or an environmental burden. In a warming world it is increasingly a basic health, labor and productivity system. The World Health Organization estimates approximately 489,000 heat-related deaths annually between 2000 and 2019, and heat-related mortality among people over age 65 rose sharply in the following decades.⁵

France provided a stark warning in 2026. Public Health France estimated 5,764 excess all-cause deaths during the June 17 to July 2 heat wave, a 36 percent increase across the affected departments. People age 75 and older accounted for roughly two-thirds of the preliminary excess-mortality estimate.⁶

THE POLICY ERROR

Denying or stigmatizing mechanical cooling does not protect the climate. It transfers risk to older people, low-income households, schools, workers and health systems.

The correct engineering response is not unlimited, inefficient air conditioning. It is a cooling system: shade, ventilation, insulation, reflective materials, urban trees, efficient heat pumps, district cooling, thermal storage, cleaner refrigerants and power systems able to meet peak demand. The IEA has estimated that only about 15 percent of the 3.5 billion people living in hot climates owned air conditioning in 2021, with the lowest access in Sub-Saharan Africa and South Asia.⁷

This is a model for the broader report. Human development requires more of a valuable service - safe indoor temperatures - while technology and governance reduce the natural-capital cost per unit of that service.

Treat water as infrastructure, ecosystem and balance-sheet asset

Water connects every part of the development-natural capital tension. It is a basic human need, a production input, an energy resource, a habitat and a climate buffer. The 2026 United Nations World Water Development Report estimates that 2.1 billion people still lack safely managed drinking water.⁸ The World Bank estimates that water-dependent sectors support roughly 1.7 billion jobs worldwide.⁹

Water is also intensely local. A gallon conserved in a wet basin is not equivalent to a gallon restored in a stressed aquifer. Quantity, quality, timing, location and ecological function all matter. This is why water markets and credits are more difficult than carbon markets: the commodity is not globally interchangeable and the consequences are basin-specific.

The engineering portfolio

- Measure first: metering, basin data, industrial process data and transparent loss accounting.
- Use less where waste is real: leakage control, precision irrigation, efficient fixtures and process redesign.
- Use water again: municipal and industrial reuse, fit-for-purpose treatment and closed-loop systems.
- Create new supply where justified: desalination and advanced treatment as part of a portfolio, not a license for unlimited demand.
- Rebuild natural infrastructure: wetlands, watersheds, soils and aquifer recharge where they provide cost-effective services.

The World Bank argues that municipal and industrial water reuse could grow eightfold by 2040, reaching 430 million cubic meters per day and unlocking as much as \$340 billion in investment. The opportunity is substantial, but it requires regulatory clarity, reliable off-take, project finance and public trust.¹⁰

FINANCE OPPORTUNITY

Water resilience can become an investable asset class when physical benefits are measured, contracts allocate performance risk and claims are tied to local hydrology rather than generic volume.

06 | WHERE ENGINEERING STOPS

Not every natural asset is substitutable

A serious pro-engineering agenda must also identify where engineering is an incomplete substitute. Treatment plants can improve water quality, but they require capital, energy and maintenance that a healthy watershed provided passively. Seawalls can defend selected coastlines, but they can transfer erosion and destroy habitat. Controlled agriculture can protect crops from weather, but it cannot economically reproduce every ecological relationship across entire landscapes.

Some natural assets are effectively non-substitutable on human time scales: species, old-growth ecosystems, coral reefs, deep aquifers, stable glaciers and complex soils. Others may be technically replaceable but at costs that rise sharply as depletion proceeds. The correct economic implication is not that nature has no price; it is that price alone may be an inadequate safeguard when thresholds are uncertain and losses irreversible.

WHY THIS IS NOT CORNUCOPIANISM

Engineering optimism is justified only within ecological boundaries. Some natural assets are effectively non-substitutable on human time scales, and price alone may be an inadequate safeguard when thresholds are uncertain and losses irreversible.

A governance hierarchy for natural capital

1	Avoid. Do not locate discretionary activity in places where the loss is irreversible or the systemic value is unusually high.
2	Minimize. Redesign projects to reduce land, water, habitat and pollution impacts before considering compensation.
3	Restore. Repair damaged assets in the same ecological and social system wherever possible.
4	Compensate. Use credits or offsets only for residual impacts, with transparent limits and credible verification.

Natural capital accounting can improve decisions by tracking physical stocks and flows alongside monetary value. The purpose is not to pretend that every species or ecosystem can be reduced to a single price. It is to make depletion visible, identify dependence, compare scenarios and prevent current income from masking a decline in future productive capacity.¹

07 | FINANCE AND GOVERNANCE

From technology to delivered outcomes

Technology does not scale itself. Projects require contracts, permits, standards, buyers, creditworthy counterparties and institutions capable of execution. Finance and governance determine which engineering options become real assets and which remain demonstration projects.

Six disciplines for development without depletion

1 Measure physical outcomes. Track energy delivered, methane stopped, water restored, land converted, ecosystem condition and resilience - not only spending or commitments.	2 Account for stocks and flows. Include changes in natural assets and infrastructure condition when assessing growth, project returns and public wealth.
3 Use durable, outcome-based rules. Specify measurable results, preserve technology competition, limit public support and require a credible exit path.	4 Differentiate by development stage. Expect more from affluent economies while financing reliable infrastructure in poorer countries.
5 Make adaptation investable. Treat cooling, water reuse, flood protection, wildfire resilience and grid hardening as core infrastructure.	6 Protect claims integrity. Environmental credits should be additional, durable and verified, and should never disguise avoidable operational impacts.

The boardroom implication

Boards and investment committees should ask three questions. First, which natural systems does the strategy depend on? Second, where is the company assuming that public infrastructure or ecosystems will continue to provide services at historical cost? Third, which capital expenditures would lower both operating risk and environmental intensity? These questions move sustainability from a communications function to capital allocation and enterprise risk management.

GOVERNANCE TEST A credible sustainability strategy should survive a change in political administration, a credit committee review and an engineering audit.

S-LAB 2026 AT A GLANCE

S-Lab's 2026 work connects four layers of the model: applied execution through the Walker Ranch methane-abatement transaction; carbon-market research through the proposed R&D Hub; early water-credit research; and a university platform linking instruction, research, practice, convening and student opportunity.

W+E Forward: from university idea to market transaction

W+E Forward grew from the S-Lab ecosystem as a nonprofit platform connecting measurable environmental outcomes with capital-market discipline. Its broader purpose is to support practical energy and water improvements, especially for small and medium-sized enterprises. Legacy methane wells offered a deliberate first use case: the intervention is site-specific, engineered, monitorable and capable of producing a verified environmental asset. S-Lab advisory materials describe methane abatement as measurable, auditable, permanent and financeable.¹²

The Walker Ranch transaction advances that model. Carbon X identifies overlooked methane sources, permanently plugs leaking wells and verifies emissions reductions. AT&T connectivity links remote sites, field crews, sensors, monitoring systems and verification workflows, supporting real-time data and transparency. AT&T presents the collaboration as part of its Gigaton Goal to enable one billion metric tons of emissions reductions by 2035 through the use of AT&T connectivity.¹¹

W+E Forward brokered the transaction. That intermediary role matters because environmental projects often fail when the necessary parties do not naturally assemble: developers, buyers, verifiers, financiers and technology partners each require credible data, claims and a commercial structure. W+E Forward helped create the framework in which those interests could meet.

WHAT THE TRANSACTION DEMONSTRATES

A university-linked initiative can move beyond research and convening to help create a measurable, contractible and scalable environmental outcome.

The broader W+E Forward model

The proposition is larger than a single transaction: plug legacy methane wells, create high-integrity environmental assets and use market-based finance to support productive water and energy improvements. Credits are a financing mechanism, not the end objective.

Four elements of a replicable model

- A physical intervention with clear engineering scope.
- Measurement, reporting and verification that a buyer can diligence.
- A corporate use case tied to operational capability - in this instance, connectivity and data.
- A financial structure that can be repeated across multiple projects rather than treated as a one-off grant.

Carbon X + AT&T | Walker Ranch Project

COLLABORATION ANNOUNCEMENT

**Carbon X™**

**AT&T**

Carbon X has collaborated with AT&T to advance methane abatement through connectivity.

Combining field expertise with digital infrastructure to identify, mitigate and verify methane emissions at scale.

WALKER RANCH PROJECT



Overlooked methane sources identified



Engineered well plugging permanently eliminates leaks



Verified emissions reductions converted to high-quality carbon credits



AT&T connectivity enables real-time data, transparency and trust

This collaboration supports AT&T's Gigaton Goal and drives scalable, data-rich methane abatement with real environmental and business impact.

BROKERED AND MANAGED BY

**WATER + ENERGY
FORWARD**

Connecting Innovation. Driving Impact.

CLEANER
ENERGY
STRONGER
COMMUNITIES
BRIGHTER
TOMORROWS

Figure 1. W+E Forward brokered the Walker Ranch partnership, linking engineered well plugging and verified methane reductions with AT&T connectivity.

Building the market infrastructure around environmental outcomes

The Walker Ranch transaction demonstrates execution. The next questions concern the research, data and governance infrastructure that could help credible environmental markets develop. S-Lab is considering two early-stage concepts. Neither is an operating product, and each should advance only if market need, technical capability, sponsorship and institutional support are demonstrated.

PROPOSED CARBON MARKETS R&D HUB

DRAWING BOARD | EARLY EXTERNAL INTEREST

S-Lab is exploring a neutral, sponsor-supported research platform for comparable carbon-market reporting, methodology analysis, transaction transparency and claims integrity. The concept remains at the design stage: no sponsor base, operating platform or proprietary database is yet in place. Early conversations nevertheless suggest interest in the problem it is intended to address.

- Periodic market brief on transactions, buyer behavior and methodology developments.
- Participant and methodology maps that improve comparability without implying endorsement.
- Integrity analysis covering additionality, permanence, verification, co-benefits and delivery risk.
- Later databases or dashboards only if sponsorship, data rights and demonstrated demand justify them.

WATER-CREDIT RESEARCH CONCEPT

PRELIMINARY | NO INSTITUTIONAL PARTNER YET

W+E Forward is beginning to test whether measurable, locally relevant water improvements might support financeable environmental outcomes. The concept remains preliminary, and no technical or institutional partner has yet been formally engaged. The immediate task is to define the questions, expertise and evidence that a credible protocol would require before considering any pilot.

- Define the physical benefit, baseline and additionality in transparent local terms.
- Account for basin, season, water quality, durability and community effects.
- Prevent double counting and limit corporate claims to verified benefits actually delivered.
- Identify the hydrological, technical, data and verification capabilities required for a credible pilot.

DEVELOPMENT BOUNDARY

These are research concepts, not commitments. W+E Forward provides evidence of execution; the proposed Hub and water-credit work should be described as questions S-Lab is testing with the market.

The role of universities

Universities can occupy a valuable middle ground between advocacy, government and commerce. They can define methods, test claims, train students, convene participants and provide a neutral platform for data. S-Lab should continue to combine public research with applied work, using W+E Forward as an operating laboratory while testing the case for a Carbon Markets R&D Hub and framing the questions a credible water-credit protocol must answer.

Eight principles for development without depletion

1	Replace scarcity rhetoric with an abundance agenda. Make reliable electricity, cooling, water, housing and mobility the starting point. Sustainability policy that cannot explain how it improves human capability will not endure.
2	Measure total wealth, not income alone. Add natural-capital and infrastructure measures to major public-project appraisal, corporate risk analysis and long-term investment decisions.
3	Make cleaner systems economically self-reinforcing. Build grids, transmission, firm generation, storage, water systems and resilient cities while driving cost, reliability and performance to the point that adoption no longer depends primarily on mandates.
4	Differentiate responsibility by development stage. High-income economies should reduce waste and resource intensity rapidly; low-income economies need financing for growth, access and resilience.
5	Coordinate where national interests overlap. Prioritize common measurement, reciprocal market access, narrow agreements and modular coalitions that can function under partial participation and political change.
6	Bound industrial policy and preserve competition. Use public support for research, shared infrastructure and genuine coordination failures. Keep interventions transparent, outcome-based, technologically neutral where possible, time-limited and subject to exit discipline.
7	Protect the irreplaceable. Use avoid-minimize-restore-compensate as a governance hierarchy and establish no-go boundaries where natural assets cannot be credibly replaced.
8	Demand integrity from environmental markets. Credits should be additional, durable, local where the impact is local, transparently verified and linked to investment that would not otherwise occur.

Development is not the enemy. Depletion is.

The coming decades will require more energy, more infrastructure and more productive capacity. They will also expose the cost of treating natural systems as free, permanent and infinitely resilient. The choice is not between development and stewardship. The real choice is between development that expands the future and development that consumes it.

Engineering offers many of the answers: cleaner power, efficient cooling, water reuse, precision agriculture, resilient cities, better materials and credible monitoring. Political will can open temporary windows, bounded public policy can address genuine infrastructure and coordination failures, and international cooperation can enlarge markets where national interests overlap. None of these substitutes for economics. Cost, performance and reliable demand determine whether new systems become durable rather than politically dependent.

Finance can move credible solutions from prototype to scale. Governance can keep claims honest, place durable bounds around public intervention, protect assets that cannot be replaced and design institutions that remain useful when administrations and alliances change. A technologically advanced world can still be a diminished world. Avoiding that outcome requires not less human ambition, but more capability with less depletion.

FINAL PROPOSITION

Prosperity should be financed by productivity, innovation and replenishment - not by quietly liquidating the natural balance sheet.

About Marquette S-Lab | Governance + Sustainability

The Marquette S-Lab bridges academic research, market discipline and practical sustainability execution. Its model connects instruction, research, practice, convening and student opportunity across energy, water, carbon markets, governance and natural capital.

RESEARCH PROPOSITION

S-Lab focuses on questions that sit between disciplines and institutions - where engineering, finance and governance must work together for measurable outcomes.

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