
Summary analysis

White Paper

Scaling up renewable energy and energy efficiency for public facilities in a refugee-hosting country

The case of schools and hospitals in Jordan

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The Norwegian Refugee Council (NRC) is an independent humanitarian organisation helping people forced to flee.

Executive summary

This white paper demonstrates that a coordinated effort to take a people-centred approach to retrofitting and solarizing public buildings can bring national wellbeing, humanitarian and economic gains. The findings and recommendations are the culmination of a series of inter-ministry discussions and practical research between 2018 and 2021 which took place as part of the Renewable Energy for Refugees (RE4R) project. It finds that Jordan can and should move beyond donor-funded energy strategies in this area, towards a system that allows the private sector and other local and national partnerships to scale up implementation. To do this, it is important to take account of past experience and lessons learned from development and humanitarian initiatives in this space.

The context: why public buildings, why now?

Jordan's economy was hit hard by COVID-19 and global measures to contain it, which have compounded ongoing challenges of unemployment and accommodating a large, predominantly urban, refugee population. With government debt rising above 100 per cent of GDP in 2021¹, Jordan needs to find ways to cut long-term costs yet make investments that provide jobs and create long-term value for the country. At the same time, fuel costs are rising due to the ongoing Russia-Ukraine crisis with ramifications for a society dependent on importing fuel to meet 92 per cent of its energy demand and facing increasing weather extremes. As such, the government has stated its intention to both increase national energy security and climate resilience.

As the pressures and bills for public buildings such as schools and hospitals mount, addressing energy and water offer the opportunity to improve conditions and services. This area offers welfare and development benefits for both Jordanians and refugees while freeing up government resources to devote to urgent health, education and social care. Jordan's experience with humanitarian efforts to fortify community-use infrastructure such as schools and hospitals also offers a leading light for other countries dealing with urban displacement.

Jordan's national plans and targets already support investing in public buildings at scale and the coming year (2022–2023) is critical in developing detailed strategies. In late 2021, Jordan's energy minister announced a target of 50 per cent of electricity generation from renewable sources by 2050 (it stood at 20 per cent in 2020). Residential, government and commercial buildings account for over 60 per cent of electricity demand in the country so building efficiency improvements, solar thermal and solar photovoltaic (PV) technologies will be essential in meeting this goal. The Jordan Renewable Energy and Energy Efficiency Fund (JREEEF), an arm of the Ministry of Energy and Mineral Resources (MEMR), has since 2015 guided and supported pioneering donor-funded work in solar water heating, solar PV and retrofitting nationally. Paving the way for more

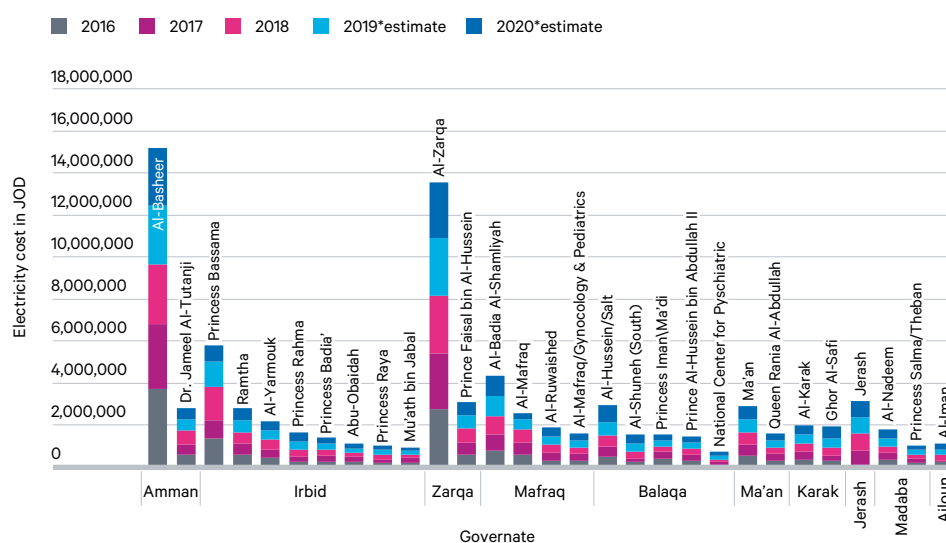
¹ World Bank (2021), Jordan's Economic Update – October 2021, 7 October, <https://www.worldbank.org/en/country/jordan/publication/economic-update-october-2021>.

commercial upscaling, Jordan’s Cabinet approved the National Green Growth Action Plan (2021–2025) in June 2020. This recognizes public buildings as an opportunity to boost the market for green services.²

Rising costs and debts

Large public buildings are charged at high rates for much of their electricity and many entities are in deficit. Users such as hospitals and large government schools using more than 750kwh/month pay more than most commercial entities and heavy industry for additional consumption. Bills are substantial. For example, the ministries of education and health were charged 20.3 million JoD (US\$28.6m) and 10m JoD (US\$14m) respectively in 2018, whilst urgent spending is required in many other areas. Whereas schools have been closed during lockdown periods since 2020, hospitals are likely to have faced higher diesel and electricity bills for basic services such as hot water, demand for which rose during the COVID-19 pandemic.³ In 2020, 30 hospitals under the Ministry of Health (MoH) consumed 7.5m litres of diesel at a cost of almost JoD 4m (\$5.64m). Figures 1 and 2 show five-year costs for most MoH hospitals.

Figure 1. Diesel cost (JoD) for MoH Hospitals during the period 2016–2020

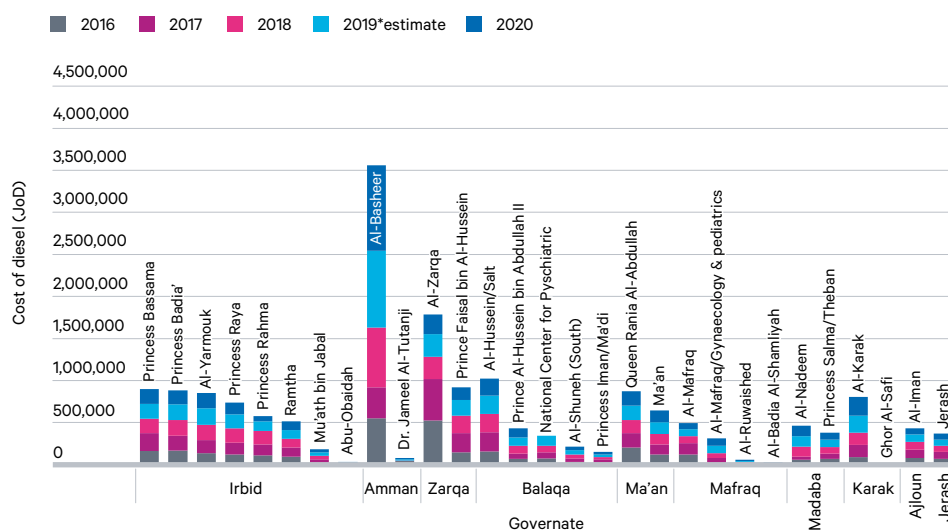


Source: Chatham House based on data provided by the Jordanian Ministry of Health.

² The plan sets out several objectives for public buildings to be achieved through collaboration between the Ministry of Public Works and Housing, MEMR, Municipalities, and the Ministry of Environment, the Royal Scientific Society, Jordan Green Building Council, the Jordanian Engineering Association with support from external financiers and the construction industry. See Energy Sector, Green Growth National Action Plan 2021–2021, https://www.greengrowthknowledge.org/sites/default/files/downloads/policy-database//20022_Jordan_Energy_v04_HL_Web.pdf.

³ Data for governmental hospital electricity costs in 2020 is not fully available but early figures suggest it is in the region of JOD17 million (\$24 million), diesel and water costs are not yet available beyond 2019.

Figure 2. Electricity cost (JoD) for MoH hospitals during the period 2016–2020



Source: Chatham House based on data provided by the Jordanian Ministry of Health.

Water for governmental hospitals alone is also costing the health service at least 2 million JOD (\$2.82m) a year and can be addressed simultaneously.⁴

Leaking pipes, inefficient taps and sanitation create inefficiencies in large public buildings and need to be fixed or upgraded as part of any sustainable energy project. Since the onset of the COVID-19 pandemic, usage of water will have increased in some facilities so there is also a greater need for efficiency so that sanitation and hygiene needs can be met while keeping bills manageable. A key issue at the national level is the cost that the Water Authority of Jordan has to recover from its own electricity bills, primarily for pumping water. Non-revenue water including leakages, theft, or inaccurate metering is estimated at between 30 to 60 per cent in several governorates of Jordan.⁵ Progress on these issues, as well as grey water reuse in buildings, will help the country manage increasing population and climate pressures on water.

2022 to 2025 marks a critical period in which to lay the groundwork for transformative action in public buildings. Public building energy costs will be higher in 2021/22 given the jump international fuel prices and the return to work and school. Taking stock of past experiences while developing the proposed plans will enable agencies, civil society, private sector, donors, and investors to work together more effectively.

⁴ MoH accounts show that governmental hospital water bills totaled JOD 1,944800 for 2019. This does not include clinics and health centres. This is likely to have risen due to COVID-19 from 2020.

⁵ A number of initiatives such as those led by USAID and GIZ are working to reduce this through maintaining pumps, fixing water network leakages and improving metering. Ministry of Water and Irrigation (2021), 'Technical Report: Non-Renue Water Round Table Discussion Utility Performance Monitoring Unit (UPMU), First Roundtable Session, June 21st 2021, Amman Rotana Hotel', http://www.mwi.gov.jo/EBV4.0/Root_Storage/AR/EB_Pages/UPMU_Report_from_the_1st_NRW_roundtable_workshop.pdf.

The evidence

Multiple studies have shown that efficiency measures and solar energy sources could enable better services such as year-round hot water and cooling in summer, and reduce bills. Many energy investments are feasible and worthwhile with the current tariff for public buildings so incentives to enable scale up should be explored. Payback periods are generally between 3 and 5 years for solar PV and solar water heating. Efficiency offers both short and long-term returns depending on measures taken. Detailed audits on Jordanian ministry buildings have shown that some efficiency improvements such as switching to LED lighting pay back in under one year.⁶

Findings generally show that solar PV can cover almost all of current electricity demand in schools. However, most schools are in need of improved classroom temperatures during Winter and Summer so solar PV and basic efficiency applications have proven to reduce bills by 30 to 100 per cent, whilst enabling higher comfort levels. Between 2015 and 2021, over 300 schools had been retrofitted under King Abdullah II's Initiative Schools Heating Programme and these are generating increasing evidence.

Hospitals show untapped potential. Over the last 5 years, figures suggest that governmental hospital bills alone reached JoD 85.8m (\$120m) for electricity and JoD 18m (\$25m) for diesel. This would justify large-scale investment, as the German-funded Energy Efficiency in Public Buildings (EEPB) programme, which includes 17 hospitals and 22 health care centres, is showing. Solar water heating is one area offering quick wins. Research on 10 military hospitals (under the Ministry of Defence) shows that, with current diesel prices, this would generate the equivalent of US\$3.2m per year in diesel over five years, paying back initial investment in 3.5 years.⁷ For electricity, solar wheeling has shown substantial reductions for private hospitals. For example, the Amman Islamic Hospital reduced its electricity bills by 50 per cent this way.

Focus groups demonstrated the interest of governmental hospital staff and managers in energy and environmental improvement, and the value of consultation (see Box 1).

Box 1. Staff and management views on energy at Jerash and Ramtha hospitals

Based on Ministry of Health recommendations, Ramtha Governmental Hospital (Irbid governorate) and Jerash Governmental Hospital (Jerash governorate) were selected to improve understanding of the acceptance and willingness of the hospital staff to transition to a sustainable energy system. Both hospitals have high energy bills and the Syrian conflict has affected patient occupation rates. Ramtha has seen sharp

⁶ 'Energy Savings Action Planning for Government Buildings in Jordan', Deloitte Consulting, July 2016. USAID/Ministry of Information and Communication Technology case study, 2017.

⁷ Audits and analysis conducted by Austrian firm AEE for Millennium Energy Industries, 2018, updated with January 2022 diesel prices.

fluctuations in patient numbers related to border openings and closures, while at Jerash, patient occupancy doubled between 2011 and 2018, with electricity bills rising six-fold between 2016 and 2020.

Although they do not pay the electricity and fuel bills, staff and management expressed strong interest in energy conservation and sustainable energy projects which they believed could bring better services and health care to their patients. In both hospitals, staff referred to power outages which led to reversion to manual data entry and the temporary loss of patient data while the IT system was down, increasing the potential for errors.

Staff at both hospitals showed great interest in renewable energy installation, suggesting the utilisation of rooftops and parking lots. They wanted to see bill savings reinvested to cover some of the hospital needs such as new medical equipment and patient beds. Views differed on long-term maintenance the renewable energy systems. Staff at the Ramtha prefer that it is fully run by a private company or for at least for a couple of years. Staff at Jerash, meanwhile, prefer to have full responsibility for the system and to be involved from the beginning of implementation.

To provide the right incentives, discussants suggested that accreditation be given to hospitals which adopt sustainable applications and practices.

Experience in the humanitarian response

Sustainable energy is a relatively new area for humanitarian response that emerged in Jordan as one priority area of *The Jordan Response Plan for the Syria Crisis (JRP)* (beginning in 2014). Jordan has received well over one million Syrian refugees in the last 10 years, with all refugees accounting for around 35 per cent of the population.⁸ The country has been at the forefront of a movement to enable humanitarian funding to contribute to both refugee welfare and the country's long-term resilience. Energy is a priority in the residential sector because the additional population has meant an increase in subsidies for electricity and cooking fuel in the residential sector; for the public sector, unsubsidized tariffs mean higher bills for ministries serving municipal needs. Buildings such as schools, hospitals, and houses of worship serve mixed national and refugee communities and have thus become a natural focus for both humanitarian and development efforts.

Several national energy-related initiatives received support on humanitarian grounds and provide essential experience on which to base future scale up. These have chiefly focused on schools under the umbrella of the Schools Heating Initiative, Table 1 gives a summary.

⁸ While the number of Syrian refugees registered with UNHCR in Jordan stands at 650–700,000, it is estimated that around 1.3 million Syrians have taken refuge in Jordan, including those not registered. Total refugee numbers in Jordan are higher, with over 2.2 million Palestinian refugees and around 90,000 from other countries.

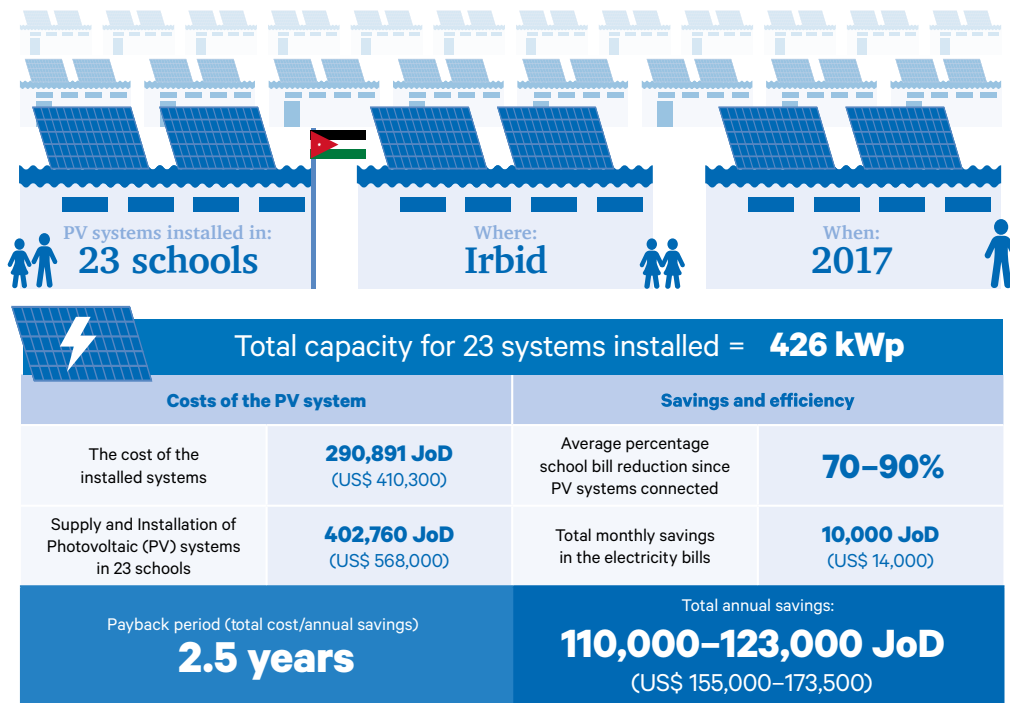
Table 1. Humanitarian-focused energy projects for schools in Jordan

Project	Focus	Partners	Additional aspects
Implementation of Replicable Renewable Energy Pilots in Jordan 2016–2017	PV for 23 schools in Irbid. Aimed to support state schools in Irbid that have been affected by the refugee influx, with solar systems to offset electricity demand.	Implementer: Norwegian Refugee Council (NRC) Jordan, MoE plus private companies Partners: MoE, MEMR Funder: EU	Provision of monitoring equipment, scoping of revolving fund with the MoE, awareness raising sessions for pupils and staff on RE Capacity Building for engineers at the assigned directorate of education on solar systems installation and maintenance.
Sustainable Education through Renewable Energy 2017–2020	Solar PV and efficient heating and cooling systems for 120 schools. Aim to improve learning environment and community cohesion.	Funder: Princess Alia Foundation Implementers: Future Pioneers for Empowering Communities (FPEC) & Horizons for Green Development Partners: MoE, JREEEF, NERC/RSS Funder: Government of the Netherlands	Training for teachers, students and community leaders in energy rationalization and anti-littering culture; team-building activities between Syrian and Jordanian students. Jordanians and Syrians trained in installing and maintaining RE systems.
RE4R Solar for Schools Programme 2017–2021	Solar and energy efficiency upgrades for 14 schools in Irbid. Same as earlier project in addition to energy efficiency upgrades to improve the learning environment.	Implementer: NRC Jordan plus private companies Partners: MoE, JREEEF, Practical Action Funder: IKEA Foundation through RE4R, led by Practical Action	Capacity building for MoE engineers in preparation for regional RE maintenance units; awareness raising for pupils and staff; classroom decoration and bathroom repairs.
Solar for schools	Educational facility improvement for 8 schools. Solar PV, air conditioning units and LED lighting.	Implementer: Mercy Corps with MASE energy Partner: NERC/RSS Funder: JREEEF	Not known.

Figure 3 shows the proven savings from Norwegian Refugee Council’s (NRC) 2017 project. NRC’s follow up under RE4R, ending in 2021 shows early signs of similar success, although lockdown has complicated the savings analysis. Projected savings for the 14 schools in total are in the region of JoD 23,420 (\$33,022) each year.

Figure 3. An example of savings achieved from solar PV on 23 schools

NRC’s solarization cost and savings



Projects have demonstrated the human benefits of decorating and applying energy efficiency upgrades alongside PV. The most common response to improvements made in RE4R focus groups was that the upgraded facilities helped to create a conducive learning environment. This included bathroom and classroom upgrades as well as sealing cracks and repairing broken windows. Students commented that the school looked “cleaner and brighter” which encouraged them to come and learn. Principles and teachers felt more comfortable in the delivery of classes.

In wintertime, we used to hear the wind sound shaking the windows, we even could feel the air leaking from the windows after the works done by NRC repaired the window and became well-closed which improved the learning environment for the students and feels safer.

Quote from one of the teachers, NRC consultation 2020

I used to receive warnings from the directorate when the monthly bill reached 1,000 JoD or above, and it affects my annual evaluation as a principle, comparing the electricity costs after the PV system was installed to the same period last year, over half of the consumption is covered and the bill is lower than 400 JoD, it’s a great thing for a school hosting over 500 students and running double shifts, operating for 9 hours for six days a week.

Quote from one of the principles, NRC consultation 2020

Challenges

The Inter-ministry Committee identified several challenges to scaling up sustainable energy on public buildings. These include:

- Difficulty in collaboration between ministries and agencies around sustainable energy upgrading for public building, given the spread of responsibilities and benefits;
- Lack of transparency in bill payment and uncertainties about where savings could accrue and how they could be used;
- Inability of some ministries to take on finance, legally or practically, or to contract the private sector;
- Banks' need for assurance of repayment (guarantees) to provide capital;
- Ministries are often unable to identify where inefficiencies and wastage are taking place;
- Bureaucratic delays, particularly relating to project approvals, solar connection and unconnected maintenance needs, all of which could reduce the value of systems;
- Distribution company unwillingness to connect solar PV to the grid where the building has unpaid electricity bills;
- Inconsistent and ad-hoc quality assurance criteria for technical applications;
- Difficulty in evaluation of performance and savings over time due to lack of systems digitization and monitoring;
- Failure due to systems falling into disrepair when short-term (2–3 year) project maintenance contracts run out.

Priorities going forward

To realize the potential of well serviced, efficient, green public buildings, we urge the government to:

1. **Set clear, high-level goals for greening public buildings which align with both Jordan's Sustainable Development Goals (SDGs) and Nationally Determined Contributions (NDCs).** In this regard, we strongly support the Energy Sector actions of the Green Growth Action Plan En04 and En05 which include publishing a National Green Building Strategy and Action Plan (NGBSAP) with targets and projects to implement up to 2030 and specifically, a roadmap and detailed budget for “scaling up the implementation of energy efficiency upgrades to all public buildings over a period of five years”. We note that this may need closer to 10 years, to enable market readiness.

2. **Put wellbeing of building staff and users at the heart of the roadmap.** This fits with climate resilience and green city objectives already evolving in several governorates of Jordan and could benefit from municipal, humanitarian, and civil society collaboration. Retrofitting alongside upgrading, guided by user needs, provides opportunities to improve conditions for vital activities such as learning, medical treatment and patient recovery, as well as educating people about safe and sustainable energy practices.
3. **Pool the available data from pilots and audits and resource the ministry gathering and reporting capacities and mandates for energy.** Box 2 suggests priorities for ministry level actions to support performance and national targets.

Box 2. Ministry-level preparedness

- **Create a centralised energy management unit in each ministry mandated with energy systems' performance.** This could build on the work of NRC with the Ministry of Education (MoE) and the Energy Efficiency in Public Buildings (EEPB) project with the Ministry of Public Works and Housing (MoPWH), MoE & MoH. Each ministry should develop a database to collect their energy bills in a way that allows the analysis of the consumption according to historical data.
- **Mandate an energy manager for every public building with practical targets to meet.** This role would easily be paid for through the building savings and clear responsibility would encourage maintenance and continual improvement. The MEMR in cooperation with RSS/NERC has initiated this programme, with a focal point from each ministry.
- **Prepare for longer-term private sector involvement in a system's upkeep.** An energy manager can address basic matters but can also act as the focal point for each facility, ensuring better reporting and follow-up with an expert company contracted for maintenance and repair. Clear channels of communication and the ability to monitor a system in real time will facilitate this relationship.

4. **Offer clarity on sovereign risk.** For example, the new Public Private Partnerships (PPP) department within the Prime Minister's office could issue clear guidelines on lending for public buildings alongside the Roadmap. The Ministry of Planning and International Cooperation (MoPIC) could take a role in connecting pilots and grant-funded projects with larger plans and potential financiers. JREEEF would remain critical in channelling Jordanian government finance to projects. Box 3 offers options for addressing the financing.

Box 3. Options for addressing finance

- **Bundle public buildings** to enable efficiency/green upgrade packages to be financed by the larger financiers, for example by national or multilateral development banks (MDBs). This would require audits at scale that show savings potential as well as flagging issues with infrastructure. The National Energy Research Center has amassed a body of knowledge that could underpin such plans. Bundling service contracts would allow the private sector to be contracted to ensure their responsibility and accountability for maintenance.
- **Piloting the Build-Operate Transfer (BOT) model** where the company puts up the capital and runs the system until the Ministry has paid off the capital cost, paying no more than they pay annually for energy at present. This could begin with solar water heating systems for the health sector. A separate vehicle or committee tasked with the handling and accounting of the contract would be required for this model.

5. **In the short-term, concentrate on buildings efficiency, solar water heating and green upgrades to buildings that do not require grid connection.** The need to manage the variability of renewable power alongside existing thermal power contracts has led to a freeze on renewable projects of over 1MW in Jordan. When the national electricity grid is fully upgraded public facilities should be given priority for wheeling projects.
6. **Setting the right incentives will be key to long-term sustainability.** These should include:
 - **Aligning incentives for deployment of sustainable energy at the utility and electricity distribution company level.** NEPCO and the distribution companies currently stand to lose from public sector entities reducing their energy use. Bold new ideas such as merging NEPCO and WAJ and/or enabling distribution companies to become ESCOs should be studied.
 - **Making transparent the utilities bill payment process for public buildings and how sectors in question can benefit from savings even when they are in deficit.** The idea of 50 per cent going to utilities deficit and 50 per cent back to the building as envisaged by the EEBP project is one potential avenue if the accounting and decision-making can be made simple and transparent. Box 4. gives some practical options for redistribution.

Box 4. Options to make energy savings work for people

- **Devolution of budgets:** Ideally, greater financial responsibility would be devolved to the local level, i.e. the ministry in question devolves some or all responsibility over the budget to local authorities for public buildings management. This creates incentives to invest in energy efficiency and renewable energy, and to use the cost savings to improve facilities.

- **A triangulation mechanism:** In absence of devolution, a cooperation mechanism could be formed between the Ministry of Finance (MoF), the responsible ministry, and the building management to account for and redistribute the savings. This would require baseline and savings accounting at the ministry level *and* the agreement of the MoF to transparently re-channel a portion of the budget to the building management.
- **Conditional aid:** Donors and NGOs wishing to fund sustainable energy projects could provide aid on the condition that the government then funded a specific need as determined by the building management/users (e.g. a new classroom, equipment, an operating theatre etc.). This would require an initial agreement between the donor/implementer, building managers and ministry to specify the investment in the building and at what point this would come, e.g. after proven bill savings of one year.

7. Develop an eco/green certification programme for schools and hospitals.

MoPWH has a rating scheme for green building according to the Jordan Green Building Guide. The Jordan Green Building Council has developed a rating tool for residential buildings which could be adapted to the complexities of schools and hospitals and ensure that heads and staff receive recognition for the improvements. However, few people know of these materials and better advocacy and support is needed to roll them out nationally.

Lessons for future work in Jordan and wider humanitarian work with public buildings

Internationally, experience from Jordan suggests several factors for success: working in inclusive partnerships with good coordination with state and local authorities; a high level of consultation with building users and managers; working with bodies that are incentivized to make the project happen; being flexible to adapt to emerging realities and new facts on the ground; and finding ways to institutionalize accountability around issues such as safety, quality and maintenance.

In general, projects also need a much longer time-frame for evaluation (e.g. 3+ years following project completion), to check on whether savings were achieved, whether awareness was institutionalized, whether this affected levels of service and refugee inclusion, and how savings were reinvested.

Energy is a difficult area for humanitarian agencies to engage with on a national scale but engaging with infrastructure in core areas such as health and education offers multiple gains. In most countries hosting large, forcibly displaced populations, many municipal buildings are ageing and in poor repair, affecting the quality of services. Improving such facilities not only offer a way to reach vulnerable people, but also an opportunity to support local community and host-country needs.

In addition to the critical importance of understanding the policy and incentives context, Box 5. gives a summary of technical considerations applicable in Jordan and many other urban displacement situations.

Box 5. Project-level considerations for work on public buildings

- **Thorough assessments** of the building infrastructure, energy and water usage patterns, and costs are critical in order to plan the most effective options. We suggest that energy, water and waste audits are conducted together.
- **Consultation and inclusion** of building managers, staff and users and private sector companies can bring unexpected dividends. These will not only highlight what is most needed, and what level of engagement in maintenance is feasible, but can also raise local and institutional awareness of the benefits of efficiency and RE.
- **Addressing energy in public buildings must go hand in hand with upgrades that the users want.** For example, in the NRC RE4R schools component, solar panels were accompanied by renovation work to fix bathrooms and classrooms. In the scoping groups with hospital staff, people expressed the urgency of addressing medical waste and water conservation.
- **Quality assurance.** Quality control requires standardised tools to assess compliance of the installed system with the engineering standards, international codes and the equipment's vendor requirement. A customised checklist, ideally digitised and shared between client, funder and consultant, must be introduced for each type of system installation. A qualified third party will need to check and sign off on before declaring the work complete.
- **Approvals.** To avoid delays, agreements and approvals required from the government entities, utility companies must be finalized before starting the project construction works.
- **Efficiency and passive techniques** are under-valued and under-resourced and require work on mind-set change in order to reap the full value of renewable energy and energy efficiency interventions. Building repair, upgrading and green space additions can work in tandem with efficiency improvements to improve wellbeing for users.
- **A clear and workable plan for maintenance.** Lack of maintenance is the main reason for project failures. Technological applications should be simple and require minimum maintenance. It is essential that responsibilities are clear and that those responsible are motivated to carry them out. Service contracts with remote monitoring that allow fast identification of errors are ideal.

In summary

Jordan offers an environment ripe for innovative green projects, given the emerging frameworks and initiatives aimed to promote assistance and investment in these areas. Given the experience of the last five years, this paper/the Inter-ministry Committee strongly recommends that planners take on board the successes and lessons learned from past and ongoing projects and that new funding and initiatives build on achievements in order to increase reap multiple socio-economic rewards.

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The full White Paper on which this Summary version is based will be published online in May 2022. If you would like to make any comments or corrections ahead of that time, please contact Glada Lahn glahn@chathamhouse.org and Dr Majd Al-Naber MajdAlNaber@wana.jo.

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