Electrical Energy Transition Playbook

Best Practices for Partners

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Practical Pathways for Energy Transition

This playbook highlights **practical pathways** for electrical energy transition across manufacturing operations.

The intent of sharing this playbook is to inspire action, share recommended solutions, and offer a starting point towards assessing options to reduce site energy use and associated operational GHG emissions.

1

Energy Transition Overview

Provide a clear understanding of heat and electricity decarbonisation basics, objectives and execution approach

2

Electrical Energy Decarbonisation Pathway

Potential decarbonisation pathways for electrical energy with implementation guidance for key technologies

3

Execution Approach and Ownership Model

Proposed approach to identify decarbonisation opportunities and move from intent to execution

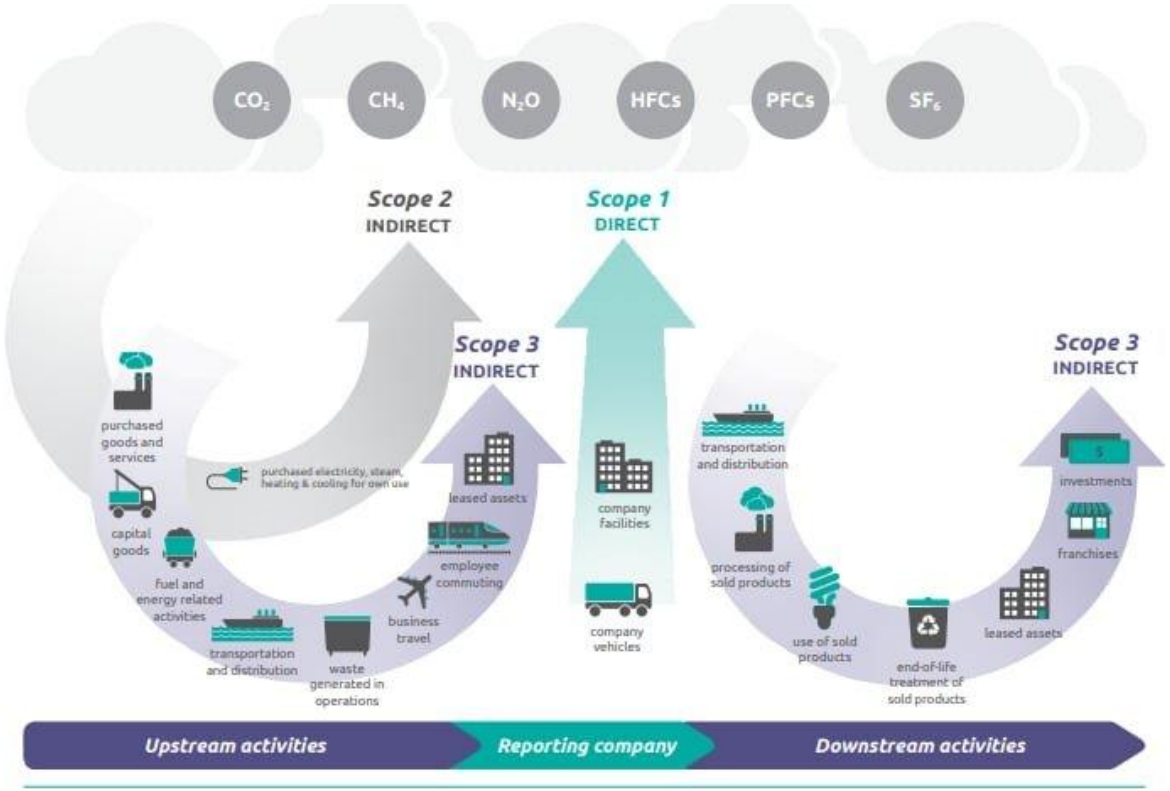
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Case Studies

Real examples of technologies implemented across Unilever facilities with lessons to replicate

Energy Transition Overview

Understanding Emissions Scopes (Scope 1, 2, and 3)



Scope 1: Direct emissions from sources owned or controlled by the organisation

- ***Stationary combustion: fuel burned onsite for heat/steam***
- Mobile combustion: fuel used in company-owned vehicles/equipment
- Process emissions: chemical/physical reactions inherent to manufacturing processes

Scope 2: ***Emissions from production of purchased electricity, heat, & steam***

Scope 3: Emissions from upstream and downstream value chain activities

Process emissions are industry- and company-specific, so this playbook doesn't address them directly. **The focus here is thermal and electrical energy transition—the lever that generally applies more consistently across industries.**

Source: GHG Protocol

Understanding Energy Types (Thermal and Electrical)

Thermal Energy

Fuel used to generate heat for manufacturing processes
E.g.: Boilers, furnaces, ovens, and hot air generators.

Majority Scope 1 Emissions: Generated on-site from fuel combustion

Electrical Energy

Electricity powers manufacturing processes, packaging lines
E.g.: Motors, compressors, and controls.

Majority Scope 2 Emissions: Purchased from the grid

Why is Energy Transition Important?



Commercial value upside: Can drive savings in energy costs and reduce exposure to fuel and power price volatilities



Sustainability expectations: Supports credible progress against net-zero or renewable energy commitments



Direct operational control: Direct impact from equipment and fuel changes which can enable decarbonisation without dependence on upstream supply chain readiness



Highest impact per facility: Heat and power systems typically deliver the biggest abatement potential per facility

Source: GHG Protocol

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Key Considerations for Electrical Energy Transition

Effective electrical energy transition often requires partners to **focus on a small number of high-impact, execution-oriented pathways that enable meaningful and scalable emissions reductions.**



Ensure holistic view of emissions landscape

Take a holistic view across processes, utilities, and sites to ensure all major sources are systematically captured and addressed



Build region-specific renewable pathways

Create region-based data profiles covering certificate mechanisms and PPA availability to identify the clean electricity pathway for each region



Prioritise clean energy as a fast decarbonisation lever

Accelerate reductions through clean electricity sourcing, including renewable certificates and PPAs, while improving power quality over time



Embed electrical efficiency in parallel

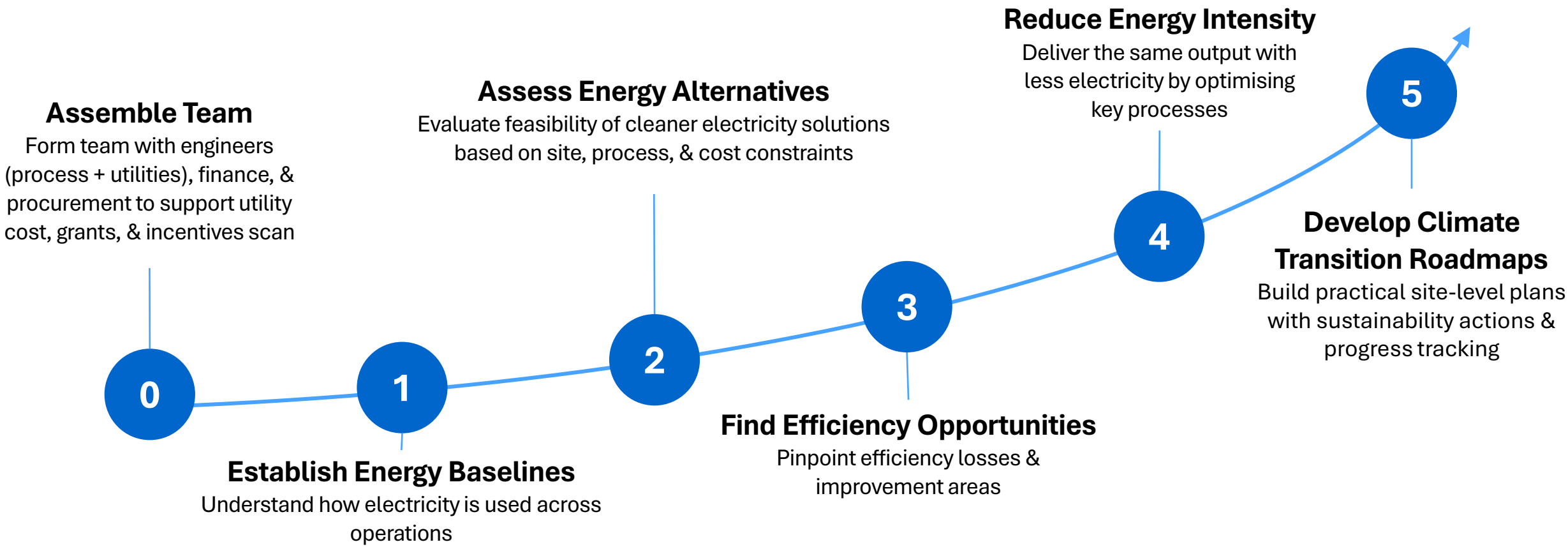
Improve efficiency through equipment and process optimisation in parallel with clean power adoption to reduce costs and improve overall performance

Together, these considerations can typically translate Scope 1 & 2 action into progress toward value chain emissions reduction

Electrical Energy Transition: Decarbonisation Approach

Framework for Electricity Decarbonisation

While best practice generally prioritises energy efficiency first, then renewable energy transition, decarbonisation can often be accelerated by pursuing market-based mechanisms such as EACs[1] in parallel with on-site renewables, clean energy contracts, and efficiency improvements.



Unilever has found that this approach leads to practical and phased decarbonisation actions aligned with site-level realities.

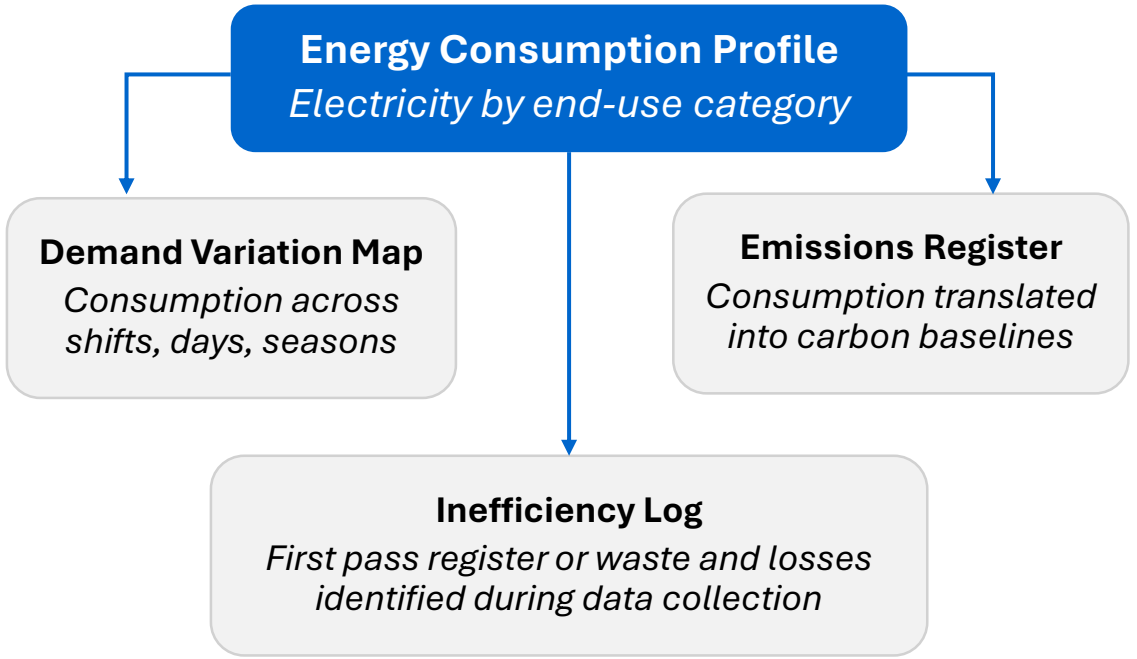
[1] *Energy attribute certificates*

Step 1: Establish Energy Baselines

Preparation & Data Collection

- **Define audit scope & objectives**
  - Align on facilities & electricity systems in scope
  - Confirm stakeholders and data collection timelines
- **Gather process flowcharts, layouts, & regulations**
- **Collect energy bills & environmental data**
- **Conduct interviews with key stakeholders**
  - Talk to operations & maintenance stakeholders, shift supervisors
  - Capture changes to equipment, schedules, volumes

Key Outputs



Build a clear baseline of how electricity is generated, procured, and used across the facility
Identify top electricity uses and demand variation

Step 2: Assess Energy Alternatives

A. Profile your site

Ownership & Space
Is your facility leased or owned? How much roof or land space is available for on-site generation?

Grid & Interconnection
What are the interconnection limits and grid capacity? Is supply reliable?

Load Profile & Demand
What are the electricity consumption & peak demand patterns?

B. Scan your market

Renewable Availability
What renewable electricity options exist in your region, including unbundled EACs[1] (RECs, GOs, I-RECs)?

Utility & Policy Landscape
Are green tariffs or PPAs available and commercially viable?

Incentives & Mandates
What subsidies, renewable targets, or compliance requirements apply?

C. Evaluate and decide

Technical Fit
Which options are viable given your site's physical and grid constraints?

Cost Feasibility
Which options are realistic given capex availability, electricity prices, and target deadlines?

D. Build renewable electricity procurement strategy[2]

Define preferred approach
Select the right mix: unbundled EACs, self generation, contracted energy

Incorporate market inputs
Leverage price forecasts & benchmarks; engage external consultant as needed

Evaluate trade-offs
Compare cost, risk, & flexibility across options

Align and move forward
Build a clear business case; secure leadership sign-off

[1] *Energy attribute certificates*

[2] *Detailed Execution Guidance*

Step 3 & 4: Identify Efficiency Opportunities and Reduce Energy Intensity

3 - Identify Efficiency Opportunities

Use baseline information to identify inefficiencies and opportunities to reduce unnecessary electricity demand

Find opportunities for electrical efficiency

Analysis & Assessment

- Check existing metering and monitoring systems
- Analyse consumption patterns
- Review environmental impacts and compliance

Outputs & Improvement Planning

- Create register of environmental impacts
- Identify energy & environmental improvement opportunities
- Develop measurement & action plan

4 - Reduce Energy Intensity

Reduce energy use and operating costs by optimising controls, upgrading equipment, and managing loads

Deliver the same output with lower kWh consumption & peak demand

Right-size Equipment

Match capacity to actual demand

Meter & Monitor

Increase visibility of energy use at the asset and process levels

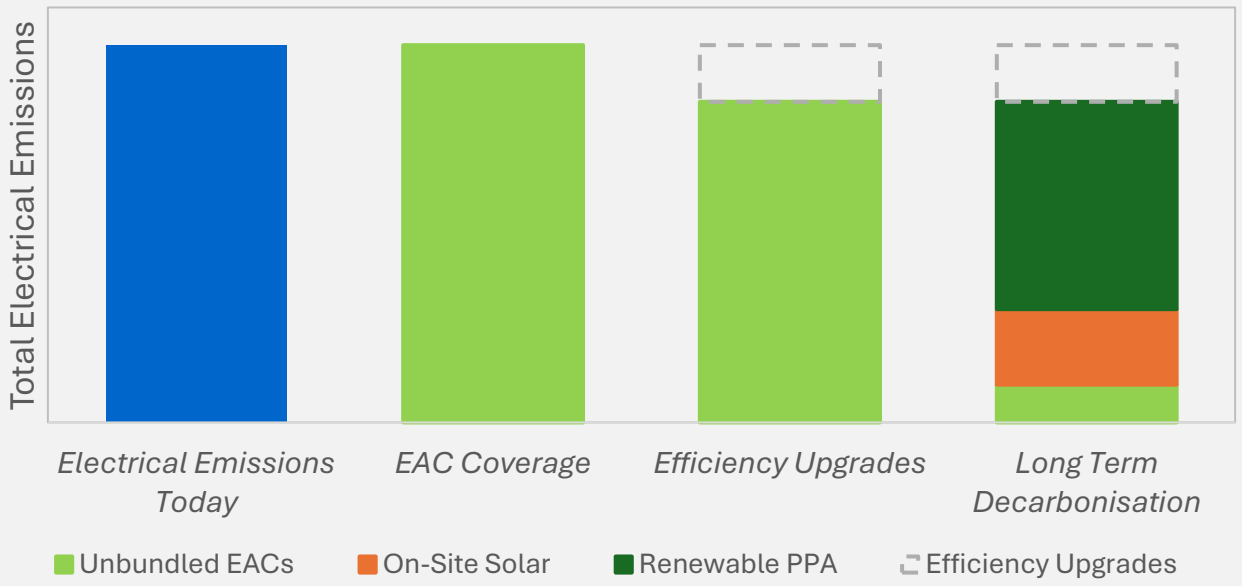
Upgrade Technology

Upgrade to energy efficient technologies

Step 5: Finalise Energy Transition Roadmaps

Create costed roadmaps with decarbonisation initiatives aligned with operational and investment timelines.

Sample Decarbonisation Roadmap (only for illustrative purposes)
Starting from today's emissions, each bar shows how much different clean electricity and efficiency actions can help close the emissions gap



Market mechanisms like unbundled EACs[1] can activate renewable coverage now to meet near-term targets while higher impact solutions like PPAs[2], on-site solar, and efficiency upgrades are developed.

- **Unbundled or bundled EACs** offer immediate coverage with no capex required
- **Energy efficiency upgrades** reduce total demand
- **On-site solar** generates clean electricity directly at the facility
- **Renewable PPAs** source large volumes of clean electricity from third-party generators

Actual tailored solutions will depend on market maturity and site availability. Partners should assess their own operations holistically to understand project fit.

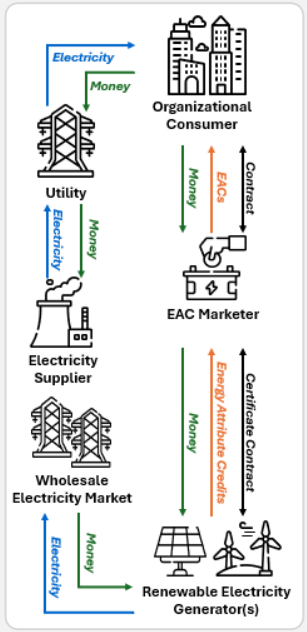
Single solutions can rarely decarbonise a site fully; effective roadmaps will often combine various renewable solutions and market mechanisms to close the gap

[1]*Energy attribute certificates;* [2]*Power purchase agreements*

Electrical Energy Decarbonisation Pathways

Electricity Decarbonisation Options at a Glance

CLEAN ENERGY GENERATION & SOURCING



UNBUNDLED EACs[1]
Tradable certificates representing 1 MWh of renewable electricity, purchased separately from physical power



RENEWABLE ELECTRICITY SUPPLY CONTRACTS
Medium-longer term contracts w/ utilities & electricity suppliers for clean electricity



RENEWABLE PPAs
Long-term contracts to purchase renewable electricity from third-party generators



ON-SITE RENEWABLES
Solar panels/wind turbines installed on rooftops or nearby land to generate electricity at the facility

Additionality

DEMAND OPTIMISATION



DEMAND FLEXIBILITY & BATTERY STORAGE
Manage when and how electricity is consumed via eTES[2] and batteries



ELECTRICITY EFFICIENCY SYSTEMS

[1]*Energy attribute certificates;* [2]*Electrified thermal energy storage*

The list of technologies provided are not exhaustive

RE100 Key Technical Criteria for Renewable Electricity Procurement

RE100 is a global initiative bringing together 400+ businesses committed to using 100% renewable electricity in their operations.

Renewable Energy Resources

Always Renewable
Wind, Solar, Geothermal, Marine

Conditional
Biomass & Hydropower (must be sustainability certified, e.g. ISCC, Green-e, LIHI, EKOenergy[1])

Not Included
Hydrogen (energy carrier, not a resource), Energy Storage (not a resource)

Energy Procurement Options

Self Generation
Company-owned energy projects; retain energy attributes

Physical PPA
Direct contract with a generator for renewable electricity

Financial/Virtual PPA
Financial instrument; company receives energy attributes and EACs separately

Electricity Supplier Contract
Project-specific or retail supply contract with an electricity supplier

Unbundled EACs
Energy attribute certificates purchased separate from generation and electricity procurement; cancellation statement required

Passive Grid
Default grid power if ≥95% renewable mix with no specific allocation mechanism

Key Requirements

EAC Cancellation
All claims must be backed by a valid EAC cancellation statement

15-year Plant Age
≥85% of renewable electricity must come from plants commissioned or re-powered within the last 15 years

15% Exemption
Up to 15% of consumption is exempt from 15-year rule

Market Boundary
Generation & claim must be within the same electricity market boundary

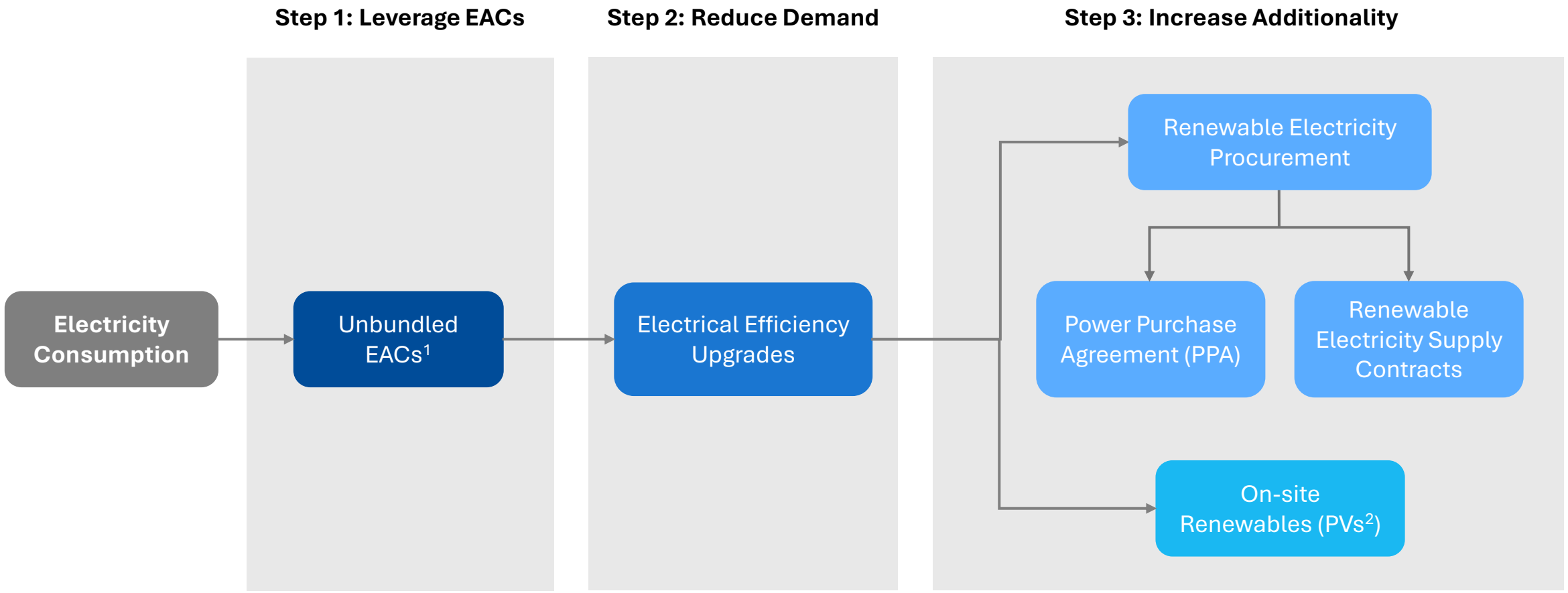
No Coal Co-firing
Electricity generated via co-firing with coal is explicitly excluded

Partners may wish to consider joining RE100; it can help support electrical decarbonisation efforts

[1]These are certification bodies. ISCC = International Sustainability and Carbon Certification, LIHI = Low Impact Hydropower Institute

Source: RE100 Technical Criteria; Join RE100

Execution Pathway: Electrical Energy Transition - Approach



In Unilever's experience, Electrical Energy Transition is rarely linear in practice. Multiple interventions - such as Unbundled EACs, Energy Efficiency Measures, PPAs, and On-site Renewables - often need to happen in parallel

[1]Energy Attribute Certificates; [2] Solar PV - Solar Photo Voltaic

Unbundled Energy Attribute Certificates

What are Unbundled Energy Attribute Certificates (EACs)?

Market-based instruments (certificates) purchased alone, separate from electricity. They represent a claim for the renewable attributes associated with 1 MWh of renewable generation. *Often known as RECs in the US, GOs in Europe, and I-RECs in other markets.*

Unbundled EACs are typically best fit for buyers with near term targets or who need to fill gaps in their renewables portfolio

How it works

- Certificate purchased directly on open market (or via a broker), independent of electricity contracts
- Each certificate = 1 MWh of renewable generation from the same market as the buyer's electricity supply

When it makes sense

- Renewable coverage needed in markets without structured contracts available
- Additional source for gap filling residual electricity demand
- Need for fast, flexible solution for near-term reporting requirements

Key benefits

- Typically, the fastest path to renewable coverage
- Maximum flexibility, available in any volume and most geographies at a low cost with no long-term commitment
- Procurement through brokers and trading platforms simpler than other procurement types

Key limitations

- Weakest additionality under most sustainability frameworks
- Decoupled from buyer's actual electricity costs; no financial hedging only added costs
- EACs must come from generation in the same markets as consumption

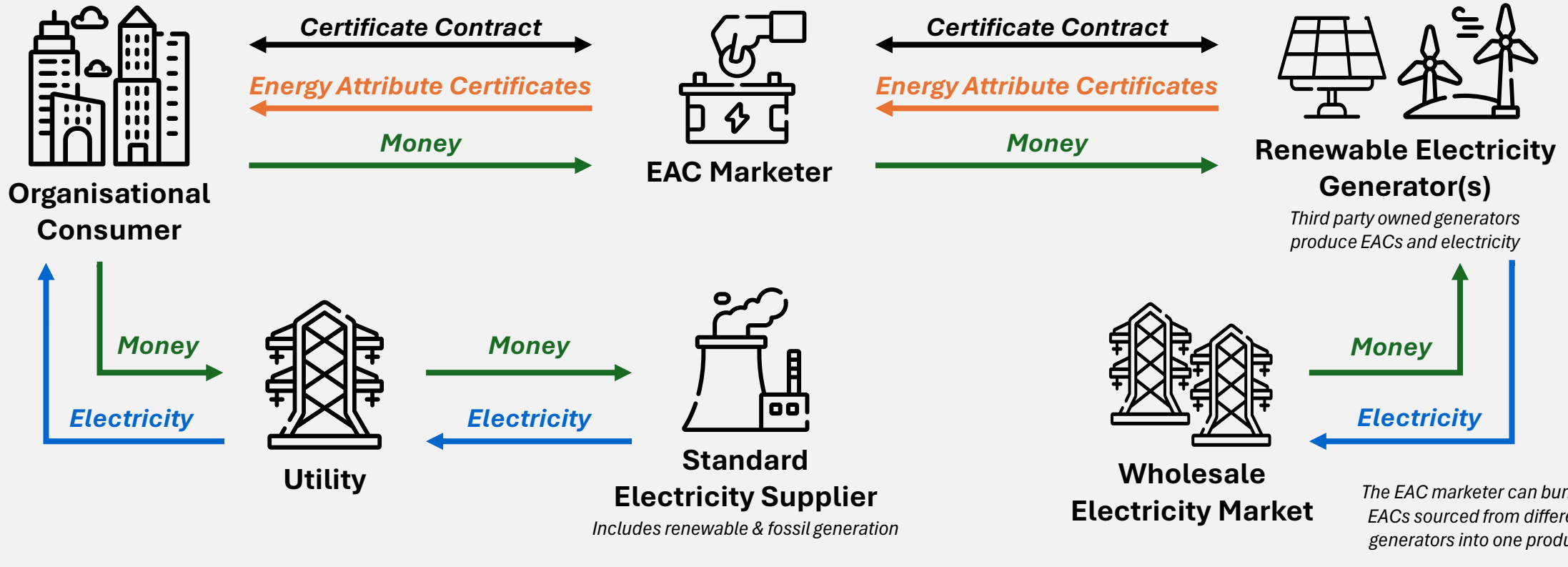
Sources: RE100 Technical Criteria, US EPA Green Power Markets, (1) See RE100 criteria for market boundaries.

Clean Energy Sources Overview

Schematic Representation: Unbundled Energy Attribute Certificates

What are Unbundled Energy Attribute Certificates (EACs)?

Market-based instruments (certificates) purchased alone, separate from electricity. They represent a claim for the renewable attributes associated with 1 MWh of renewable generation. *Often known as RECs in the US, GOs in Europe, and I-RECs in other markets.*



Sources: RE100 Technical Criteria, US EPA Green Power Markets

Electrical Efficiency Upgrades: Conserve, Right-size, and Upgrade

1. Conserve

Eliminate waste before investing in upgrades. Fix compressed air and steam leaks, remove idle loads, and address control gaps that drive unnecessary consumption.

2. Right-size

Align equipment capacity with actual process demand. Oversized motors, pumps, and fans operate inefficiently at partial load, driving unnecessary electricity use. Right-sizing may reduce structural energy waste.

3. Upgrade

Prioritise efficiency upgrades for high-run-time, variable-load equipment like motors, pumps, fans, compressors, chillers and HVAC[1]. High-efficiency units and variable speed drives better match output and demand.

Examples only; not exhaustive

- *Efficient Compressed Air Systems*
- *Efficient Chillers & Cooling Systems*
- *Efficient Pumps*
- *Efficient Fans & Blowers*
- *Efficient Lighting*
- *Efficient Electrical Motors*

Metering & monitoring can improve visibility into electricity use at the asset and process level, enabling the above mechanisms

[1] *Heating, Ventilation, and Air Conditioning*

Refer this for additional information on technologies

Electrical Efficiency Upgrades: Compressed Air & Chillers

Compressors and chillers are usually among the largest electricity consumers in manufacturing. Optimising both can typically deliver significant energy and cost savings.

Compressed Air & Compressor Efficiency

Compressed air is the fourth largest utility and is often more expensive (on a per unit energy delivered basis) than the others but up to 30% of compressed air energy can be lost to leaks.

- **Fix Leaks:** Audit distribution networks and machine level connections; industry best practice targets leakage rates <10%
- **Match Supply to Demand:** Variable speed drive compressors adjust output to actual load, avoiding energy waste from fixed-speed systems at partial capacity
- **Recover Waste Heat:** Up to 80% of the electrical energy consumed by a compressor can be recovered for water or process heating

Chiller & Cooling System Efficiency

Chillers also consume significant amounts of electricity in manufacturing sites and are often one of the most inefficient equipment types.

- **Upgrade to High Efficiency Chillers**: Magnetic bearing compressors generally use 20-40% less energy and require less maintenance than conventional units
- **Keep Systems Clean and Well-Operated**: Fouling and poor controls can erode efficiency by up to 30%; variable speed drives and regular maintenance can prevent this
- **Right-Size and Sequence Cooling Loads:** Match chiller capacity to actual demand across shifts and seasons; avoid running large chillers at low partial load

[1]*Heating, Ventilation, and Air Conditioning*

Refer this for additional information on technologies

Electrical Efficiency Upgrades: Additional Technology Improvements

Partners may want to prioritise efficiency upgrades for high-run-time, variable-load equipment like motors, pumps, fans, and HVAC[1] systems. High-efficiency motors and variable speed drives can match output and demand.

Some examples of how to drive electrical technology efficiency

Optimise Pumping Systems

- Trim impellers in oversized pumps
- Install pump controllers
- Match pump capacity to system requirement (operate near BEP[2])
- Replace throttle valve or bypass control with VFD[3] control

Improve Fan & Blower Performance

- Upgrade to high-efficiency impellers
- Replace belt drives with direct drives
- Install two-speed motors or VFDs
- Reduce duct leakage and system resistance

Modernise Lighting Systems

- Replace legacy lighting with LED fixtures
- Remove excess fixtures (de-lamping)
- Maintain and clean luminaires regularly
- Install occupancy sensors & daylight controls

Upgrade Motors & Add Speed Control

- Replace standard motors with IE4 / IE5[4] high-efficiency motors
- Install on-board or external VFDs for variable-load systems
- Replace old motors (don't rewind) during maintenance cycles
- Verify motor loading and power factor post-installation

Reduce Electrical System Losses

- Replace conventional V-belts with cogged raw-edged belts
- Eliminate air and flue gas leaks
- Avoid continuous operation in batch environments
- Ensure motors operate near optimal load range

[1]Heating, Ventilation, and Air Conditioning; [2]Best efficiency point; [3]Variable frequency drive; [4]International efficiency classes

Refer this for additional information on technologies

Clean Energy Sources: Physical Power Purchase Agreements

What is a Physical Power Purchase Agreement?

Long-term contract between a corporate buyer and a renewable energy developer for the supply of electricity from on-site projects owned by a third party or through the grid and its associated certificates (EACs).

Physical PPAs are typically best fit for large buyers with significant load in deregulated energy markets

How it works

- Fixed price per MWh, typically 10–20 year term
- Electricity supplied from on-site projects owned by third parties or off-site projects via direct line or grid connection
- Buyer receives EACs bundled with the supply, which count toward renewable energy goals

When it makes sense

- Large, regionally specific, long-term electricity load
- Market allows retail access
- Need for longer-term price stability
- Buyer seeks to drive additional renewable electricity infrastructure

Key benefits

- Strong renewable credibility, direct link to a specific project
- Pre-agreed pricing may help protect against rising energy costs over time

Key risks

- Long contract terms create risk if the buyer's energy needs change
- Only available in deregulated markets
- Can be administratively complex to set up

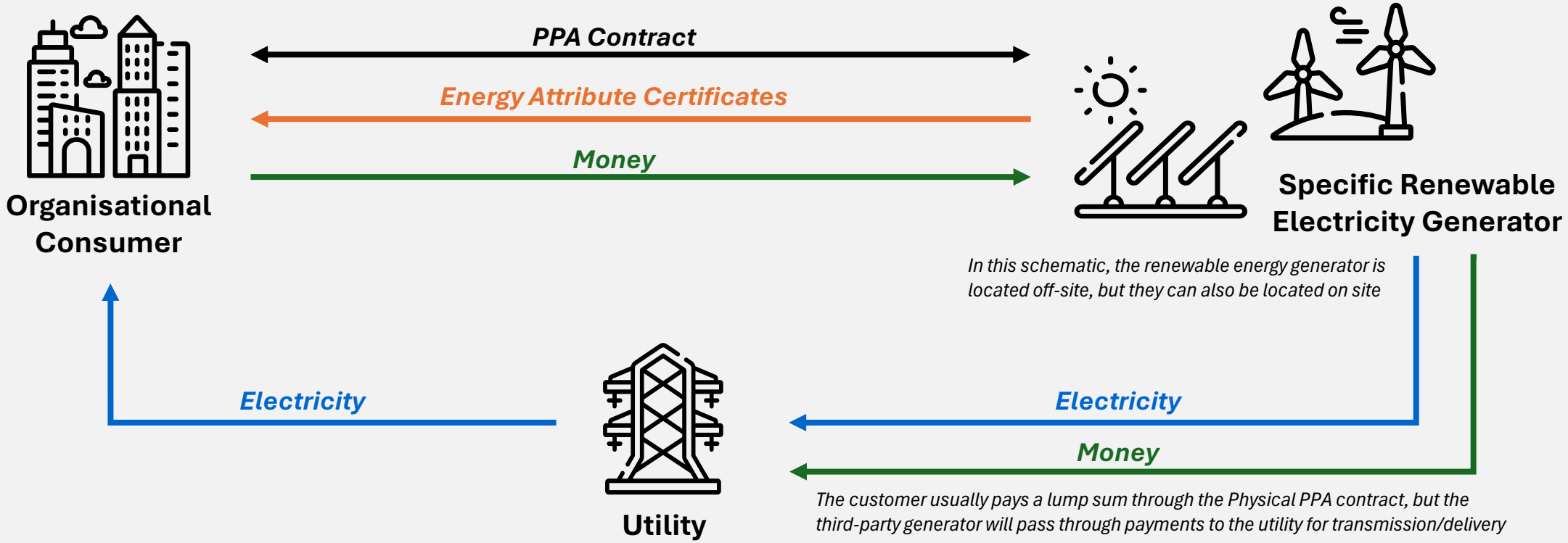
Sources: *RE100 Technical Criteria*, *US EPA Green Power Markets*

Global PPA Availability *Clean Energy Sources Overview*

Schematic Representation: Physical PPAs

What is a Physical Power Purchase Agreement?

Long-term contract between a corporate buyer and a renewable energy developer for the supply of electricity delivered through an on-site project owned by a third party or through the grid (often via a utility/retailer sleeve) and its associated certificates (EACs).



Sources: RE100 Technical Criteria, US EPA Green Power Markets

Clean Energy Sources: Virtual Power Purchase Agreements

What is a Virtual Power Purchase Agreement?

Financial contract, not a physical electricity agreement, where a corporate buyer assumes market risk related to the sale of a generator's electricity in exchange for energy attributes. Also referred to as Financial PPAs.

Virtual PPAs are typically best fit for large buyers with significant load in deregulated energy markets

How it works

- Fixed price per MWh over a 10–20 year term
- Developer sells electricity into the wholesale market
- Buyer and developer settle difference between fixed and market price ("contract for differences")
- Buyer receives project's EACs and buys electricity from utilities as normal

When it makes sense

- Load is spread across multiple locations within the same market boundaries[1]
- Goal is to finance new renewable capacity and secure EACs without needing physical delivery
- Appetite for a financial instrument with market exposure

Key benefits

- No physical delivery needed (but VPPA project and load need to sit in the same market boundary for EAC matching)[1]
- Finances renewable builds = EAC traceability
- Upside when market prices > strike price
- Can hedge against rising electricity costs

Key risks

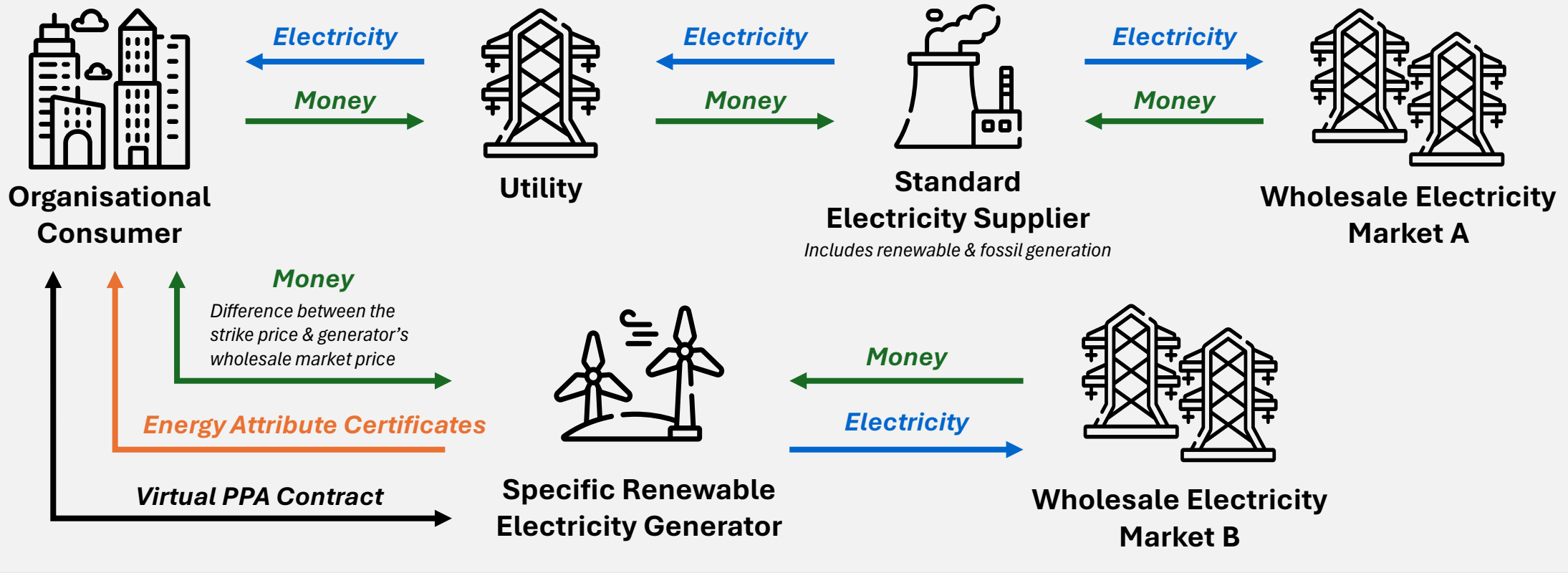
- Financial risk if market prices < strike price
- Requires knowledge and comfort with financial contract structures and market dynamics
- As a financial instrument, electricity must be separately procured

Sources: RE100 Technical Criteria, US EPA Green Power Markets, (1) See RE100 criteria for market boundaries.

Schematic Representation: Virtual PPAs

What is a Virtual Power Purchase Agreement?

Financial contract, not a physical electricity agreement, where a corporate buyer assumes market risk related to the sale of a generator's electricity in exchange for energy attributes. Also referred to as Financial PPAs.



Sources: RE100 Technical Criteria, US EPA Green Power Markets

Clean Energy Sources: Green Tariffs

What are Green Tariffs?

Utility-administered programme that lets large business customers purchase renewable electricity through a long-term contract managed by their utility, which procures or builds a renewable project on the customer's behalf.

Green tariffs are typically best fit for medium or large buyers in regulated utility environments

How it works

- Medium to longer term enrolment in a utility program tied to specific projects
- Programme charge per kW, receive credit based on project's actual output
- Full transparency on energy attribute sourcing

When it makes sense

- Regulated markets where PPAs are not available
- Need for project-specific renewable commitments without wholesale market risk
- Desire for meaningful near-term progress on renewable targets

Key benefits

- Accessible in regulated markets
- Project-specific EACs offer more credibility than generic green products
- Simple to execute through existing utility relationships

Key risks

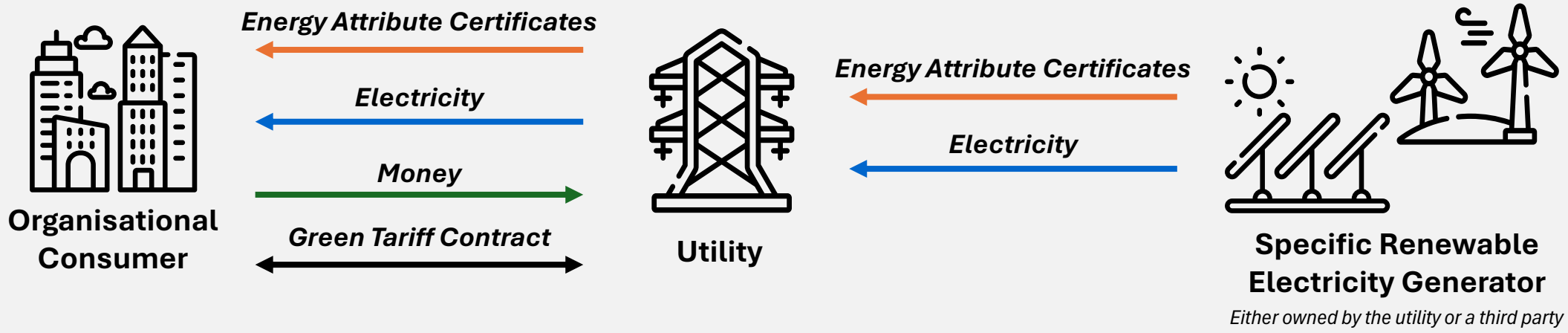
- Does not drive new clean energy builds
- Visibility into but limited control over project selection and pricing terms
- Programme availability varies by utility

Sources: RE100 Technical Criteria, US EPA Green Power Markets

Schematic Representation: Green Tariffs

What are Green Tariffs?

Utility-administered programme that lets large business customers purchase renewable electricity through a long-term contract managed by their utility, which procures or builds a renewable project on the customer's behalf.



Sources: RE100 Technical Criteria, US EPA Green Power Markets

Clean Energy Sources: Retail Green Electricity Product

What are Retail Green Electricity Products?

Standard electricity supply contract where the retail supplier (utility) matches the buyer's consumption with renewable certificates, marketing the supply as "100% renewable." No direct relationship with a *specific* generating project.

Retail products are typically best fit for smaller buyers looking for simple, low commitment renewable solutions

How it works

- "Off-the-shelf" arrangement with electricity supplier
- Buyer pays a per kWh premium on monthly utility bill for renewable electricity
- Choice available for how much electricity to enrol in
- Typically, shorter contracts

When it makes sense

- Smaller businesses early in their sustainability journey
- Minimal time or resource investment available
- Need short-term/bridge solution to demonstrate renewable progress while sourcing solutions with more additionality

Key benefits

- Easy and fast to implement, managed via existing utility relations
- Short-term options and low volume commitment
- Accessible to buyers of any size

Key risks

- High ease of implementation but typically acts as a quick win
- Low transparency[1] and additionality compared to asset-linked renewable solutions

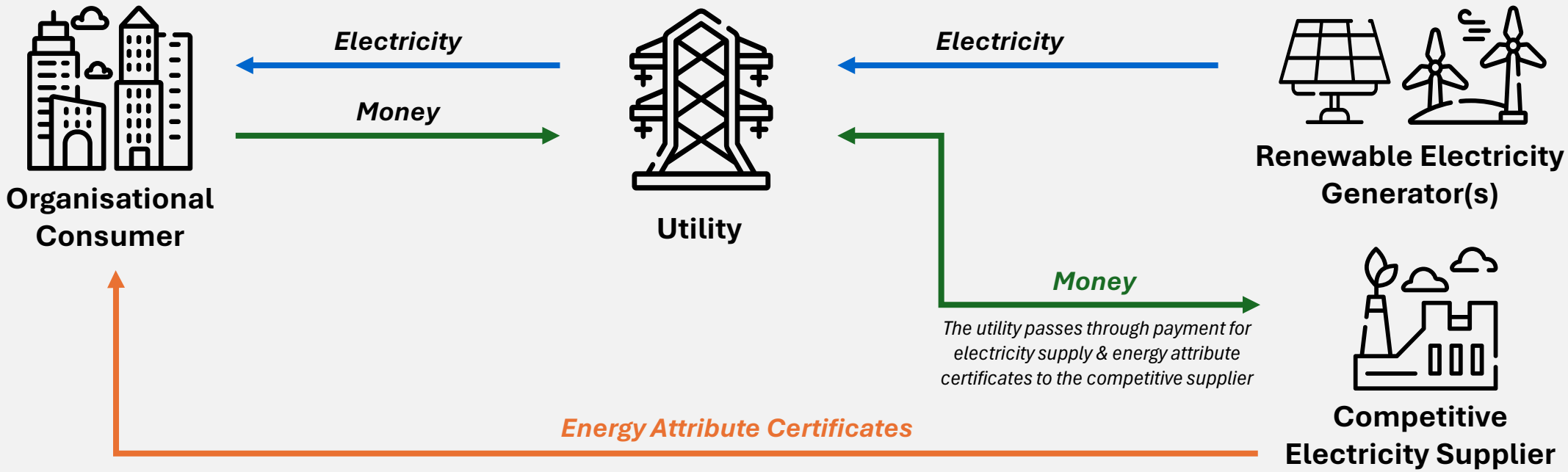
[1]RE100 requires 85% of renewable electricity from plants under 15 years old - harder to verify for off-the-shelf retail products with limited source transparency

Sources: RE100 Technical Criteria, US EPA Green Power Markets

Schematic Representation: Retail Green Electricity Product

What are Retail Green Electricity Products?

Standard electricity supply contract where the retail supplier (utility) matches the buyer's consumption with renewable certificates, marketing the supply as "100% renewable." No direct relationship with a *specific* generating project.



This schematic reflects competitive green power products as a retail supply option. Another option is utility green power products - also off-the-shelf with unspecific generation but supplied directly by the default utility with no competitive supplier.

Sources: RE100 Technical Criteria, US EPA Green Power Markets

Clean Energy Sources Overview

Technology Deep-dive: On-site Solar

On-site solar PV (photovoltaic) systems generate electricity directly from sunlight using solar panels installed at a facility, helping reduce grid electricity use and associated emissions

Zero Gross Emissions
Solar energy is renewable and does not generate emissions

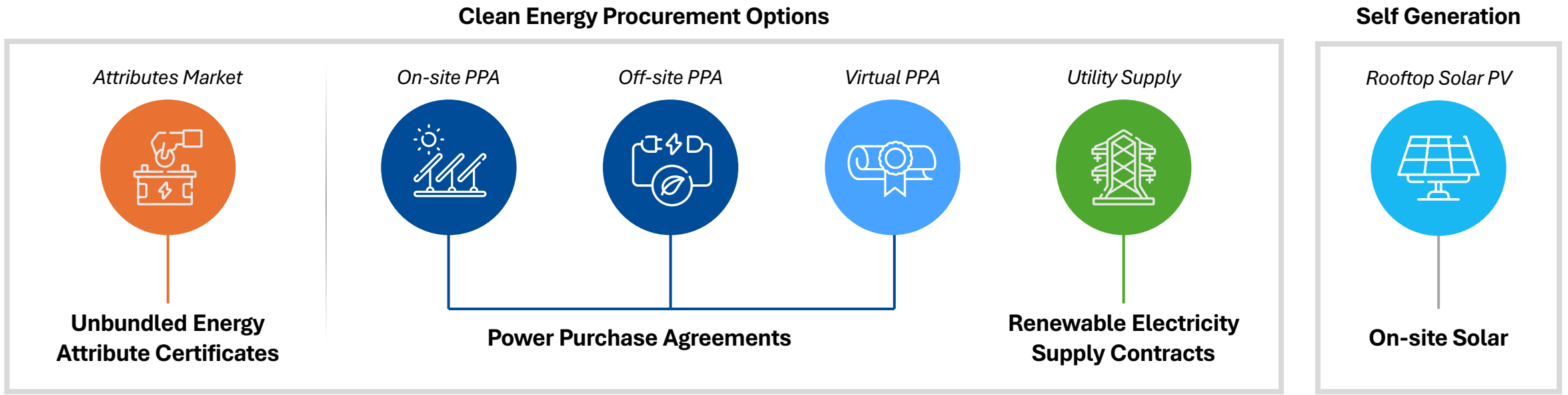
Utility Cost Savings
Reduces grid electricity purchases and utility costs + potential savings from energy incentives

Low Maintenance Costs & Long Lifespans
Solar panels often have lower maintenance costs than conventional power plants and can last 25-30 years

Key criteria to assess feasibility, cost, and integration risks for on-site solar deployment

- **Site selection:** Irradiation, climate, shading, topography, land availability, roof suitability
- **Regulatory and permitting:** Compliance with local regulatory and permitting authorities
- **System sizing and design:** Alignment of energy demand and solar panel technologies and mounting structures
- **Electrical infrastructure and grid integration:** Grid capacity, voltage stability, interconnection requirements
- **Operation and Maintenance:** Well-designed operation and maintenance plan, trained workforce/maintenance contracts

Summary of Key Renewable Energy Options



	Unbundled EACs	Physical PPA	Virtual PPA	Green Tariffs	Retail Products	On-site Solar
Electricity Supply?	No	Yes (via grid/direct line if off site)[1]	No	Yes	Yes (unspecified projects)	Yes (direct, on-site generation)
Project Contracts?	No	Yes	Yes	Indirect	No	Self-generation; no third-party contract
Typical Contract Length	Short term/Spot	Long term (10-20 years)	Long term (10-20 years)	Medium to longer term	Shorter term	
Typically Best For	**Buyers needing immediate coverage** & for gap filling	**Large buyers with stable load** in deregulated markets	**Large buyers with multi-region** load across Europe & North America[1]	**Medium or large buyers** in regulated utility markets	**Smaller buyers** or those newer to sustainability	Buyers **owning sufficient roof or land area**
Typical Additionality	**Low** additionality	**High**, finances new renewable build projects	**High**, finances new renewable build projects	**Medium**, project specific EACs	**Lower** transparency	**High**, new renewable capacity

*Sources: RE100 Technical Criteria, (1) Load and the VPPA need to be in the **same market boundary**, see RE100 criteria for market boundary definitions*

Execution Guidance

Considerations for deployment in your organisation

Execution Guidance: Electrical Energy Decarbonisation

Ownership Structure
RACI definition; steering team formation (Ops., Eng., Finance); review cadence and stage-gate checkpoints

Executive Sponsorship
Executive sponsor identified; strategic alignment confirmed; success criteria defined

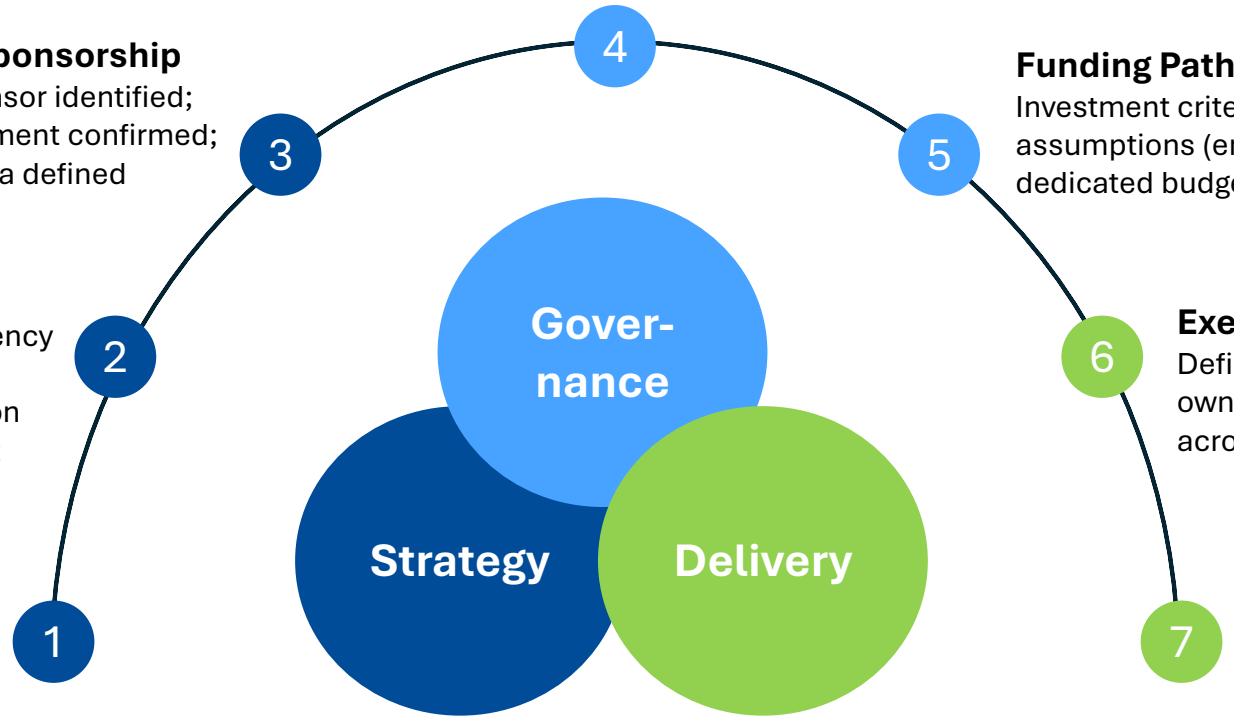
Funding Pathway
Investment criteria; Standardised assumptions (energy prices, downtime); dedicated budget/Capex pathway

Business Case Development
Estimation of potential savings, efficiency gains, emissions reduction, and investment needed; initial prioritisation of initiatives by feasibility, risk, impact

Execution
Defined milestones; site-level ownership; structured rollout across facilities/business units.

Baselining & Opportunity Research
Energy, emissions, and cost baseline; hotspot identification; secondary research on peer practices, tech. maturity, regional energy landscape, and national strategy

Performance Measurement
Actual vs. forecast energy, cost, and CO_2 impact; quarterly reports; reinvestment of savings



Research → Business Case → Governance → Execution → Verification

Partner decarbonisation can be supported by streamlined governance - clear ownership, predictable funding, structured execution, and verified impact.

Execution Guidance: Deep Dive

Strategy

Energy Baseline | *Business Case* | *Executive Sponsorship*

Key Activities
- Baseline energy & identify hotspots
- Screen technical levers
- Develop approx. savings & Capex range
- Prioritise 2–3 scalable initiatives

Key Stakeholders
- **Engineering** → Baseline data & feasibility
- **Sustainability** → Target alignment, benchmarking, sourcing guardrails
- **Commercial Leads** → Strategic positioning
- **Finance** → Assumption validation

Governance

Ownership Structure | *Capital Pathway*

Key Activities
- Build detailed ROI model
- Validate technical & operational feasibility
- Define accountable project owner
- Align funding structure

Key Stakeholders
- **Executive Sponsor** (COO / CFO / BU Head)
- **Finance** → NPV, IRR, sensitivity validation
- **Operations Leadership** → Deployment readiness
- **Procurement** → Vendor & contracting strategy

Delivery

Execution Plan | *Performance & Results Tracking*

Key Activities
- Execute defined milestones
- Monitor actual vs. forecast savings
- Conduct variance analysis
- Capture lessons & scale plan

Key Stakeholders
- **Project Management** → Delivery accountability
- **Engineering** → Technical execution
- **Finance** → Savings verification
- **Sustainability** → Impact tracking

Gate 1 – Concept Approval

Gate Criteria
- Clear problem statement (cost/intensity gap)
- Ranked short list of initiatives
- Rough savings & Capex range
- Strategic relevance (cost, resilience, ESG)

Gate 2 – Investment Approval

Gate Criteria
- Validated ROI model (incl. sensitivity)
- Defined funding structure
- Risk & implementation plan
- Accountable owner assigned

Gate 3 – Performance Validation

Gate Criteria
- Verified savings vs. forecast
- Variance explanation
- Implementation learnings
- Scale-up recommendation

Detailed business case development authorized → Capital approved & governance structure formalized → Replication across sites approved

Unilever

Case Studies

Case Study – Direct Power Purchase Agreement (PPA) in Poland

Direct PPA enabled lower costs, price stability, and impactful renewable sourcing in a high-carbon market



Background

- Poland's electricity mix is carbon intensive (69% fossil based in 2025[1]), creating cost & emissions exposure
- Corporate target of 100% renewable electricity by 2030 through direct sources
- Need for additional, large-scale renewable sourcing beyond grid supply

Approach

- Entered a direct (physical) PPA with large-scale wind and solar projects
- Secured long-term supply (10 years) with fixed pricing
- Included bundled renewable certificates for traceability and reporting

Unilever Outcomes

- **Cost impact:** Lower electricity cost vs. market benchmarks; savings flowing directly to P&L
- **Price stability:** Long-term hedge against power price volatility
- **Sustainability:** Additional and traceable renewable sourcing

Sources: (1) Ember

Case Study – Power Purchase Agreement (PPA) with Brookfield in India

Hindustan Unilever's (HUL) PPA unlocked renewable electricity access for manufacturers at lower cost than the grid



Background

- India's grid is carbon-intensive, creating high emissions exposure for HUL's own operations and for its collaborative manufacturers (HUL's Scope 3)
- Collaborative manufacturers, accounting for 1/3rd of Unilever manufacturing in India, lacked the scale to independently access competitive renewable energy rates

Approach

- Entered a group-captive, open-access PPA with Brookfield for a 45 MW solar park in Rajasthan
- Fixed competitive pricing secured over a 20-year contract term for 32 sites across 15 states
- Agreement extended to 10 collaborative manufacturers, with Unilever negotiating on their behalf

Unilever Outcomes

- **Cost Impact:** Expected 25% electricity cost savings compared to grid rates
- **Estimated Emissions Impact:** Over 28 ktCO2e per year estimated in avoided emissions from collaborative manufacturers, estimated to cover about a quarter of Unilever's own operational electricity demand in India
- **First multi-state, multi-partner PPA of its kind in the Indian FMCG sector**

Sources: (1) Unilever Solar electricity deal in India

Case Study – Virtual Power Purchase Agreement (PPA) in Spain

Virtual PPA + GOs decarbonise electricity in multiple European countries at scale, without Capex investment



Background

- EU electricity grids vary significantly in carbon intensity and renewable mix, making site-by-site procurement complex and inconsistent

Approach

- Entered a Virtual PPA with Statkraft for ~61 GWh of renewable electricity from solar farms in Spain
- Single contract covering multiple European countries (in the same EU market boundary[1])
- Remaining electricity volumes covered by bundled GOs (EACs).

Unilever Outcomes

- Directly financed new renewable capacity, delivering high additionality
- Single contract structure enabled decarbonisation at scale across dispersed sites without physical infrastructure

*(1) Load and the VPPA need to be in the **same market boundary**, see RE100 Technical Criteria for market boundary definitions*

Additional Information

Tools Available for Energy and Technology Assessments

EUROPEAN COMMISSION, PVGIS
Photovoltaic geographical information system that shares data on solar radiation and photovoltaic system performance to estimate solar energy production potential worldwide

GOOGLE, ENERGY ASSESSMENT TOOL
Online self-service platform to help manufacturing facilities identify energy saving opportunities and conduct preliminary energy assessments

U.S. DEPARTMENT of ENERGY

KEY TOOLS & RESOURCES

PVWATTS
Online calculator that estimates the energy production of grid-connected photovoltaic (PV) energy systems to help develop estimates of the performance of potential PV installations

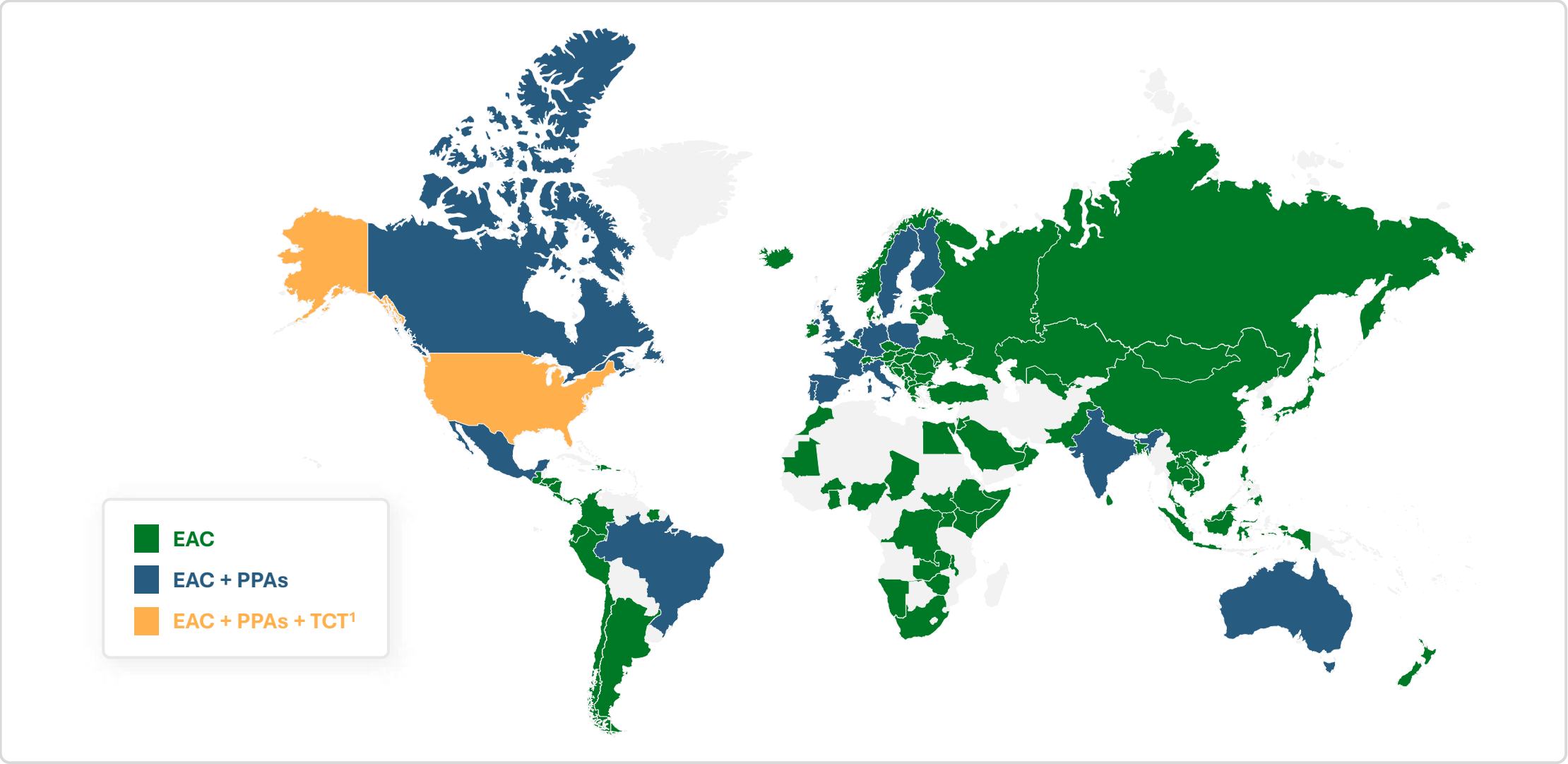
REOPT
Web tool to help evaluate the economic viability and optimal combinations of distributed PV, wind, battery storage, combined heat and power, and thermal energy storage at a site

ENERGY FOOTPRINT TOOL (GUIDE, TOOL)
Excel tool to help plant managers establish a baseline of energy consumption and track annual progress of intensity improvements, energy savings, etc.

MEASUR
Online software tool to help model manufacturing energy use and generation, quantify savings opportunities, and create visualisations for project pitches

TECHTEST
Excel tool that integrates Life Cycle Assessment (LCA) and techno-economic analysis methods to estimate potential energy and cost impacts of new technology

What Renewables are Available Where



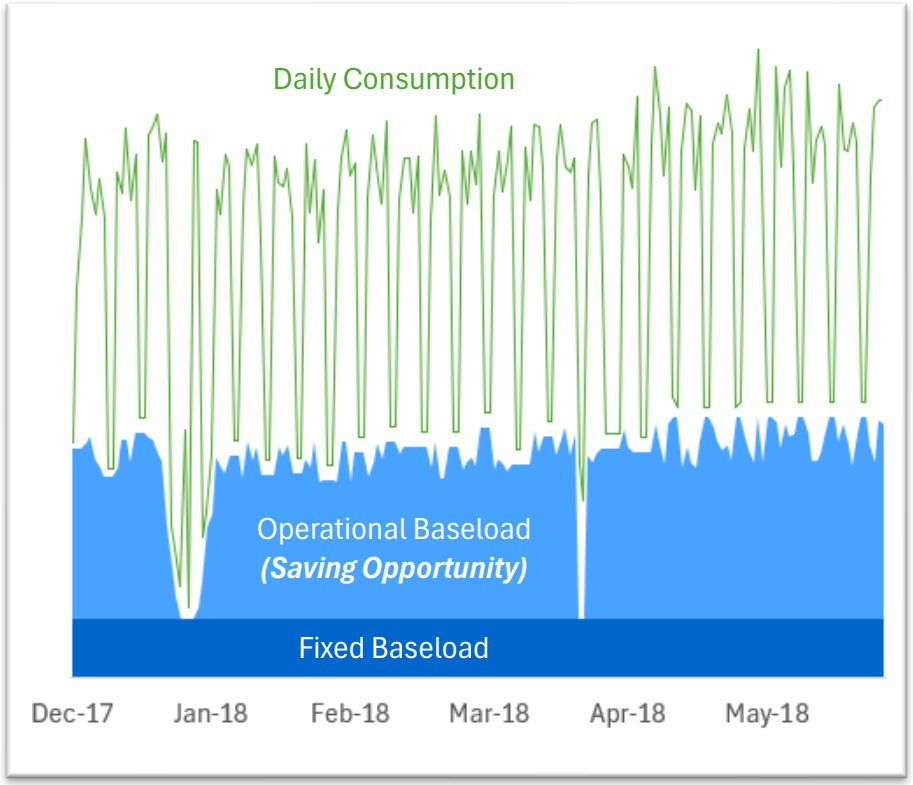
[1]*TCT = Tax credit transfer*

Source: ***Schneider Electric (2026)***

Technology Deep-dive: Baseload Reduction

Baseload is the electricity a site consumes even when it isn't producing. In Unilever's experience, reducing baseload can be among the highest impact, lowest cost efficiency actions.

Sample Factory Baseload Analysis (for illustrative purposes only)



Baseload Identification

Baseload Identification: Monitor consumption in shutdown periods. The lowest sustained reading is the true baseload.

Types of Baseload *(typical ranges; actual figures can vary by site)*
Critical (~5%): Essential systems that must run continuously
Unnecessary fixed (~10%): Assets left running during non-production
Operational (~15-20%): Energy used in equipment ramp up and down

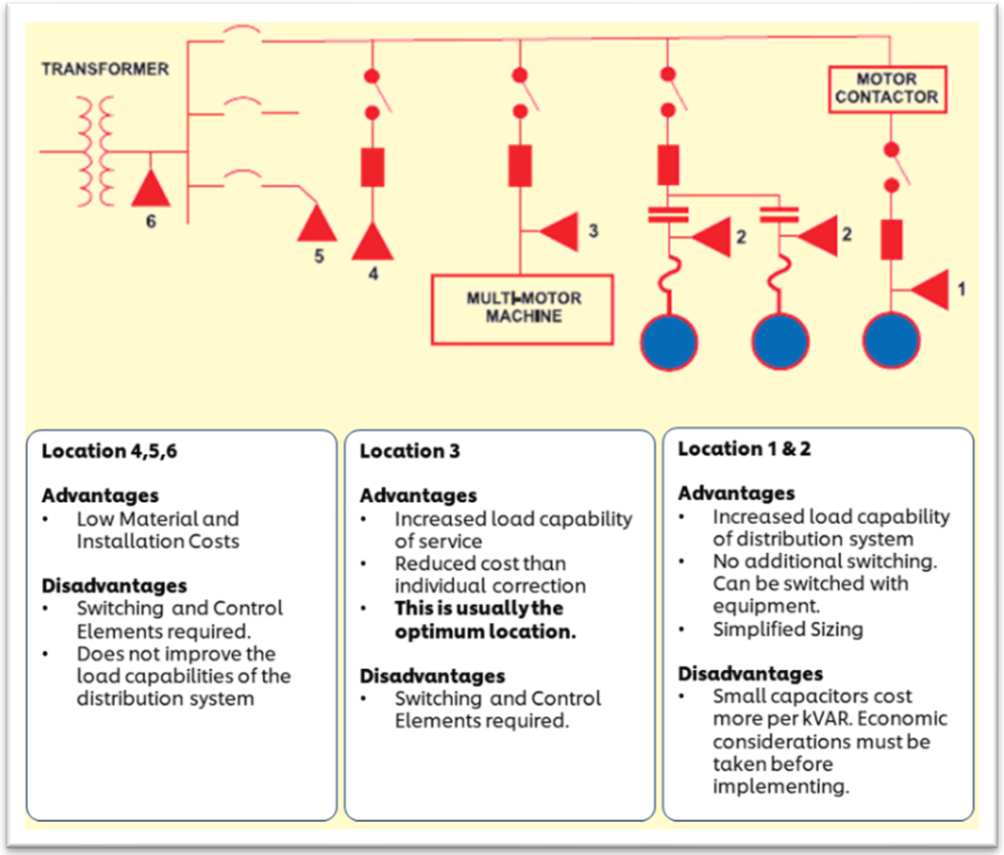
Baseload Reduction

1. **Eliminate idle loads:** Auto shut down equipment when production stops
2. **Optimise set points & controls:** Match utility output to actual demand
3. **Meter and monitor:** Identify largest consumers, prioritise, & track progress

Technology Deep-dive: Electrical Systems Efficiency

Electricity loses energy before it even reaches equipment, through cables, transformers, and inefficient electrical components. Addressing these losses is low-visibility but can be high-value.

Power Factor Correction Example (for illustrative purposes only)



Correct your power factor
Reduces excess current draw, lowering distribution losses and utility demand charges

Upgrade to high efficiency transformers
Industry guidance typically recommends operating at 50-70% load for peak efficiency; high efficiency models can reduce fixed losses

Right size cables and components
Limits voltage drops across the distribution system

Address harmonics
Non-linear loads like VSDs[1] and UPS[2] systems degrade power quality and accelerate equipment wear; reactors or active filters can mitigate this

[1]*VSD = Variable speed drive,* [2]*UPS = Uninterruptible power supply*

Technology Deep-dive: Variable Speed Drives

A variable speed drive (VSD) reduces electricity use by **adjusting motor speed and torque to match real process demand**. Instead of wasting energy via valves, dampers, or brakes, VSDs control output to deliver only the power needed.



Energy Cost Savings
Often reduces electricity consumption by matching motor output to real demand

Improved Equipment Life
Soft start capability can reduce mechanical stress and extend asset life

Better Connectivity & Diagnostics
Easier monitoring, fault detection, and integration into Cloud services and automation networks

Low Implementation Complexity
Typically, easily retrofitted to existing motors

Technology Deep-dive: Variable Speed Drive Key Considerations

This is a non-exhaustive technical checklist to assess feasibility, cost, and integration risks for variable speed drive deployment

Throttling based control is common
Systems rely on partially closed valves or dampers to regulate flow/air

Process demand varies over time
Equipment operates at full speed despite changing production requirements

High run time pump and fan systems
Pumps, fans, blowers, and ventilation systems are a significant share of electricity consumption

System resistant changes frequently
Performance is affected by changing backpressure, filter fouling, or varying operating conditions

Clear operational and maintenance value
Opportunities to reduce mechanical stress, improve control stability, and enhance equipment reliability

Exceptions will require engineering validation
Some applications (e.g. specialized pumps and compressors) may require detailed technical review before implementation

Technology Efficiency Improvements: Efficient Pumps

Energy-efficient pumping can reduce electricity use by matching pump operation to actual demand, rather than wasting energy through throttling or excess run-time

Examples of common problems and approaches partners may wish to consider



Equipment Inefficiency	Solution
Flow controlled by partially closed valves	Match pump output to demand using speed control instead of restricting flow
Water recirculated through bypass lines	Eliminate unnecessary pumping by resizing pumps or reducing operating speed
Too many pumps running in parallel	Automate pump sequencing so only the required pumps operate at a given time
Pumps running continuously in batch operations	Align pump run-time with production cycles through demand-based control
High maintenance and frequent breakdowns	Operate pumps in their optimal range to reduce mechanical stress and wear