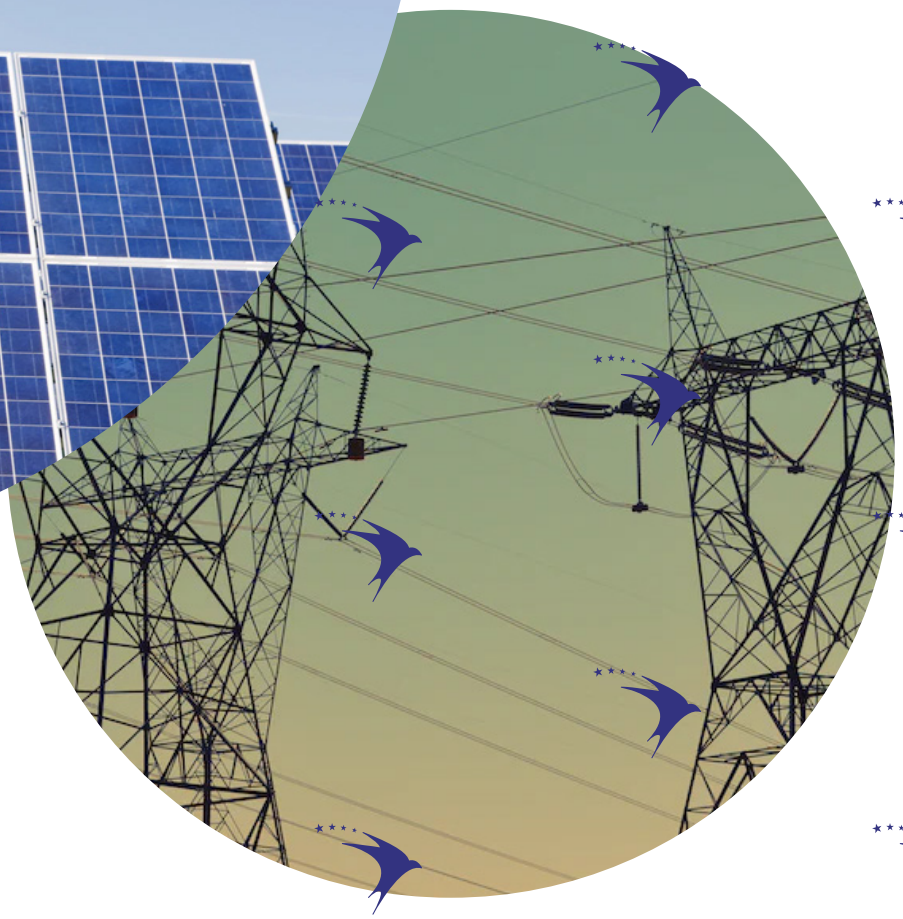

MEMO

Energizing Independence

Creating a Safe, Reliable, and Sustainable Regional Energy System

Institute of European Right

NED NATIONAL ENDOWMENT FOR DEMOCRACY
SUPPORTING FREEDOM AROUND THE WORLD

IRI INTERNATIONAL REPUBLICAN INSTITUTE
Advancing Democracy Worldwide

> On October 17-19, in Vilnius, a forum titled “Energizing Independence: Creating a Safe, Reliable, and Sustainable Regional Energy System” was held, organized by the Institute of European Right and the International Republican Institute. It was attended by energy sector experts from the Scandinavian and Baltic countries, as well as Ukraine and Moldova. This memo has been prepared based on the presentations and discussions that took place during the event with Chatham house rules in place.

Six key takeaways

1. Strategic Communication

Effective communication is paramount when discussing energy topics, especially in areas as complex and often misunderstood as nuclear energy and renewables. It's not just about conveying facts but also about building trust, dispelling myths, and ensuring that the public is well-informed. By doing so, we can foster a more informed debate and ensure that decisions made at both the policy and individual levels are based on accurate information.

2. Sound Policy

For a nation to truly advance its energy independence, it requires robust and comprehensive national energy policies that promote energy supply diversification and use of domestic energy resources. These policies should not only address the current energy needs but also anticipate future challenges and opportunities, not least regarding base load power. By having a clear roadmap, countries can ensure a stable energy supply, attract investments, and drive innovation in the sector. Developing and implementing that roadmap requires human resources and capacity building of relevant decision-makers.

3. Regional Cooperation

Energy challenges often transcend national borders, making regional cooperation essential. By collaborating with neighboring countries, regions can pool resources, share best practices, and develop joint infrastructure projects. This not only helps in confronting shared energy challenges but also in capitalizing on opportunities that can lead to greater energy independence and security for all involved. This is especially the case in Europe, where EU directives provide opportunities for regional cooperation in the energy sector.

4. Energy Education

An informed electorate is crucial for the successful implementation of energy policies. By fostering education on energy issues, we ensure that the public understands the complexities of the energy sector, the challenges it faces, and the potential solutions available. This not only leads to better decision-making at the ballot box but also enhances societal trust in the energy solutions being proposed and implemented.

5. Forward Looking Policy

The energy landscape is constantly evolving, with new technologies emerging and old ones becoming obsolete. As such, effective energy policies must be forward-looking, anticipating future trends, challenges, and opportunities. This ensures that the country is not just reacting to the present but is proactively preparing for the future, ensuring a stable, sustainable, and secure energy supply. Clear and transparent regulations must also be considered to effectively govern the energy transition.

6. Energy as Profession

The energy sector is vast and complex, requiring a diverse range of skills and expertise. As the sector evolves, there will be a growing need for professionals who are well-versed in the latest technologies, policies, and trends. It's crucial to promote energy as a viable and attractive profession to the next generation, ensuring that we have the talent and expertise needed to navigate the challenges and opportunities of the future.

Overview and Opportunities of Lithuanian Energy System

Historical Background

After declaring independence in the 1990s, Lithuania‘s energy sector grappled with outdated infrastructure, energy-intensive industries, and a strong dependence on Russian energy. This dependence was highlighted when Russia enforced an energy blockade. In response, Lithuania diversified its energy sources. By 1999, it had its first oil terminal, reducing reliance on Russian oil. From 2014 to 2016, Lithuania broadened its energy horizons with an LNG terminal and electricity links to Sweden and Poland. By 2023, Lithuania attained a „Three zero zone“ status, marking a significant move towards energy autonomy.

Present Energy Scenario

Oil dominates Lithuania‘s energy consumption, with transport being the chief consumer and polluter. The shutdown of the Ignalina nuclear power plant left a void in electricity generation. For years, Lithuania depended heavily on imports, but now sees renewables as a key solution. Major energy milestones include the Būtingės oil terminal, Klaipėda LNG terminal, NordBalt & LitPol link, and the rise of biomass for heating.

Energy Vision for the Future

Lithuania aims for electricity self-reliance by 2030 through three avenues:

- **Decarbonized Energy**
  Prioritizing electrification, hydrogen production, and EU compliance.
- **Regional Hydrogen**
  Establishing nuclear reactors for consistent power and boosting hydrogen production.
- **Zero Carbon Commodities**
  Manufacturing items like ammonia and methanol using hydrogen.

Lithuania aspires to be an energy exporter, focusing on zero-carbon goods and hydrogen, transitioning from domestic decarbonization to a regional energy influencer.

Growth in Renewables

There‘s been a notable rise in renewable energy reservations for grid connections in Lithuania. From 700 MW in 2020, projections reach up to 8 GW by 2025. The „prosumer“ trend, where consumers generate their own electricity, especially via rooftop solar, is on the rise. The goal is to achieve a renewable generation capacity of 9.4 GW by 2030.

Addressing Challenges

The inconsistent nature of renewables presents balancing issues. Potential solutions encompass electricity imports, gas power plants, and possibly a hydro accumulation plant. Lithuania also champions local electricity generation and consumption, urging households to adopt rooftop solar. The overarching aim is to maintain energy affordability for all.

Strategic Goals

Lithuania‘s ambitious targets focus on enhancing renewable energy capacity. A national hydrogen strategy is underway, with pilot projects in transport and industry paving the way for larger initiatives. Lithuania‘s energy strategy merges security, environmental, economic, and social goals, striving for energy independence, decarbonization, export potential, industrial expansion, and cost-effective energy. Predictions show a drop in final energy demand from 93 to 75 TWh, with notable rises in electricity and hydrogen.

Security of Gas Supply & The Moldovan Energy Policy

Energy Crisis

Moldova, historically positioned between East and West, faces challenges due to the Transnistrian region. Housing major industrial assets and the primary power plant, this region has been beyond governmental reach since 1992, complicating Moldova‘s energy strategy. In September 2022, Gazprom drastically reduced or halted gas supplies to 13 EU nations. By November, Moldova‘s supply was slashed to just 5.7 mcm/day, pushing the government to urgently explore alternative energy sources.

Present Energy Scenario

In August 2022, Moldova designated JSC Energocom as the official gas supplier. Energocom actively sourced gas from European

markets, storing it in underground gas storages in Ukraine and Romania. Moldova‘s energy choices have been historically swayed by its geopolitical position, oscillating between Eastern and Western influences. The Trans-Balkan route, connecting Southern Gas Sources to Central Europe, is crucial for Moldova. However, technical discrepancies between Moldova‘s transmission system operator (TSO) and Ukraine‘s counterpart mean the reverse flow capacity is virtual. Still, this pipeline is vital for diversifying Moldova‘s energy sources. In October 2023, Moldova removed tariffs at two of the four interconnection points between its TSO and Ukraine‘s. This route is being primed as a key supply route for Central Europe. With the Gazprom–Naftogaz contract ending in 2024, the Trans-Balkan Route‘s importance is set to rise.

National Security Concerns

Moldova‘s energy dynamics are intertwined with national security. The energy market has occasionally been a blackmail tool. Moldova‘s dependency on a single supply route, combined with the Transnistrian region‘s autonomy, has amplified its vulnerabilities. Geopolitical pressures, including Russian threats and Transnistrian issues, have swayed energy decisions. Moldova‘s economic hurdles are tied to its geopolitical challenges, especially the Transnistrian conflict. Efforts to attract investors for power systems have been hampered by this conflict. Yet, Moldova‘s approach is integration-focused, ensuring Transnistrian enterprises register in Moldova and comply with its regulations, aiming for economic cohesion.

Overview of Armenian Energy sector

Introduction

Armenia, spanning 29,800 square kilometers and home to 2.96 million people, has navigated challenges like the 2018 Velvet Revolution, the 2020 COVID-19 pandemic, and the 2020 Azerbaijan conflict. Despite these, it saw 12.6% economic growth in 2022, spurred by migrant influx, business expansion after Russia's Ukraine invasion, and a robust services sector. By mid-2023, GDP growth reached 10.5%, with services, IT, and transportation leading the way. However, the declining chemical industry and household-centric energy consumption underscore Armenia's economic and agricultural challenges.

Energy Landscape

Energy Mix

Armenia's energy comprises nuclear, hydroelectric, and natural gas. With 100% electrification and 96% pipeline gas access, natural gas dominates both Total Energy Supply and Total Final Consumption (TFC).

Production & Self-Sufficiency

Nuclear energy leads at 60%, followed by hydro (22%), biofuels (13%), and solar (5%). Yet, Armenia's self-sufficiency is just 23% of the total energy supply.

Power Generation Mix

43% thermal, 32% nuclear, 21% hydro, 4% all other renewables.

Import Dependency

Lacking domestic fossil fuels, Armenia depends 80% on imports, primarily Russian, with an 8.3% increase in 2021.

Energy Consumption

In 2021, Armenia's TFC stood at 2.8 Mtoe, with natural gas (55%) leading, trailed by oil (21%) and electricity (19%). The services sector was the top energy consumer.

Power Generation & Infrastructure

Nuclear Energy

The Metsamor Nuclear Power Plant, with one operational reactor, is pivotal for Armenia's electricity. Plans include extending its lifespan and adding a new unit. Despite seismic concerns, recent tests affirm its safety.

Hydro & Renewables

Armenia taps its rivers for hydroelectricity and is expanding into solar photovoltaics, especially given the latter's impressive resource potential and growth enabled by ongoing legal-regulatory reforms.

Energy Pricing & Tariffs

Residential gas prices have soared by 200-250% over a decade, reaching $165 per 1,000 cubic meters from Russia in 2022. Tariffs vary by consumption and sectors.

Policy

Armenia‘s alignment with the EU‘s CEPA since March 2021 targets legal harmonization by 2029. As an Eurasian Economic Union member, Armenia eyes unified EAEU gas and electricity markets by 2025. Armenia, aligned with international treaties like the Energy Charter Treaty and Paris Agreement, has crafted sustainable energy strategies, including the National Energy Security Concept. In 2023, Armenia updated its National Energy Strategy to formalize targets for renewable energy share of electricity consumption to be 50% in 2030 and 60% in 2040, and consider small modular nuclear reactors. Ongoing electricity market liberalization is aligning Armenia with EU best practices, and enabling further development of renewables.

Future & Challenges

Armenia prioritizes renewable energy, energy efficiency, nuclear power plant longevity, a new nuclear plant, and domestic electricity market liberalization. Goals include heightened self-sufficiency and reduced import reliance. Armenia‘s energy sector, poised for growth and diversification, benefits from its commitment to sustainable energy and strategic alliances. Investments in infrastructure, policy reforms, and regional integration are vital for its energy trajectory.

Lessons and Pitfalls of the Swedish Green Transition

Introduction

Sweden‘s modern energy system, originating in the 1950s, expanded its hydro power capabilities in the north during the late 1950s. However, this came with ecological implications. The nation‘s increasing oil dependency, viewed as a geopolitical risk during the Cold War, spurred the initiation of its nuclear program. Sweden‘s nuclear endeavors were not merely to meet energy needs but were anchored in its quest for energy autonomy and geopolitical stability.

Infrastructure and Capacity

Sweden‘s energy infrastructure, with a vast transmission capacity from north to south, was at its peak underpinned by 13 GW of hydro power and 12 nuclear reactors. Originating from the 1950s‘ hydro power expansion in the north, Sweden‘s nuclear program swiftly positioned it as the world‘s third-largest nuclear nation. The strategic placement of hydro power in the north and nuclear power in the populous south enabled large-scale power transfers, ensuring consistent electricity supply nationwide.

Energy Transitions

Sweden‘s energy evolution emphasizes cleaner sources, integrating nuclear, wind, and solar energy. In the 1970s, Sweden witnessed one of the world‘s swiftest energy transitions, commissioning 11 reactors in 13 years, outpacing Germany‘s solar and wind expansion a decade

later. By the mid-1980s, Sweden‘s nearly 100% fossil-free electricity system delivered stable, low prices. However, 1990s‘ electricity market reforms and nuclear shutdowns posed challenges. As of 2020, six of the twelve nuclear reactors had been decommissioned. The ruling coalition at the time emphasized renewables which led to wind and solar power expansion, but at the cost of system instability and rising consumer prices. The 2021 European energy crisis further highlighted Sweden‘s vulnerability, despite its historical energy independence.

Strategic Goals

Sweden‘s green transition, while commendable, offers lessons in balancing ambition with reality. Energy systems must be grounded in tangible realities, not just symbolic politics. Sweden‘s 2021 experience, where European electricity prices influenced its market, underscores the importance of energy independence and base load power. Moreover, Sweden‘s four-decade-long commitment to nuclear waste management, proposing deep underground storage, exemplifies its dedication to sustainable energy practices.

The Hydrogen Revolution and Green Transition

Hydrogen Production

The Lithuanian Energy Institute (LEI) has actively contributed to European Research projects from 2014-2021. Hydrogen‘s role spans production, storage, transportation, and utilization. The presentation delves into production methods like methane pyrolysis, used by companies like Achema and Orlen Lietuva. Green hydrogen production challenges, storage methods, and transportation infrastructure are also discussed, emphasizing hydrogen‘s potential in reducing CO2 emissions in transportation and its role in decentralized energy production.

Hydrogen in Energy and Industry

Industry giants like ORLEN Lietuva, SG Dujos, and Klaipėdos nafta are exploring hydrogen‘s potential. Achema‘s significant hydrogen demand for ammonia production contributes to 18% of Lithuania‘s CO2 emissions. Amber Grid is integrating hydrogen into the natural gas grid, while Elinta Motors is developing hydrogen fuel cell vehicles. Ignitis aims to establish a 700 MW offshore wind park by 2030. Academic institutions, including Klaipėda University and Kaunas University of Technology, are advancing hydrogen research. The presentation also underscores the importance of infrastructure for hydrogen transportation and its potential in energy storage.

Public Acceptance

Public perception is pivotal for new technology adoption. A Japanese case study indicates a positive sentiment towards hydrogen fueling stations. In Lithuania, the LEI is gauging public sentiment and addressing concerns. Safety measures, based on scientific research, have been implemented to ensure hydrogen‘s safe handling. Public education and outreach are essential to foster a positive perception and dispel myths.

Conclusion

Hydrogen is a promising catalyst for Lithuania‘s green transition. Collaborative efforts from industry, academia, and policymakers can position Lithuania at the forefront of hydrogen innovation. Continued research, infrastructure development, and public awareness are vital for harnessing hydrogen‘s potential in Lithuania.

Overview of Nuclear Energy in Finland

Introduction

With a 6% decrease from the previous year, Finland‘s electricity consumption is 82 TWh. Nuclear power contributes 35% to domestic production, projected to exceed 40% upon the Olkiluoto 3 (OL3) unit‘s commissioning. Aiming for climate neutrality, competitiveness, and energy security, Finland‘s strategy envisions nuclear power as a cornerstone for emission-free electricity. The diverse energy sources, including nuclear, support this vision.

Production and Mining

Finland‘s nuclear infrastructure is anchored by facilities like Terrafame Oy in Sotkamo, licensed for uranium recovery from a nickel mine until 2050. Teollisuuden Voima Oyj (TVO) manages the Olkiluoto facility, housing three units, enhancing the country‘s nuclear output. Fortum‘s Loviisa facility, with two units commissioned in the late 1970s, remains a consistent energy contributor. Finland‘s commitment to nuclear waste management is evident with Posiva‘s ongoing spent nuclear fuel disposal project in Olkiluoto and the VTT test reactor‘s 2021 decommissioning license.

Nuclear Energy Policy

Finland‘s nuclear policy is progressive, with the government endorsing nuclear energy. STUK, founded in 1958, oversees Finland‘s nuclear safety. Operating under various ministries, STUK ensures radiation protection. Its regulations and YVL Guides are being

updated for 2028. Internationally, STUK collaborates with entities like the IAEA, European Commission, and engages in regional initiatives and projects like AFCONE and RescEU. This includes embracing new nuclear applications, updating the nuclear energy act for Small Modular Reactors (SMRs), securing key authority resources, and influencing EU policies. TVO and Fortum units have operational licenses extending to 2038 and 2050, respectively. The spent fuel repository license application, submitted in 2021, is under review, and studies on SMRs reflect Finland‘s interest in advanced nuclear technology. For over 40 years, Finland has prioritized nuclear waste management. Posiva, established in 1995, leads the encapsulation and disposal of nuclear waste. The under-construction encapsulation plant will securely process fuel assemblies for disposal in the ONKALO repository. Eurajoki was selected for waste disposal due to its technical suitability, public support, and municipality‘s willingness. Open communication, including a Municipal Cooperation Committee and a visitor center, has ensured transparency.

Olkiluoto Nuclear Power Plant

Owned by TVO, the Olkiluoto plant in Eurajoki has two operational units and a third in operation since April 2023. The facility also includes waste storage and disposal infrastructures. The OL3 unit, an EPR with a 1,600 MW output, began electricity production in April 2023, contributing significantly to Finland‘s energy.

Local Community Involvement

Finland‘s population largely supports nuclear energy, attributed to the nation‘s rigorous safety standards, nuclear energy‘s role in addressing climate change, and its economic stability in electricity pricing. Eurajoki‘s support for Olkiluoto has been crucial. Continuous dialogue, a Municipal Cooperation Committee, and a visitor center ensure transparency and trust. The plant‘s economic contributions, including employment during OL3‘s construction and its operational phase, have benefited the local community.

Ukrainian energy sector after the Russian invasion.

Impact of the Russian War on Ukraine‘s Energy Sector

The full-scale invasion by Russia resulted in the occupation of significant portions of Ukraine‘s electricity generation capacities. Over 9 GW of power remains under Russian control, including the Zaporizhzhia Nuclear Power Plant (6,000 MW) and several thermal power plants. Despite these challenges, Ukraine‘s energy sector has shown resilience, continuing to provide energy to its citizens and businesses. The sector has also further integrated into the EU and declared a stronger energy transition agenda.

Electricity Consumption Trends

Electricity consumption in Ukraine saw a significant drop of 33% due to the war and has since stabilized on a year-on-year level. The decline was initially 28% at the onset of the war, exacerbated by population outflow, destruction of industrial production facilities, and attacks on energy infrastructure. The average electricity consumption in October 2023 is 11.0 GW, slightly lower than the 11.4 GW in October 2022.

Winter Generation Forecast

The forecast for average electricity generation during the winter of 2023/24 is 13.8 GW. However, during peak consumption times, the demand could rise to 16.7 GW. Even with successful repairs and no further damages, the available capacity might only reach 14.7 GW, indicating a potential deficit of up to 2 GW. This suggests a need for electricity imports to meet the demand.

Capacity Restoration Efforts

DTEK, a major energy company in Ukraine, has been actively working on restoring its capacities. By the end of 2023, DTEK aims to restore 12 power units, adding a total capacity of 2,242 MW. Despite these efforts, there remains a potential deficit in power generation, emphasizing the importance of securing the energy infrastructure against potential threats.

Coal and Gas Reserves

As of October 17, 2023, Ukrainian thermal power plants (TPPs) have accumulated 1,060 thousand tonnes of coal in stock. DTEK accounts for 85% of the country's coal production, primarily located in the Dnipropetrovsk oblast. The gas stocks in Ukraine's underground storage facilities are sufficient for the upcoming winter, with an expected level of 16.0 bcm by November 1, 2023.

Surviving the Previous Winter

Ukraine managed to navigate the challenges of the previous winter through emergency support from international partners and donors. This support included equipment for substations and power plants, generators for critical infrastructure, and electricity imports from Europe. Additionally, the dedication of workers in the energy sector played a crucial role in ensuring energy supply during challenging times.

Protection and Backup Power Supply

Given the strategic importance of power plants, especially thermal generation facilities, there‘s an emphasis on their protection. DTEK has taken measures to provide backup power supply for its TPPs and mines, ensuring continuous operation even in case of power outages.

Equipment Needs for Restoration

To further bolster the energy infrastructure, there‘s a need for specific equipment, including steam turbines, power transformers, and other essential components. Acquiring this equipment is crucial for the restoration and enhancement of the energy sector‘s capabilities.

Contacts for Cooperation and Support

For collaboration and support related to DTEK‘s restoration efforts and humanitarian aid, interested parties can reach out to Oleksiy Povolotskiy, the Corporate Governance and Compliance Director at DTEK, and Andrii Hvorostianko, a member of the Working Group on Humanitarian and Technical Aid at DTEK.

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