

MAINTAINING MOMENTUM IN THE ENERGY TRANSITION

Security, Affordability, and Resilience in a Changing Geopolitical Context

Synthesis report based on NTNU Energy Transition Week workshops, held in
Trondheim in March 2026

BRIEF

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This synthesis report summarizes two high-level workshops held as part of the 2026 NTNU Energy Transition Week, organized by the NTNU Energy Transition Initiative. The report argues that maintaining momentum in the energy transition requires connecting climate action with security, affordability, resilience, competitiveness, and public legitimacy. It synthesizes key discussions on geopolitical pressure, resilient infrastructure, digitalization and cyber risk, supply-chain dependencies, finance, demand-side action, governance, and preparedness. The key conclusion is that many transition measures can support multiple objectives simultaneously, but only if they are carefully designed, financed, and implemented.

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Key Messages

- *First*, climate action remains central to the energy transition. But maintaining momentum will also require a secure, resilient, affordable, and competitive energy system.
- *Second*, geopolitical instability can either accelerate or delay the transition. It may strengthen the case for reducing fossil-fuel dependence, but it may also raise costs at least in the short run, increase risk premiums, and shift political attention toward short-term security responses.
- *Third*, resilience must be built into energy systems from the beginning. Infrastructure, digital systems, supply chains, and market designs should be planned for disruption, not only for efficiency under normal conditions.
- *Fourth*, demand-side action is one of the clearest no-regret strategies. Energy efficiency, demand flexibility, and reduced peak demand support climate goals, lower costs, reduce infrastructure pressure, and strengthen energy security.
- *Fifth*, the transition requires stronger institutional coordination. Many of the most important challenges are not purely technical; they concern governance, responsibility, trust, financing, regulation, and public legitimacy.

I. INTRODUCTION

Maintaining momentum in the energy transition has become more urgent and more complex. The transition remains essential for reducing greenhouse gas emissions, but it now takes place in a more uncertain geopolitical and security environment, with challenges including energy weaponization, physical attacks on infrastructure, cyber risks, and growing concern over strategic dependencies. Energy policy cannot therefore be framed only as climate policy. It is increasingly connected to security, affordability, industrial competitiveness, energy & infrastructure resilience, and public legitimacy.

This broader framing matters because energy systems support almost every core function of modern society, such as transport, digital infrastructure, industry, and defense. Disruptions in energy supply can therefore quickly spread beyond the energy sector and affect economic stability and national security. As a result, the dependencies embedded in energy systems are also security vulnerabilities. At the same time, the energy transition changes the nature of these dependencies: it can reduce exposure to fossil-fuel imports and geopolitical pressure on oil and gas flows, but it can also create new vulnerabilities, such as concentrated clean-technology supply chains. *The transition does not eliminate energy geopolitics; as fossil-fuel dependence declines, new strategic dependencies may emerge.*

The central challenge is therefore to design an energy transition that is not only low-emission, but also secure, resilient, affordable, and legitimate. Renewable energy, electrification, energy efficiency, storage, flexible grids, demand-side action, digital coordination, and resilient infrastructure can support several of these objectives at once. However, these co-benefits are not automatic. They depend on various factors, such as credible policy frameworks, good governance, institutional coordination, public trust, and careful system design. To examine these issues, two workshops were organized as part of *NTNU Energy Transition Week 2026* [1], [2]. The first workshop focused on drivers of a resilient and secure energy transition, while the second addressed how to maintain momentum by identifying co-benefits among climate, affordability, and security. This report synthesizes the main points dis-

cussed across the two workshops and identifies key implications, priority actions, and open questions for further work.

II. MAIN INSIGHTS FROM THE WORKSHOP DISCUSSIONS

A. MAINTAINING TRANSITION MOMENTUM UNDER GEOPOLITICAL PRESSURE

A recurring point in the workshops was that today's geopolitical situation can push the energy transition in opposite directions. Security concerns may strengthen the case for moving faster away from fossil fuels, because lower dependence on imported fuels can reduce exposure to volatile prices and vulnerable supply routes. In this sense, the transition can be understood not only as a climate strategy but also as a means of reducing strategic vulnerability.

At the same time, geopolitical pressure can make the transition harder to deliver. Uncertainty can increase investment risk, raise the cost of capital, and shift political attention toward short-term emergency measures. In such a context, security and affordability may be used as an argument to slow climate action, even though they could also strengthen the case for a better-designed transition.

How these pressures are framed matters. *For a no-regret solution, the transition should not be presented as a separate climate agenda competing with security and affordability.* The challenge is to respond to immediate geopolitical pressures without losing sight of long-term decarbonization.

B. TURNING CLIMATE, SECURITY, AFFORDABILITY, AND COMPETITIVENESS INTO CO-BENEFITS

A central question in the workshops was how the current focus on security, affordability, and competitiveness can support the energy transition rather than distract from it. The discussions did not assume that these objectives are automatically aligned. Instead, they focused on identifying transition measures that can support multiple objectives simultaneously, depending on how they are designed, financed, and implemented. Several examples were discussed:

- *Renewable energy* can reduce exposure to imported fossil fuels, volatile fuel prices, and vulnerable supply routes.
- *Energy efficiency* can lower bills, reduce infrastructure pressure, and decrease the amount of energy that must be secured during crises.
- *Electrification* can reduce fossil-fuel dependence and improve system efficiency when supported by adequate grids and flexibility.
- *Clean technologies and resilient infrastructure* can support industrial development, strategic capability, and preparedness.

However, the discussions also made clear that **co-benefits are not guaranteed**. A poorly designed transition can create short-term affordability challenges, local opposition, new supply-chain dependencies, higher investment needs, and new security risks. The central issue is therefore not simply whether clean energy is beneficial, but how transition measures are governed, financed, and implemented.

C. BUILDING RESILIENT INFRASTRUCTURE AND POWER SYSTEMS

The discussions repeatedly returned to the importance of resilient infrastructure. Energy infrastructure is increasingly exposed to natural hazards and intentional threats, including physical attacks and cyber risks, as illustrated by the situation in Ukraine. The workshops highlighted that protecting critical infrastructure has become a whole-of-society challenge.

Power systems are especially important because electrification is central to the energy transition. As transport, industry, heating, and digital services become more electricity-dependent, electricity security becomes a broader societal security issue. *Power systems must therefore be designed to manage ordinary variability while maintaining sufficient resilience to extraordinary disruptions.*

The workshops highlighted several dimensions of power-system resilience: stronger grids and interconnection, short- and long-duration storage, flexible demand, distributed generation, islanding capability, and system restoration. Participants pointed to Ukraine as an example of why spare equipment, local repair capacity, rapid restoration, and the ability to improvise

matter when energy infrastructure is under attack. Distributed energy resources can also help, provided they can operate independently and reconnect safely.

Resilience should therefore not be treated as an add-on after infrastructure is built. It should be embedded in design, regulation, and operation from the beginning.

D. MANAGING DIGITALIZATION, AI, AND CYBER RISK

Digitalization and artificial intelligence were discussed as both enablers and vulnerabilities. Digital tools are essential for the operation and optimization of increasingly complex energy systems. However, digitalization also increases dependence on software, data, communication networks, automated control systems, and external technology providers. Additionally, as digitalization becomes more widespread, energy systems become more exposed to cyber threats.

AI may support more efficient energy use and better operation of complex systems. However, several participants identified the growth of data centers and AI-related electricity demand as an important planning uncertainty. Where these loads are concentrated, they can strain grid capacity, complicate system balancing, and compete with other electrification projects for connections.

A practical implication is that the transition requires digital trust. This includes secure software, robust operational technology, clearer responsibility for cyber resilience, data governance, and fallback options when digital systems fail. Manual or degraded-mode operation remains important in highly digitalized systems. Finally, post-quantum security was raised as a long-term design consideration, although its urgency was debated.

E. REDUCING STRATEGIC DEPENDENCIES IN SUPPLY CHAINS AND INDUSTRIAL CAPACITY

The workshops emphasized that the low-carbon transition depends on materials, manufacturing capacity, and global value chains. Critical minerals, including rare-earth elements, and clean technologies such as batteries, solar panels, wind turbines, electrolyzers, and power electronics are all strategically important. The workshops repeatedly emphasized that concentrating production and processing in a limited number of countries creates new vulnerabilities.

This does not mean that countries should aim for full self-sufficiency. Global trade and international cooperation remain essential. However, the discussions pointed to **the need for diversified, robust, and trusted supply chains**. Strategic autonomy should mean reducing excessive dependence, building backup options, strengthening alliances, and developing industrial capabilities where they matter most. Expanding domestic capacity can nevertheless involve trade-offs in cost, environmental impact, and local acceptance.

Supply chains are also linked to how value is distributed throughout the global transition. The discussion raised concerns that many resource-rich countries export raw materials but capture limited value from processing, manufacturing, and technology development. A resilient transition should avoid simply reproducing these patterns, and should support value creation and fairer partnerships in countries that supply critical resources.

F. MAKING THE TRANSITION INVESTABLE AND AFFORDABLE

Finance and affordability were recurring concerns. The transition requires large capital investments in generation, grids, storage, digital systems, industrial transformation, and resilience. At the same time, geopolitical and regulatory uncertainty, as well as supply-chain risk and market volatility, may increase the cost of capital.

Affordability is central because public support for the transition depends in part on whether people perceive energy policy as fair and manageable. Long-term system benefits may not be enough if households and firms face short-term cost increases. The workshops therefore highlighted the need to connect macro-level transition benefits with visible improvements for consumers and industry.

The workshops also emphasized that resilience must be made investable. Energy systems need infrastructure that can perform not only under normal conditions, but also during disruptions, crises, and periods of stress. However, these resilience benefits are not always clearly rewarded in existing markets. If resilience is treated only as an extra cost, it may receive too little investment. Addressing this challenge will require policies and market frameworks that encourage

investment in resilient low-carbon infrastructure and provide confidence that such investments will be supported over the long term.

G. TREATING DEMAND-SIDE ACTION AS A NO-REGRET SECURITY MEASURE

Demand-side measures were among the clearest no-regret solutions discussed. Energy efficiency, demand reduction, demand flexibility, building renovation, and industrial efficiency can all reduce emissions while supporting affordability and security. Demand-side action is sometimes treated as secondary to energy supply, but the workshop discussions challenged this view.

Reducing and shifting demand can lower the need for new infrastructure, reduce exposure to imported fuels, ease pressure on grids, lower peak loads, and improve resilience during crises. In many cases, energy efficiency is already economically attractive, but implementation remains too slow.

A broader view of demand is also needed. Demand is not only about using more efficient technologies. It also depends on how societies organize transport, housing, industry, urban development, and access to services. This makes demand-side action both technical and social, requiring policy support, public legitimacy, and cross-sector coordination.

H. STRENGTHENING GOVERNANCE, PREPAREDNESS, AND PUBLIC LEGITIMACY

Many workshop discussions pointed to governance as a limiting factor. The transition involves many actors: governments, regulators, system operators, municipalities, defense institutions, infrastructure owners, technology providers, investors, researchers, industries, and citizens. *Responsibilities are often fragmented*, especially when risks cross the boundaries between civilian and military systems, public and private ownership, or energy and digital infrastructure.

Preparedness requires clearer roles and better information-sharing. Scenario exercises, emergency protocols, and cross-sector coordination are essential. Knowing infrastructure is critical is not enough; actors

PRESSURES ON TRANSITION MOMENTUM		RESILIENCE-ORIENTED RESPONSES	
 Geopolitical instability and energy weaponization	→	 Reduce fossil-fuel dependence; strengthen preparedness, strategic autonomy, and energy-system resilience.	
 Critical infrastructure exposure (physical, natural, cyber, hybrid threats)	→	 Build resilient grids, storage, restoration capability, and protection of undersea, offshore, and digital infrastructure.	
 Digitalization, AI and cyber vulnerabilities	→	 Strengthen cyber resilience, data governance, secure-by-design digital systems, and fallback operation.	
 Supply-chain concentration and critical dependencies	→	 Diversify suppliers, build strategic industrial capacity, and develop circularity, recycling, and trusted partnerships.	
 Affordability pressure and investment risk	→	 Improve market design, reduce risk premiums, de-risk critical investments, and target public support where needed.	
 Public opposition and weak legitimacy	→	 Increase local benefits, transparency, participation, fairness, and visible community value from transition infrastructure.	
 Rising demand and grid pressure	→	 Accelerate energy efficiency, demand flexibility, demand response, local energy solutions, and smarter system operation.	

Fig. 1. Existing pressures on transition momentum and the resilience-oriented response.

must know who is responsible, who communicates with whom, and how decisions are made during disruption.

Public legitimacy is equally important. Infrastructure cannot be built at the necessary pace without social acceptance. Local communities must see benefits, not only burdens. This applies to grids, wind power, industrial projects, storage, and other transition infrastructure. A resilient energy transition must therefore combine technical robustness with trust, fairness, participation, and visible local value. This also means promoting local participation and strengthening local value cycles, so that communities can benefit from local production, exchange, spending, and reinvestment associated with the transition. The discussions also raised misinformation as a risk to public trust, particu-

larly during crises. Clear explanations of how energy systems and markets work, including their costs and trade-offs, were identified as important for informed public debate.

International cooperation remains necessary. Even as countries seek greater strategic autonomy, the transition depends on shared knowledge, trade, technology cooperation, and allied partnerships. The challenge is to reduce vulnerability without retreating into isolation.

III. CONCLUSIONS AND PRIORITY ACTIONS

A. OVERALL CONCLUSIONS

The workshops showed that maintaining momentum in the energy transition requires a broader understanding of what the transition must deliver. *Climate mitigation remains central, but progress will also depend on whether the emerging energy system is secure and resilient, affordable for consumers, investable and competitive for industry, and legitimate for communities.*

Resilience should therefore be built into the transition from the outset. Planning must account for disruption as well as efficiency, while infrastructure, digital systems, supply chains, markets, and institutions must be treated as parts of an interconnected system. *The most valuable solutions are often those that reduce several vulnerabilities while delivering several benefits at once.*

B. PRIORITY ACTIONS

Based on the workshop discussions, this report identifies five priority actions.

First, resilience should be built into new energy infrastructure from the start. Grids, offshore infrastructure, digital control systems, storage, and distributed energy resources should be planned with disruption, recovery, and security in mind.

Second, grid expansion, storage, flexibility, and demand-side measures should be accelerated. They are essential for both decarbonization and energy security.

Third, cyber resilience and digital fallback capabilities should be strengthened. This requires secure software, clear responsibility for cyber risk, sound data governance, and tested manual fallback procedures.

Fourth, critical supply chains should be diversified while maintaining international cooperation. Strategic autonomy should focus on reducing excessive dependence, not abandoning global partnerships.

Fifth, governance should be improved across energy, defense, industry, finance, municipalities, and research. This needs clear roles, secure infor-

mation sharing, joint exercises, and meaningful community participation.

C. OPEN QUESTIONS FOR FURTHER WORK

Several questions remain open. How can resilience investments be financed without worsening affordability? How much strategic autonomy is realistic for Norway and Europe? How should AI-driven electricity demand be managed? How can cyber and physical security be integrated into ordinary energy planning? How can local communities receive clearer benefits from transition infrastructure? How can Europe reduce strategic dependencies while preserving open and cooperative international relations?

These questions point to the need for continued dialogue between researchers, policymakers, industry, investors, and civil society. The workshops provided a strong starting point. The next step is to build on areas of broad agreement, address the questions that remain unresolved, and turn the discussion into concrete planning, investment, and governance choices.

REFERENCES

- [1] NTNU Energy Transition Initiative, "[Workshop on Drivers for a Resilient and Secure Energy Transition](#)," Trondheim, Norway, Mar. 16, 2026.
- [2] NTNU Energy Transition Initiative, "[Maintaining Momentum in the Energy Transition: Co-Benefits between Climate, Affordability, and Security](#)," Trondheim, Norway, Mar. 17, 2026.