# Piloting Buildings of the Future: Azerbaijan's AI-Energy Playbook

WHITE PAPER

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# Reading guide

This report forms part of the World Economic Forum's AI Energy Impact Initiative,[1] a global effort to understand how artificial intelligence (AI) can support a more efficient, resilient and sustainable energy future. The initiative produces publications combining global analysis with regional and sector-specific deep dives.

The latest report in the series, "From Paradox to Progress: A Net-Positive AI Energy Framework", outlines principles to ensure that AI enables the energy transition rather than adding strain. It introduces three action drivers: **design for efficiency, deploy for impact**, and **shape demand wisely**, supported by ecosystem collaboration, capacity building and transparent measurement.

### How this report fits into the series

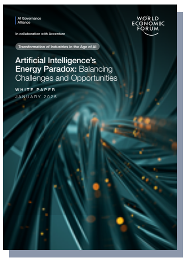
This publication is a national deep dive applying the net-positive AI-energy framework to Azerbaijan's building sector, one of the country's most energy-intensive sectors. It demonstrates how the global framework can be operationalized in a national context, focusing primarily on the **Deploy for Impact** pillar.

### What this report covers

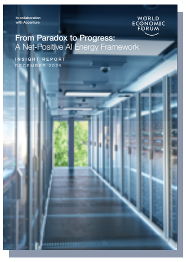
The report follows a pilot led by the Centre for the Fourth Industrial Revolution (C4IR) Azerbaijan with support from the AI Energy Impact Initiative. It assesses building energy use and digital readiness, tests an AI-enabled optimization solution, identifies key barriers, and presents a roadmap for scaling AI-enabled building efficiency actions nationwide.

## Cross industry

Impact on industrial ecosystems



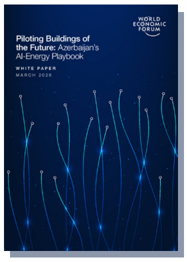

*Artificial Intelligence's Energy Paradox: Balancing Challenges and Opportunities*




*From Paradox to Progress: A Net-Positive AI Energy Framework*

## Region specific

Impact on regions




*Piloting Buildings of the Future: Azerbaijan's AI-Energy Playbook*

**Upcoming:**
*A Matter of Power: Optimization of AI and Hyperscale Data Centre Infrastructure in MENA*

# Foreword

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The buildings sector is widely recognized as a pivotal area for action in the twin green and digital transitions, presenting both significant environmental challenges and major opportunities for innovation and impact. Globally, buildings account for nearly one-third of total energy consumption and emissions.[2] In Azerbaijan, this challenge is particularly acute: buildings represent 41.7% of national energy use, well above the global average of 35%.[3]

This makes the sector a critical lever for national decarbonization. Optimizing building operations could reduce energy consumption by nearly 30%.[4] However, unlocking this potential requires strategic alignment between energy policy, digital innovation and long-term economic competitiveness.[5]

The convergence of energy and digital innovation is not only a technological shift, but a strategic pathway towards a more resilient, efficient and future-oriented economy.

Recognizing this opportunity, the Centre for the Fourth Industrial Revolution Azerbaijan, with support from the World Economic Forum's AI Energy Impact Initiative, launched a pilot in 2025.

Azerbaijan's strong energy infrastructure, supportive investment climate and established international partnerships provided a solid foundation for the pilot. Through close collaboration, an AI-enabled energy optimization solution was adapted to the country's institutional and infrastructure context, while identifying pathways to scale deployment nationally.

This paper offers a blueprint for adapting global AI energy solutions to local contexts by presenting the pilot's key findings, the lessons learned for various stakeholders, and a practical roadmap for advancing AI-enabled building efficiency nationwide.

Together, leveraging a global framework, it demonstrates how coordinated action can move AI from isolated pilots to scalable impact, positioning AI as a driver of low-carbon competitiveness in Azerbaijan.

# Executive summary

In 2025, C4IR Azerbaijan launched a pilot supported by the World Economic Forum's AI Energy Impact Initiative to explore how AI-enabled building efficiency could support national climate and energy goals. Guided by the net positive AI-energy framework, the pilot tested an illustrative solution from a global AI provider and assessed how Azerbaijan could scale energy-efficient, AI-enabled building operations.

The key achievements included:

- Ecosystem mapping to identify technical, organizational and regulatory barriers.
- AI solution deployment to optimize heating, ventilation and air conditioning (HVAC) systems and establishment of baseline consumption data.
- Drafting of a national roadmap to scale adoption of AI-enabled building efficiency.

Early results suggest strong potential: up to 25% reductions in HVAC energy use and 20-40% cuts in emissions, with return on investment (ROI) achieved within 6-18 months.[6] Scaling such AI-enabled energy solutions could help accelerate Azerbaijan's transition towards its target of 30% renewable energy capacity by 2030, while reducing reliance on inefficient building operations.

This pilot illustrates the practical application of the net positive AI-energy framework, advancing the pillar Deploy for Impact through demonstrated HVAC energy and emissions reductions. It also lays critical groundwork for one of the framework's key enablers of fostering collaboration: such as among building owners, government entities and technology partners, and enhancing accountability by improving the availability of baseline data and monitoring tools.

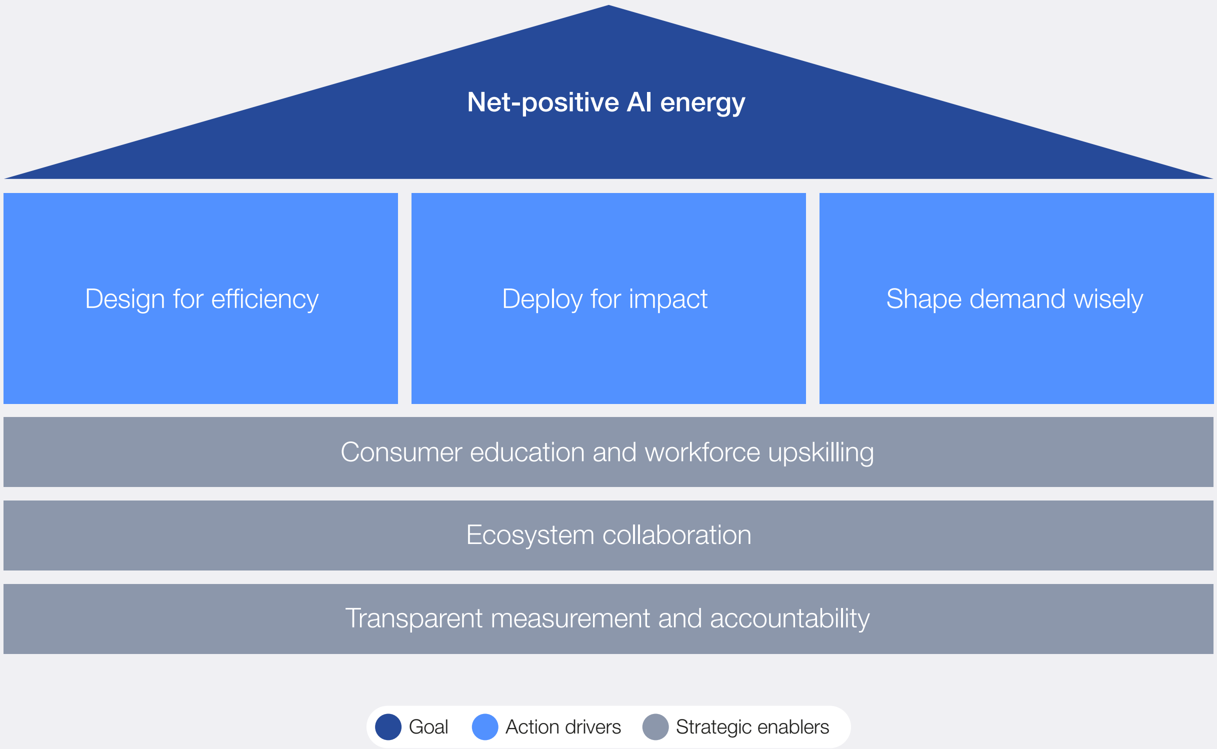
As the approach scales, further progress will be needed, particularly in enabling electricity demand-response flexibility, and in building workforce capabilities across the public and private sectors.

To succeed, the following stakeholder roles will be important:

- **Policy-makers** – updating building codes, standards and national energy-efficiency programmes, which are key to unlocking AI-enabled efficiency at scale.
- **Building owners and operators** – investing in infrastructure readiness, data availability and operational capabilities, which are critical to deploying AI solutions effectively.
- **Technology providers** – designing and deploying AI solutions that align with national energy, infrastructure and skills constraints, enabling efficient scaling beyond pilots.
- **International partners** – supporting responsible AI deployment in emerging markets to help translate local lessons into transferable best practices.

# 1 Applying the net-positive AI-energy framework in Azerbaijan

FIGURE 1 **The net-positive AI-energy framework**




The World Economic Forum's net-positive AI-energy framework outlines how AI can scale in ways that strengthen, rather than strain, energy systems. The framework is structured around three action drivers: design for efficiency, deploy for impact, and shape demand wisely. These in turn are supported by three strategic enablers: consumer education and workforce upskilling, ecosystem collaboration, and transparent measurement and accountability. Together, these elements provide a practical blueprint for aligning AI growth with energy, climate and economic goals.

This Azerbaijan deep dive operationalizes that blueprint in the buildings sector. The pilot demonstrates how AI-enabled building optimization can deliver measurable operational impact, while highlighting the key conditions for infrastructure readiness, demand flexibility and policy alignment required for durable, system-wide scale.

At a high level, the experience in Azerbaijan reinforces two core insights from the global framework:

- The three action drivers must function as a coherent system: Designing for efficiency, deploying innovative solutions and aligning demand are mutually reinforcing rather than sequential steps.
- The strategic enablers create the necessary conditions to unlock AI solution deployment at scale, where collaboration, skills and transparent measurement translate technical capability into durable impact.

By applying the framework in a national context, this report illustrates how a global AI-energy solution can translate into locally grounded action, offering a replicable pathway for scaling AI-enabled building efficiency applications in emerging markets.

# 2 Azerbaijan's net-zero buildings pilot

Inaction on energy consumption in buildings may increase long-term energy costs and hinder Azerbaijan's ability to meet its national sustainability and carbon reduction targets. In line with Azerbaijan's country-level digital transformation vision and the priorities outlined under the Digital Economy Strategy (2026-2029), this pilot aims to leverage data, AI and digital public infrastructure to support energy efficiency in the built environment.

The pilot, led by C4IR Azerbaijan, focuses on aligning local building-sector challenges with globally recognized AI and digital solutions, while ensuring coherence with national initiatives under the Digital Economy Development Strategy, the Digital Transformation Strategy (DTS) and emerging Generative AI (GenAI) use cases.

**Key objectives include:**

- Conducting a C4IR-led mapping and analysis of local opportunities and challenges, aligned with prioritized global AI solutions for energy-sector pilots.
- Developing a practical, scalable roadmap to guide pilot design, implementation and early-stage execution, including milestones and selection criteria.
- Facilitating strategic engagement with global and regional stakeholders to support resource mobilization and long-term national adoption.

Guided by the World Economic Forum's global net positive AI-energy framework, C4IR Azerbaijan generated the below scorecard summarizing key pilot results, which in turn informed a draft national roadmap for scaling AI-enabled energy efficiency in buildings in line with responsible scaling principles.

BOX 1 | **National energy-efficient buildings pilot: Performance scorecard**

- Applied
- Partially applied
- Not applied

### Challenge

Buildings in Azerbaijan are heavily reliant on outdated or fragmented HVAC systems, lacking centralized management and real-time monitoring. This drives high costs and undermines national climate goals, including Azerbaijan's commitment to reducing greenhouse gas (GHG) emissions by 35% by 2030.[7]

### Solution

A pilot introducing a global energy optimization solution applying predictive analytics, adaptive machine learning and real-time monitoring to reduce energy wastage. Internet-of-Things (IoT) sensors were installed to generate baseline data. Additional applications included demand response, predictive maintenance and occupant comfort modelling.

### Impact realized <1 year

- Strengthened institutional awareness of AI-enabled efficiency.
- Government subsidies enabled free initial adoption to generate baseline energy data.

### Impact anticipated >1 year

- Up to 25% HVAC energy savings and 20-40% emission cuts, with ROI in 6-18 months.[8]
- Scalable deployment across Baku, Sumgait and Ganja.
- Modernization of building codes and expansion of centralized management systems.

### Deploying AI for impact:
Net Positive AI levers in action levers in action

The categories below represent the sectoral dimensions of the Deploy for Impact pillar of the net positive AI-energy framework, illustrating how AI applications in buildings intersect with broader system domains such as grids, industry, transport and renewables.

- (Applied) **Building energy management:** Core impact, with measurable savings and emission cuts.[9]
- (Partially applied) **Smart grid optimization:** Partial contribution via demand response; future potential for broader integration.[10]
- (Partially applied) **Industrial process control:** Indirect relevance; predictive maintenance lessons transferable to industry.[11]
- (Partially applied) **Transport and logistics:** Not piloted; opportunities for future smart-city integration.
- (Not applied) **Renewables forecasting:** Not addressed; future integration could link demand optimization with renewables variability.

### Barriers and lessons learned

The pilot highlighted barriers across three areas:

- **Technical:** Legacy systems, fragmented HVAC, high retrofit costs.[12]
- **Organizational:** Skill gaps, resistance to change, lack of champions.[13]
- **Regulatory:** Outdated codes assuming centralized systems, limited incentives.[14]

Lessons learned include the need to assess infrastructure readiness first, align solutions with local context, invest in training and integration, build trust with transparent return on investment (ROI), and evolve supportive policy frameworks.

### Business case identified

The pilot demonstrated that AI-enabled building efficiency has the potential to deliver measurable energy savings, cost reduction and carbon abatement, while aligning with Azerbaijan's Paris Agreement commitments and wider global AI governance frameworks. As the findings showcased in this paper show, by addressing infrastructure, governance and policy gaps, the pilot offers a replicable, scalable model for smart, resilient and low-carbon buildings across the region.

# 3 A right-sized AI energy efficiency use case

After scanning around 50 global use cases, C4IR and its partner stakeholders identified and executed a pilot that involved AI algorithms for optimization and control in buildings. The effort focused on seamlessly integrating the solution with existing building management systems and supporting the AI solution application with real-time energy monitoring. Together, these capabilities aimed to reduce overall energy consumption, lowered operational costs and advanced sustainability targets by cutting the building's carbon footprint.

In addition to these core applications, the pilot also explored deployment of several other AI in energy efficiency use cases to reinforce or amplify impact:

- **Demand response integration:** The AI system integrated relevant global insights into the local energy-efficient buildings pilot. It dynamically adjusted energy use in response to grid signals, reducing peak demand and enhancing grid stability (For instance, the United States Department of Energy's Smart Grid Demand Response Program and Singapore's Smart Energy Management System, using real-time IoT-enabled load balancing algorithms applied to HVAC, lighting, and other major building loads).

- **Predictive maintenance:** By identifying anomalies in equipment behaviour before failures occurred, the solution improved reliability, reduced downtime and extended system lifespan. (For example, the European Union's Horizon 2020 AI4Buildings and Japan's Hitachi Smart Maintenance Platform, which use vibration and temperature sensors for early fault detection).

- **Occupant comfort modelling:** Drawing on global use cases, machine learning was applied to dynamically optimize HVAC and other energy-intensive systems in real time, adjusting to occupancy levels and usage patterns to balance energy efficiency with occupant comfort. (For instance, Canada's BrainBox AI and the United Kingdom's Edge Olympic smart building model, where AI combines occupancy analytics with adaptive comfort controls).

Pilot deployment (August 2024 to December 2025) highlighted how AI could take buildings in Azerbaijan beyond incremental efficiency gains towards proactive, intelligent energy management. By combining operational optimization with grid responsiveness, predictive maintenance and occupant-centric design, the pilot's design identified benefits that directly aligned with Azerbaijan's local priorities, balancing energy savings with resilience, comfort and smart-city integration.

These locally relevant and foreseen advantages were the decisive factors in selecting and adapting the appropriate or right-sized solution to local conditions, creating replicable models for future energy-efficient buildings in the country.

# 4 Failing upwards: Turning lessons into sustainable progress

This pilot was more than a proof of concept. It demonstrated how AI could directly reduce energy use in buildings while supporting Azerbaijan's broader sustainability agenda. By aligning the pilot with activities leading up to COP29 and the Forum's global Net Zero Carbon Cities initiative, its design and implementation were intentionally shaped to prioritize replicable, scalable approaches. This ensured a focus on enabling a systemic shift in the building sector towards a low-carbon, high-efficiency future, rather than delivering a one-off solution.

Although the pilot demonstrated strong potential, it did not fully achieve the expected results due to outdated or fragmented building infrastructure across most sites, which limited the feasibility of wider AI deployment. Nevertheless, these challenges provided valuable lessons on the importance of assessing technical readiness and modernizing systems before scaling nationwide.

## 4.1 From pilot to national impact

As explored further in the sub-sections below, the real value of this pilot lies in its ripple effects. Its implementation efforts not only validated AI as a powerful tool for managing energy but also:

- Encouraged adoption across public and private actors. Following the pilot, several government facilities and commercial properties in Baku expressed interest in adopting AI-based energy management systems, initiating preliminary assessments with C4IR support.
- Provided evidence to guide national energy policy, governance and business strategies. The pilot's findings will be integrated into C4IR Azerbaijan's contribution to the National Energy Efficiency Action Plan, influencing updates in public building standards and guiding local energy service companies to incorporate AI-readiness in their strategies.

### Technology applications

The pilot leveraged AI-driven energy management systems, supported by real-time monitoring and analytics, to significantly improve building energy efficiency. At its core, the solution integrated three key AI capabilities:

- **Predictive analytics** for forecasting energy demand and equipment performance, enabling proactive adjustments that reduced consumption and avoided inefficiencies.
- **Real-time data processing** to provide continuous monitoring and dynamic optimization of energy use across HVAC, lighting and other systems.
- **Adaptive control systems** that used machine learning to autonomously fine-tune operations based on occupancy, weather and usage patterns, achieving both efficiency gains and emissions reduction.

C4IR Azerbaijan and its global AI building-optimization solution vendor-partner discussed this solution with two of Azerbaijan's largest supermarket chains and one of the country's leading holding groups, representing the commercial and retail sectors. In addition, C4IR Azerbaijan held a series of consultations with several government entities to assess opportunities for AI-enabled building optimization in the public sector.

Assessments and digital readiness evaluations were conducted across multiple facilities to identify integration potential and baseline energy data. Each assessment focused on HVAC operations and energy management systems, supported by IoT-based monitoring to evaluate real-time consumption.

While no full deployment occurred due to legacy infrastructure constraints, the pilot generated valuable data on system compatibility, operational efficiency and capacity needs for future scaling.

## Innovation potential

As one of the participating facility managers noted, "The pilot showed us, for the first time, how AI could turn our everyday operational data into actionable insights. Even without full deployment, the analysis revealed that our buildings were using 20-25% more energy than needed."

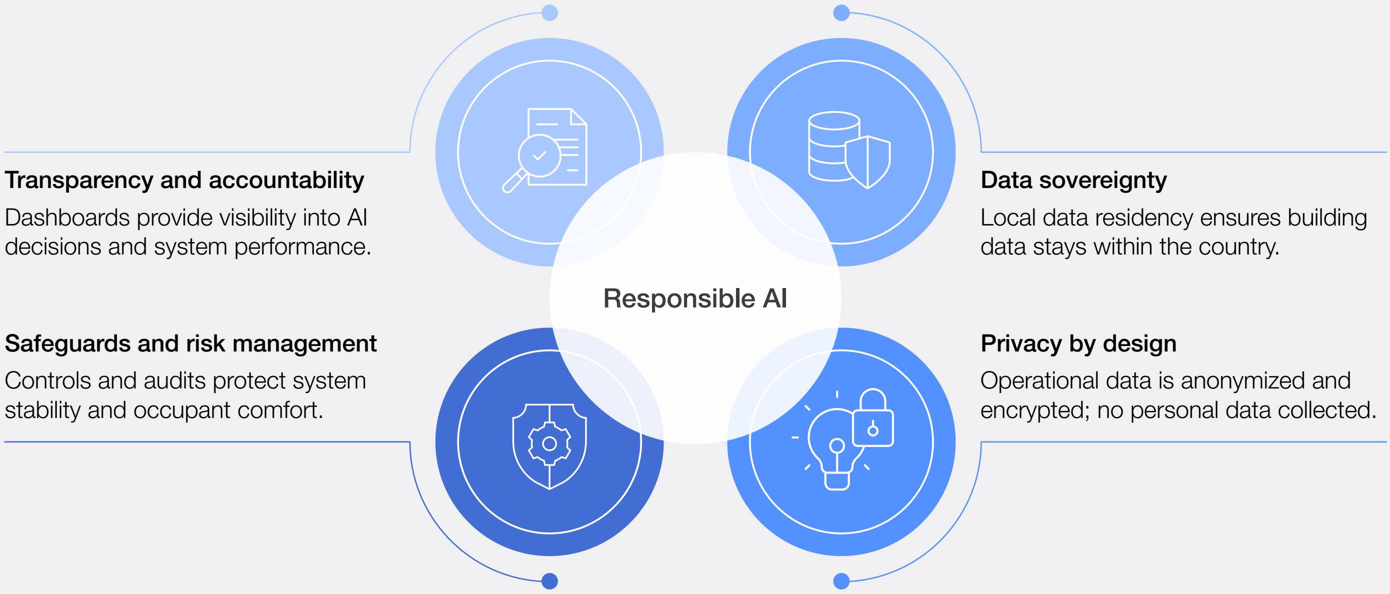
Representatives from one of Azerbaijan's largest retail chains also emphasized the broader opportunity, noting that: "Smart energy systems can help us not only reduce costs but also align with the country's new sustainability reporting standards."

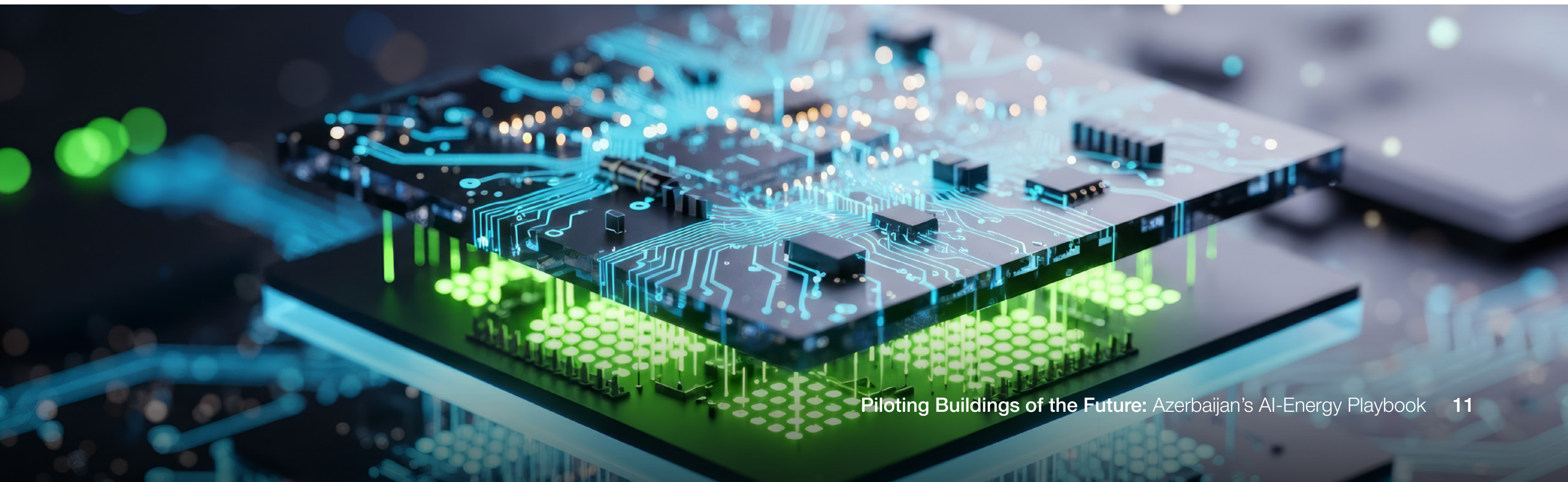
These findings demonstrated how the pilot's innovations can directly support Azerbaijan's smart city ambitions and carbon accounting efforts under the State Program for Renewable Energy (2022-2030). The approach could link building-level AI systems with city-level platforms tracking energy use, emissions and climate resilience, creating an integrated foundation for national sustainability goals.

## Responsible AI

As seen graphically below, the pilot also placed strong emphasis on responsible AI practices to ensure that the solution was not only effective but also sustainable, transparent and equitable.

FIGURE 2 **Responsible AI safeguards introduced for energy efficiency in buildings**



### Policy insight: Securing responsible AI adoption

The pilot confirmed that **responsible AI safeguards are essential for scaling energy efficiency solutions** in ways that are trusted, equitable and competitive.

**Core principles applied in Azerbaijan included:**

- **Data sovereignty:** Local data residency and processing, ensuring no building data left the country.
- **Privacy by design:** Anonymization and encryption of all operational data; no personal data collected.
- **Transparency and accountability:** Dashboards gave facility managers visibility into AI decisions, enabling validation, audits and oversight.
- **Safeguards and risk management:** Occupant comfort and system stability were protected by fallback controls, audits and ethical risk assessments.

These principles also reinforce the net positive AI energy enabler of transparent measurement and accountability by ensuring that data handling, model decisions and system performance remain visible, verifiable and trustworthy for all stakeholders.

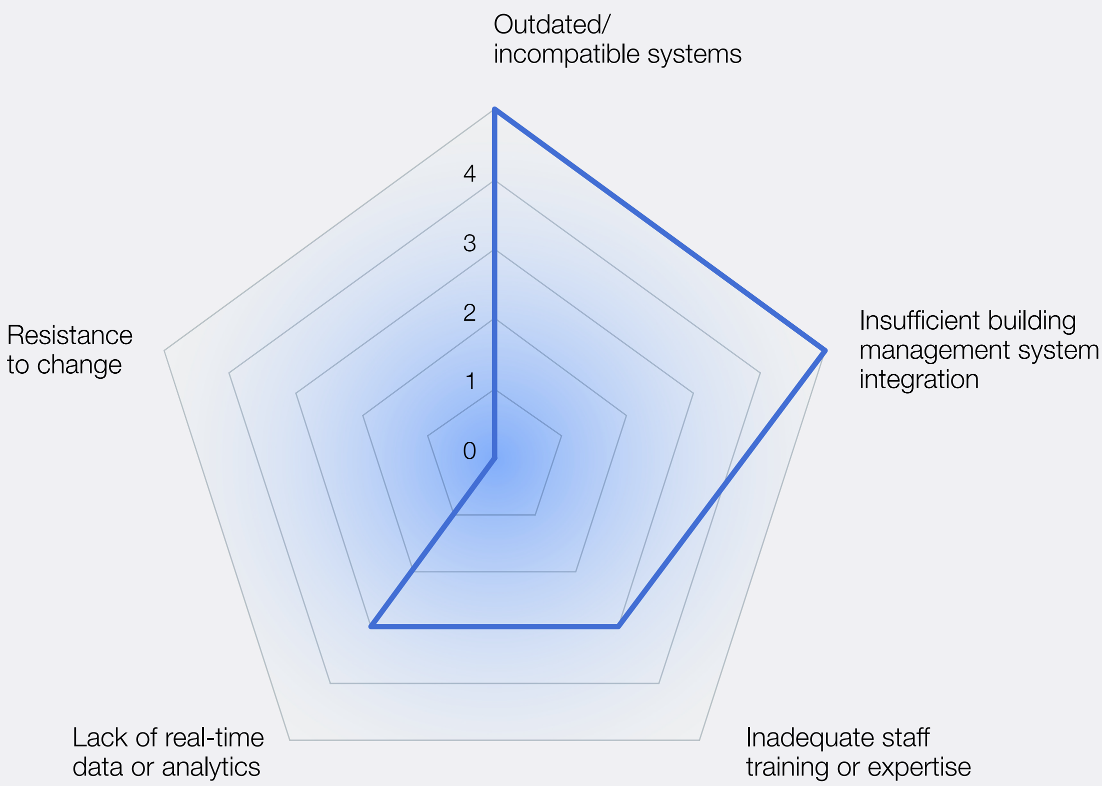
**Why this matters:** Embedding responsible AI principles not only secured stakeholder trust but also positioned Azerbaijan's pilot as a model for how countries can combine sustainability with competitiveness. By aligning adoption with international best practices (e.g. the international standard for Information Security Management Systems or ISO/IEC 27001, General Data Protection Regulation or GDPR, and the World Economic Forum's Artificial Intelligence Global Alliance or AIGA), while localizing for national priorities, governments can accelerate AI-enabled efficiency while maintaining control, security and public confidence.

# 5 Barriers, lessons and potential solutions

The barriers identified in this pilot mirror the energy, and technical and institutional challenges observed globally in AI deployments,[15] highlighting the need for coordinated action across policy, infrastructure and workforce development.

As Figure 3 illustrates, the pilot surfaced several critical barriers to scaling AI-enabled building efficiency in Azerbaijan. These fell into two categories: structural or technical constraints (outdated/incompatible systems, insufficient building management system integration, lack of real-time analytics or data), and organizational readiness gaps (resistance to change, inadequate staff training or expertise).

FIGURE 3 **Barriers to scaling AI-enabled energy efficiency building solutions nationally**




**Key:** 5 = Very severe, 0 = Not a barrier

## 5.1 Structural or technical constraints

The most pressing challenges included outdated infrastructure, incompatible building management systems and limited integration capacity. Much of Azerbaijan's building stock operates on decentralized or manually controlled HVAC units, which are not suited for AI optimization. Many buildings lack centralized systems, making AI deployment technically or financially impractical. For instance, one pilot design considered an office building with 100 independently operated HVAC units. Scaling would have required 100 separate AI deployments, and an unrealistic cost burden requiring additional middleware, sensors and communications layers.

Building codes and standards, including the Urban Planning and Construction Code, SNIP (Construction Norms and Rules)/DBN (State Building Norms)-derived regulations and the Azerbaijani State Standards (AZS), typically assume centralized HVAC systems in commercial and multi-unit buildings. While this simplifies compliance, it leaves decentralized systems unaccounted for and difficult to optimize with AI.

This barrier was evident in the grocery store pilot site, where more than 50 independent split-unit HVAC systems operated without a centralized Building Management System (BMS). Because the AI solution vendor depends on real-time monitoring and centralized digital control, deployment was infeasible. Linked to this, another issue was a lack of real-time data or analytics. This stemmed from concerns around data sharing and cybersecurity.

**Lesson learned:** AI solutions cannot deliver results without foundational infrastructure. Technical readiness assessments and system modernization must precede deployment. Hence, prioritization is critical. AI integration is most feasible in buildings with centralized or semi-centralized systems, while others may require significant retrofits or alternative solutions. Additionally, in terms of data, ensuring privacy compliance, demonstrating transparency in AI decision-making, and securing access to high-quality building data integrated with existing BMS systems are all critical to reducing resistance and enabling faster scaling.

**Identified enablers:** Prioritize centralized/semi-centralized sites for AI deployment in the short term, while incentivizing cost-effective retrofits and exploring middleware solutions for hybrid integration. Modernize HVAC/BMS systems, deploy IoT sensors, update building codes to recognize decentralized systems, and incentivize upgrades through the Energy Efficiency Fund. Regulators can also streamline data governance regulations to facilitate secure centralized data-sharing for AI-driven optimization (near-medium term); introduce national interoperability standards and recommissioning cycles (medium term); and embed AI-ready requirements in all new builds (long term).

## 5.2 Organizational readiness gaps

Institutional barriers were equally significant. Limited technical expertise, inadequate training and stakeholder resistance reduced confidence in AI-driven interventions. Many building managers had little exposure to digital systems, leading to hesitation about automation, fears of losing manual control and reliance on external vendors.

Another issue faced to a lesser degree was reluctance to change long-standing practices without ROI evidence. This resulted in a lack of internal champions empowered to oversee AI projects and limited training programmes to interpret AI outputs or manage integrations.

**Lesson learned:** Adoption depends on building local capacity, strengthening digital literacy and addressing concerns early through transparent ROI data and human-in-the-loop controls.

**Enablers:** Training and certification programmes (e.g. "Controls and Data Leads"), ROI dashboards, awareness campaigns and phased adoption pathways with human oversight.

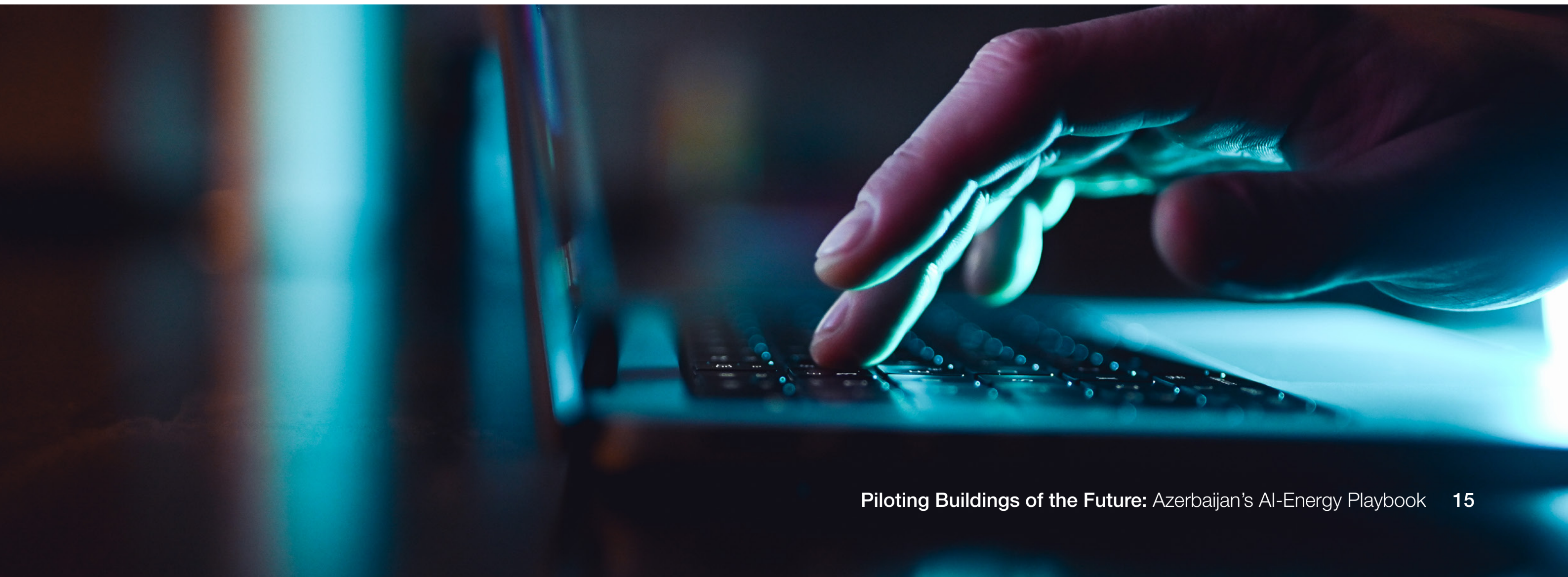
# 6 Mapping barriers to solutions and enablers

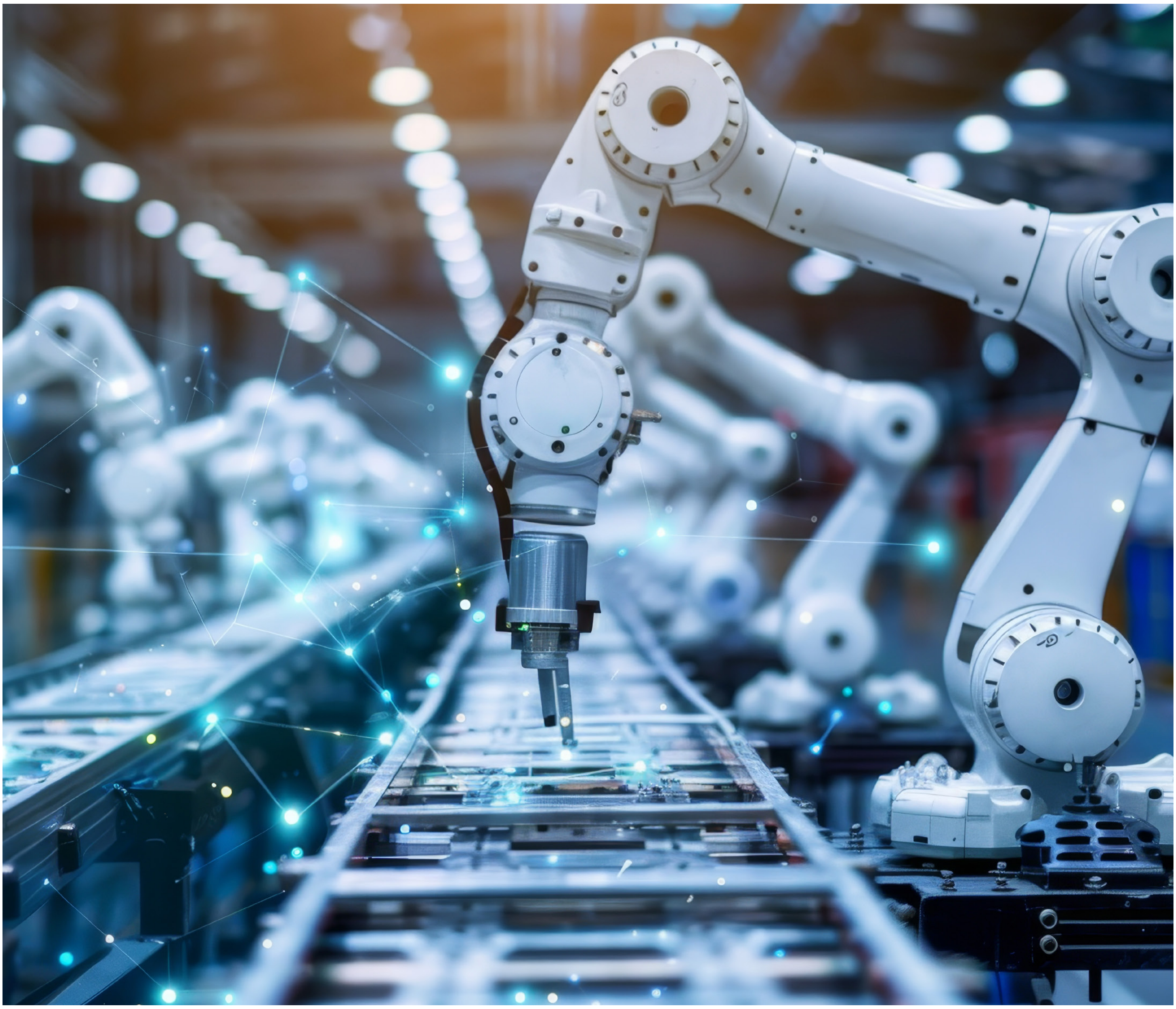
The pilot confirmed that barriers can be addressed with targeted solutions and enabling conditions. The table below maps barriers to their impacts, proposed solutions identified, enablers and expected outcomes.

TABLE 1 **Solutions and enablers for progressing a national AI-enabled building efficiency strategy**

| Barrier/challenge | Impact on stakeholders | Proposed solution | Enablers | Expected outcome |
|---|---|---|---|---|
| *Incompatible building infrastructure (decentralized HVAC) | Increased energy costs; reduced operational efficiency | Conduct readiness assessments; explore alternative vendor solutions; plan regulatory updates | Incentivize retrofits via Energy Efficiency Fund; update codes to allow multiple independent systems; prioritize centralized/semi-centralized pilots | Feasible AI deployment; reduced retrofit costs; scalable solutions |
| Legacy/older BMS with limited integration | Difficulty integrating AI; operational inefficiencies | Invest in integration capabilities; provide strong technical support; explore middleware or hybrid solutions | Introduce interoperability standards; require recommissioning every five years; subsidize digital upgrades | Seamless AI integration; improved energy management |
| Limited staff expertise/training | Resistance to change; over-reliance on vendors | Provide training and certification; ensure clear documentation; designate internal champions | Develop "Controls & Data Lead" role, national training curriculum, ROI-focused dashboards | Higher adoption rates; stronger in-house capacity; sustained operation |
| Organizational resistance to automation | Hesitation to relinquish manual control | Enable change management, phased adoption with human-in-the-loop | Conduct awareness campaigns, stakeholder dialogues; ensure safeguards protecting comfort | Greater trust in AI; smoother adoption |
| Lack of awareness/ unclear ROI | Hesitation to invest; delayed buy-in | Conduct awareness campaigns, case studies; ensure transparent performance metrics | Pilot ROI dashboards, government-backed demonstration projects | Faster buy-in; measurable performance improvements |
| Data privacy/ cybersecurity concerns | Compliance risk; stakeholder hesitation | Ensure compliance with standards, transparent governance | Ensure local data residency, encryption; create dashboards for transparency | Increased trust; stronger data-sharing confidence |
| Regulatory constraints in centralized systems | Delays in scaling; barriers to innovation | Advocate for regulatory updates to allow multiple system types | Update Urban Planning Code and related standards; align with international best practice | Enabling environment for AI efficiency; replicable national model |

* Relevant for buildings built before 2024.[16]





The mapping above highlights several key insights for defining the next phase of policy development required to unlock identified bottlenecks and enable the scaling of AI-enabled building efficiency solutions in Azerbaijan. While many of the proposed solutions can be piloted through targeted interventions, their sustained impact at scale will depend on updated or new policy frameworks that institutionalize these approaches.

For instance, to overcome the barrier of incompatible building infrastructure, particularly decentralized HVAC systems, policy updates to building codes and retrofit standards will be necessary to permit and incentivize centralized, AI-optimized energy management systems. Similarly, addressing legacy BMS systems with limited integration capacity will require the introduction of interoperability standards and procurement guidelines that mandate open architectures and data compatibility in both public and large-scale private buildings.

Data governance reforms will also be critical. Clear regulatory frameworks for data access, sharing, cybersecurity and privacy protection can reduce stakeholder hesitation and build trust in AI-driven monitoring systems. In parallel, regulatory sandboxes and adaptive compliance mechanisms can help manage risks while accelerating innovation. Finally, targeted financial incentives, performance-based schemes and public sector demonstration mandates will be essential to de-risk early adoption and catalyse market confidence.

Taken together, these policy measures move beyond isolated pilots and create the structural conditions necessary for nationwide, scalable deployment of AI-enabled building efficiency solutions.

# 7 Partnerships and stakeholder dynamics

The pilot underscored that scaling AI-enabled building efficiency requires effective multistakeholder action. Long-term success depends on the active participation of diverse actors across deployment, data sharing and feedback processes.

Building owners and facility managers were central to ensuring infrastructure compatibility and encouraging user adoption. Government agencies and regulators supported the enabling environment through policy incentives, standard-setting and public funding. Technology partners contributed technical deployment, innovation and system updates. Finally, employees and tenants played a vital role in maintaining trust, ensuring that operational improvements remained aligned with comfort and user needs.

The most instrumental partnerships emerged through collaboration between the AI solution vendor and local implementing stakeholders, including building owners, facility managers and government bodies, which ensured access to infrastructure and alignment with national sustainability goals. Strategic alliances with global organizations such as the World Economic Forum enhanced credibility, mobilized funding opportunities and created the international visibility required for scale. Together, these partnerships provided the ecosystem necessary to expand the solution and integrate it into broader energy transition initiatives.

Regulators also played a decisive role by establishing supportive policy frameworks, offering incentives for energy-efficient technologies and mandating smart energy management standards in public and commercial buildings. Key frameworks shaping this enabling environment include the Law on the Use of Renewable Energy Sources (2021), the State Program for the Use of Renewable Energy Sources (2022-2030) and the National Action Plan for Energy Efficiency (2019), all of which provide a foundation for AI-driven optimization in HVAC and related systems.

To validate suitability and ensure alignment with local realities, the pilot also convened a multistakeholder workshop. This approach enabled diverse feedback, practical adjustments and cross-sector consensus on the opportunities and barriers to scaling AI in Azerbaijan's building sector.

# 8 Value realization and scalability

The pilot demonstrated that AI-enabled building optimization can deliver significant value through energy savings, cost reductions and enhanced sustainability performance. These benefits are reinforced by a strong business case: measurable return on investment (ROI) within 6-12 months of implementation, alignment with national sustainability goals and potential for replication across multiple sites once basic infrastructure is in place.

BOX 2 **Scalability Snapshot: AI-Enabled Building Efficiency in Azerbaijan**

| | |
|---|---|
| ROI and benefits | – ROI achievable in **6-12 months** once baseline data is established.<br>– Up to **25% reduction in HVAC energy use; 20-40% emissions reduction**.<br>– Lower operational costs and improved energy reliability. |
| Priority sectors | – Public buildings: ministries, universities, hospitals.<br>– Commercial real estate and large office complexes. |
| Target cities | – **Baku, Sumgait, Ganja** – highest concentration of energy-intensive buildings. |
| Key infrastructure needs | – Modern **BMS**.<br>– **IoT sensor networks** for real-time data.<br>– **Centralized data access** to enable AI integration. |
| Scaling approach | – **Phase 1:** Subsidized IoT sensors to generate baseline consumption data.<br>– **Phase 2:** Deployment of AI optimization to demonstrate ROI and cost savings.<br>– **Dual track:** Scaling of AI in ready buildings while modernizing older stock for future adoption. |

At the same time, the pilot revealed important **limitations to scaling**. Chief among these were high upfront investment requirements, short-term reliance on government subsidies, and stakeholder resistance where AI optimization was perceived as an additional cost without clear baseline data. Many businesses lacked reliable energy consumption data, making it difficult to justify investment.

To address this, the pilot tested a **staged business model**:

– **Phase 1:** Install IoT sensors at no cost to participating buildings, generating baseline energy consumption data and building awareness of inefficiencies.

– **Phase 2:** Apply AI optimization once baseline data is available, enabling clear demonstration of ROI and cost savings.

The government supported this model with a temporary subsidy covering the first six months of adoption, helping to de-risk early investment and showcase tangible results.

Scaling efforts will focus on the major urban centres of Baku, Sumgait and Ganja, where commercial, public and government buildings are concentrated. Priority sectors include ministries, universities, hospitals, commercial real estate and large office complexes, which combine high energy demand with significant decarbonization potential. These represent the most attractive opportunities for AI-enabled efficiency given their infrastructure scale and alignment with national sustainability goals.

A key lesson learned is that AI solutions cannot deliver impact without foundational infrastructure. Many Azerbaijani buildings still rely on outdated or incompatible systems, limiting integration of advanced AI-driven energy tools. For successful scaling, it is therefore critical to prioritize modernization: upgrading BMS, deploying IoT sensor networks and ensuring centralized data access. Without this digital backbone, the full potential of AI optimization cannot be realized.

Looking ahead, scaling adoption will require two parallel tracks: one focused on expanding AI deployment where infrastructure is already suitable, and another on preparing and modernizing physical and digital infrastructure to enable future integration. This dual approach will allow Azerbaijan to both capture early gains and build long-term capacity for AI-enabled building efficiency.

# 9 Buildings of the future

## 9.1 Where things stand

The pilot surfaced practical insights into the existing governance, technical and contextual factors necessary to scale AI solutions in Azerbaijan's region-specific settings. These are:

– **AI will likely deliver the greatest impact at the operations level** where existing buildings can achieve rapid efficiency gains without major capital retrofits.

– **Designing for efficiency from the outset matters**, as data quality, sensor coverage and model optimization directly affect energy savings.

– **Smart demand shaping is essential**, requiring alignment of AI workloads with building usage patterns and grid conditions.

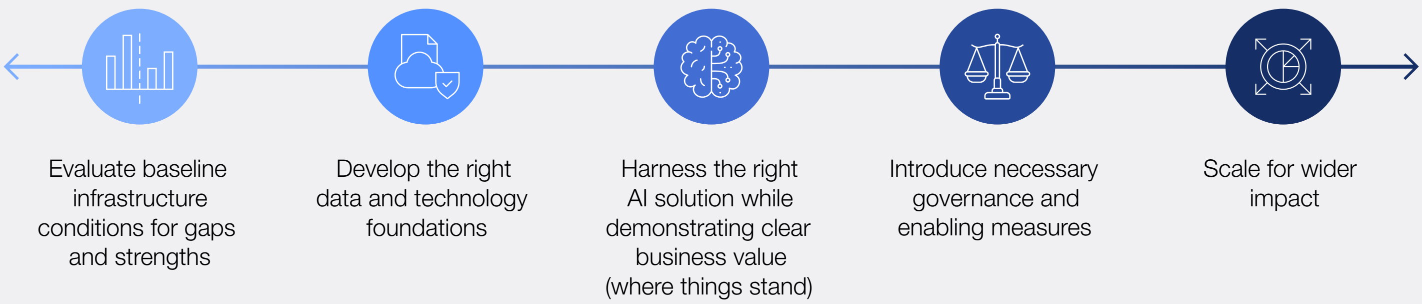
– **Scaling impact will depend on ecosystem coordination**, including regulators, building owners, technology providers and utilities.

– **Capacity building and transparency are critical enablers**, particularly for facility managers and public institutions responsible for long-term operations.

The following section provides a visual roadmap designed to guide policy-makers and stakeholders in setting priorities for action. It illustrates how different measures can be sequenced to maximize impact, creating a practical framework for decision-making. Together, these steps form the foundation of a replicable national strategy capable of delivering measurable energy efficiency gains, advancing sustainability goals and strengthening long-term climate resilience.

The proposed roadmap operationalizes the net positive AI-energy framework at the national level, translating its Deploy for Impact action driver and relevant enablers into concrete steps that reflect Azerbaijan's infrastructure, policy environment and institutional capacity.

FIGURE 4 **A proposed roadmap for energy efficient buildings in Azerbaijan**




## 9.2 The way ahead

To progress from pilot testing to scaled deployment of AI-enabled solutions in Azerbaijan's building sector, the proposed roadmap would need to be translated into a plan validated and mobilized through multistakeholder action. Drawing on lessons from the pilot and linking identified barriers to targeted interventions, it should outline a practical way forward for accelerating AI-enabled energy efficiency in Azerbaijan's buildings.

The success of any next steps will depend on clearly mapping the roles of required actors through inclusive stakeholder consultations that draw from national, regional and global partners (see example in Annex). Such mapping helps clarify who contributes to which goals; for example, policy bodies considering building code reform, ministries shaping incentive mechanisms, or convening platforms such as chambers of commerce, building code societies, architects and renovators that can drive awareness, foster buy-in and provide practical feedback for adoption at scale.

By aligning these diverse actors, Azerbaijan can ensure that pilots evolve into scalable programmes, and are technically viable, operationally practical and economically compelling. More broadly, this collaborative approach positions Azerbaijan not only to accelerate its own energy transition but also to serve as a replicable model for other countries seeking to deploy AI responsibly and competitively in the building sector.

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# Endnotes


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