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One Less Nuclear Power Plant (OLNPP)

Reframing Urban Energy Policy

Challenges and Opportunities in the City Seoul



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Achieving a Democratic and Sustainable Energy Future: Energy Justice and Community Renewable Energy Tools at Work in the OLNPP Strategy

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Introduction

Launched in 2011, United Nations' Sustainable Energy for All (SE4all – see World Bank, 2017) initiative aims to realize three objectives: (1) ensure universal access to modern energy services; (2) double the

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global rate of improvement in energy efficiency; and (3) double the share of renewable energy in the global energy mix. These objectives are also included as sub-goals of the 7th target of the UN Sustainable Development Goals (SDGs) on "affordable and clean energy" (see United Nations General Assembly, 2015). Realizing the SE4all and SDG agendas will require the world community to address the challenges of energy availability and affordability. Energy services must be accessible to all citizens at prices that everyone can afford if the shift to sustainable energy is, in fact, "for all."

Not all countries have significant accessibility deficits, but all countries — including those in the wealthy world — have difficulty meeting the requirement of affordable energy services for all. Indeed, as discussed below, a growing movement exists to address significant and, in some cases, widening inequality in affordable energy.

A key commitment of the One Less Nuclear Power Plant (OLNPP) strategy adopted by Seoul Metropolitan Government is 'energy welfare'.² While energy services are available to almost every Korean family, more than 15% of households can struggle to make bill payments during harsh winters or high temperatures. In Seoul, an

² The term used by OLNPP has the approximate meaning of 'energy fairness,' 'energy equity' and 'energy justice' employed by researchers and some countries in characterizing a social condition or metric for unaffordable energy services for sizable segments of a society (Hall et al., 2013; Sovacool et al., 2017). It is intended to address the condition of 'fuel poverty' — a commonly used term in Europe — and 'energy poverty' (frequently used in the US). In this regard, OLNPP planning and policy seeks to remove unequal burdens among members of a society to enjoy needed energy services. It does this by a mixture of national and local programs that lower fuel payments and, additionally, lower energy losses (by the application of energy efficiency strategies).

estimated 10.3 percent of total households are classified as energy-poor (Jin 2009). Nearly 70 percent of the families in the lowest income decile pay more than 17 percent of their income for energy services, while the average across deciles is much lower (less than 5 percent — see Byrne et al., 2015). Seoul Metropolitan Government (SMG) has given high priority to the goal of energy affordability for all of its citizens so that no one is denied the opportunity to participate in and enjoy the basic services of daily life necessary to be a citizen.

In addition to addressing energy welfare needs of its citizen, the City must also enable everyone to participate in the shift to the sustainable energy future envisioned in its OLNPP strategy. This includes access to renewable energy options (especially solar electric power). To meet this goal (which is likewise included in the worldwide SE4all and SDG agendas), the City has devised an initiative called 'renewable energy sharing,'³ which can empower low- and moderate-income households to enjoy the benefits of sustainability. Again, though, affordability must be included in the strategy and, in this respect, energy welfare and renewable energy must be coproduced as part of a more democratic approach to pursuing One Less Nuclear Power Plant.

This chapter examines the opportunities and challenges of

³ Again, a variety of terms are used internationally to capture this policy purpose. From 'community clean energy development' to 'local sustainable energy planning,' the aim is to empower households, neighborhoods, and communities to identify energy service needs and to meet them with local, renewable energy options in combination with energy conservation. This approach is often regarded as an effort democratize energy governance (van der Schoor & Scholtens, 2015; Moss & Becker, 2014).

energy welfare and renewable energy sharing as principles to guide City policy and planning. A review of international efforts to address both principles via policy tools is conducted, focusing on the US and UK as best-practice examples. This international review is then used to benchmark South Korea's and Seoul's efforts, with attention given to both qualitative and quantitative dimensions of impact. Finally, additional strategies that might be considered for inclusion in the OLNPP framework are offered.

A Review of International Efforts to Address the Energy Welfare & Renewable Energy Sharing Challenges When Building a Sustainable Energy Future

Studies show that energy affordability is a problem for the world community, including wealthy countries (Jannuzzi & Goldemberg, 2012; Teller-Elsberg et al., 2016). A useful comparison is to consider the income effort needed to purchase basic energy services (including electricity and heating) in the US, UK and South Korea. The countries show a similar pattern of unequal burden by income quintile (Figure 1): the 'energy poor' (typically, the lowest income quintile) must dedicate 2.5 times as much of its income to meet basic energy needs compared to middle income families (i.e., the 3rd quintile) and 4-6 times as much as wealthy households.



[Figure 1] Share of income needed to pay energy bills (heating fuel & electricity) by income quintile: Comparison of U.S., U.K. and Korea

Sources: U.S. Bureau of Labor Statistics. 2017 (last updated). Quintiles of income before taxes: Annual expenditure means, shares, standard errors, and coefficients of variation, Consumer Expenditure Survey, 2015.
 U.K. Office for National Statistics. 2017 (last updated). Household income and expenditure by income decile group, UK, financial year ending 2015, Living Costs and Food Survey 2015.
 Korean Statistical Information Service (KOSIS). 2017 (last updated). Household Income and Expenditure Survey 2014. [Income & fuel expenditure data.]
 Korea National Assembly Budget Office. 2016. "Assessment of Pricing Systems of Public Utilities (Table 28, p.46)." [Electricity expenditure data.]

Basic energy needs become unaffordable when the interplay of family income, energy prices and home energy and equipment efficiency causes a family to spend a substantially higher share of their family earnings than the majority of households (see Figure 2 and Table 1).



[Figure 2] Factors Affecting Energy Affordability

Source: Presentation at the 2014 Seoul International Energy Conference. "Sustainable Energy for All Citizens of Seoul," presented by Drs. John Byrne and Sun-Jin Yun with research assistance from CEEP Ph.D. candidates Joohee Lee and Jeongseok Seo.

Acting on the energy welfare challenge

Improving energy affordability typically involves a two-prong strategy that, on the one hand, offers payment assistance for fuel and services, and on the other, strives to lower energy waste in homes and key appliances needed by families for daily life. The US, UK and South Korea have adopted versions of this two-prong strategy.

	U.S.	U.K.	Korea
Terms commonly Used	Energy Burden	Fuel Poverty	Energy Poverty
Definition of Energy-Poor Households	•A household with a 10% energy burden.	•Household spending at least 10% on heating	• A household spending more than 10% of the total income on energy expenses.
National Programs	 Weatherization Assistance Program: Since 1976 Low-Income Home Energy Assistance Program: Since 1981 	•Warm Front Scheme : 2000-12 •Affordable Warmth Grants : Since 2013 •Winter Fuel Payment: Since 2000	•Weatherization program: Since 2007 •Energy Bill Discount & Fuel Payment Program: Since 2010

[Table 1] Policies to Address Energy Poverty: Korea Compared to US & UK

Source: Prepared by CEEP Ph.D. candidate Joohee Lee from these sources: U.S. Department of Health and Human Services, 2005; U.S. Department of Health and Human Services, 2017; Energy UK, 2017; UK Government, 2017; Korea Electric Power Corporation, 2013.

In the case of the US, the fuel payment policy prong has been in place since 1981 when the Low Income Home Energy Assistance Program (LIHEAP) passed into law. It combines payment for emergency needs and a portion-of-bill monthly payment for qualifying households (see Table 1, above). Each year about 8.5 million households are served from an eligible population of 35 million families. Funding has varied between US\$3.5-4.0 billion per year recently and has had high Congressional vote support (meaning that a substantial majority of members of the US House and Senate have vote for its appropriation). Program scope widened from a focus on heating needs to include year-round energy needs; now about 72% of LIHEAP funds address heating needs (include emergencies), while about 13% assist households with cooling needs (again, including emergencies), and the remainder covers program administration. The average annual household benefit is more than US\$500 (Byrne et al., 2014).

The country's weatherization effort dates back to 1976. The annual number of families annually served is approximately 150,000 households (including those in single — and multi-family housing, and owners as well as renters). Funding each year is over \$930 million (including US\$50 million in matching state and local contributions). The program has similar vote support to LIHEAP. Average expenditure per household is estimated to be more than US\$6,000 with a bill savings-to-investment ratio of 2.6 (when health and environmental benefits, the ratio climbs above 4.0 — see Byrne et al., 2014; ACEEE, 2014).

A defining attribute of the US LIHEAP and WAP programs is that implementation and administration are performed by local, nonprofit community agencies. Funds flow from the federal government to state agencies and then to more than 900 community agencies nationwide. Contributions from states and local governments and charities are also part of the fabric of the US system.

The percent of eligible households served by both US programs is less than needed to end energy poverty and there currently is no policy proposal of federal and local commitments that can promise to meet this goal.

Comparable data were not available to the authors for the UK case regarding the country's fuel payment and weatherization

initiatives. But the two-prong strategy guides the UK's effort to address energy poverty in a manner similar to that of the US. A notable difference is that the UK relies on central government organized public private partnerships to administer its programs rather than the US scheme of relying on non-profit community agency networks (Byrne et al., 2014; Northern Ireland Housing Executive, 2016).

At least an infrastructure of energy efficiency tools exists in both societies to tackle energy welfare needs. Its inadequacy to significantly ameliorate the problem is recognized by each country's policy analysts, who point to the very low funding levels of programs (Byrne et al, 2014). But efforts have been given to introduce fuel payment support and energy efficiency as tools of energy justice.

Acting on the renewable energy sharing challenge

The same cannot be said for efforts by the US and UK to assure that economically vulnerable households have access to clean energy tools that can empower them to be 'prosumers,' that is, energy decision makers who can govern both the amount of their energy use and the sources of its supply.

Renewable energy is an essential tool to create a sustainable future for all societies. But it should also be recognized that renewable energy systems, if properly designed, elevate the energy user to a decision maker and this, in turn, opens the possibility for families and communities to become less dependent on energy institutions which many believe they cannot influence. Locations, types and sizes of power plants (for example) are chosen without decisive community involvement and the role of the public is typically limited to paying the prices needed to secure capital investments and cover the costs of plant operations, fuel payments, and billing systems that tell us how much we owe.

There are examples in the US of initiatives to tackle this problem. The federal government and several state and local governments in the United States have an array of renewable energy (mostly solar PV) programs to help low-and moderate-income (LMI) households alleviate their energy burden.

At the federal level, the 2013 President's Climate Action Plan set forth a target of deploying 300MW of installed capacity of renewable energy technologies (so-called Renew300 Initiative), focusing on solar PV, at federally assisted housing by 2020. Through this program, the federal government partners with affordable housing developers to install solar PV on the rooftops of public housing or multi-family assisted housing administered through the U.S. Department of Housing and Urban Development (HUD) (The White House, 2015). Others include the U.S. Department of Energy's SunShot Prize: Solar in Your Community Challenge, which offers \$5 million in cash prize and technical assistance over 18 months to selected teams to develop projects or business models including community solar (U.S. DOE, 2016a), and the 2016 Clean Energy Savings for All Initiative, which sets forth a specific goal of making 1 GW of solar PV available to LMI neighborhoods by 2020 (The White House, 2016). The USDOE also maintains an assistance team under its SunShot initiative called Community and Shared Solar, which is intended to facilitate the efforts of state and local governments to address the need for renewable energy sharing (U.S. DOE, 2016b).

There are also several programs to support low- and moderateincome families at state or local levels. For example, the District of Columbia launched an Affordable Solar Program through its DE Sustainable Energy Utility, which was recently renamed Solar for All. The program helps low-income residents to install solar PV at no cost and aims to cut the electric bill of at least 100,000 qualifying households by at least 50% by December 31, 2032 (DDOE, 2017, p. 4). Through the Mass Solar Loan Program, Massachusetts state government offers loans to any households in their jurisdiction who apply for the program to install PV on their houses. This program offers a carveout for low-income families with financial incentives. including interest rate buydowns by 1.5% and a 30% reduction in loan principal (Massachusetts Clean Energy Center, 2017). California's Multifamily Affordable Solar Housing (MASH) program provides eligible low — and moderate — income households with a cash incentive (\$1.10/kWh to \$1.80/kWh) for up-front costs of PV installations (CPUC, 2015). For this effort, the state annually allocates \$65.2 million solely for low-income public housing.

Compared to the scale and history of its low- and moderateincome fuel payment and energy efficiency improvement programs, national policies in the UK to promote renewable energy development for energy poor households are modest. Although the UK's Green Deal initiative provides households with low-interest loans for renewable projects, program eligibility criteria are steep for lowincome families (Koh, et al., 2013). When a feed-in tariff was implemented in 2010, tariff rates were attractive enough for companies to provide households with affordable solar panels (Clarke, 2013). In recent years, however, reductions in tariff rates have left energy poor communities without attractive opportunities to take advantage of renewable energy technologies. The National Energy Action's Technical Innovation Fund can be used to assist families in fuel poverty to install unconventional technologies such as renewable-powered heating but to date, the number of households using the option is small (National Energy Action, 2016).

Local-level projects are under development in the UK. In December 2016, London's Borough of Camden Council launched a pilot program, '24/7 Solar,' which is designed to reduce energy bills of families at risk by installing solar PV (with storage) on rooftops (London Borough of Camden Council, 2016). This project is partly funded by the NEA. Northern Ireland's housing authority (the Housing Executive) has recently developed a solar PV scheme for energy poor households in partnership with the private sector. Through this program, more than 1,000 homes have installed solar PV systems generating electricity that is saving equivalent of \$25 per month per household on average (Northern Ireland Housing Executive, 2016). While also modest in scale, locallevel efforts are seen as promising.

For the US and UK, the purchase of renewable energy and the

governance role it can give to a family is mostly treated as a private matter. Families are expected to enter renewable energy markets and seek to buy what they can afford. For families with modest incomes, the ability to buy capital equipment or incur debt to own renewable energy systems is obviously much lower than that for middle or upper income households, creating the prospect of renewable energy evolving as an elite service and failing to address energy justice concerns.

International experience: promising but inadequate

Overall, the US and UK cases underscore the need for policy attention to the problem of energy poverty. Efforts to design a democratic response to energy poverty have been more successful in the case of the energy welfare challenge, where an infrastructure of fuel payment and weatherization programs has been in place for decades. This promising response to the problem has established its policy importance but neither country is investing in the key tool of weatherization at a rate necessary to promise an end to this aspect of energy injustice. Making renewable energy an attractive option to families most at risk of energy poverty is a recent goal with, so far, a small footprint. The build-out in the US is larger at the national and local levels but it must receive much more investment to provide a serious choice for at-risk households.

The Case of Seoul

Who are the energy vulnerable?

Article 16-2 of the Energy Act in South Korea authorizes the Government to undertake actions support universal supply of energy to all citizens. Actions anticipated by the Energy Act include:

- 1. Supply of energy to vulnerable classes in energy use, especially low-and moderate-income households
- 2. Improvements in the energy efficiency of housing occupied by vulnerable classes.
- 3. Other matters leading to improvements in the energy welfare of vulnerable classes.

In addition, Article 4-5 requires that "the State, local governments and energy suppliers shall contribute to the universal supply of energy to every citizen, including the poor." Additional to this national statement of policy responsibility, the city of Seoul is governed by its Energy Ordinance which requires "the city government to contribute to the universal supply of energy to all citizens including the energy poor with the assistance of local districts and energy utilities." As well, Seoul's energy planning authority includes an obligation to address energy poverty. And the city can mobilize its Climate Change Fund to support the energy-vulnerable based on Article 4 of the ordinance creating the fund.

According to Article 1-7 of the Energy Ordinance of Seoul, the

energy-vulnerable are those who are eligible for National Basic Living Security benefits, as well as any household in the second lowest income class specified in the Energy Act. The 2nd National Basic Energy Plan defines the energy-vulnerable as those who spend more than 10% of their income on energy. For Seoul this means approximately 10.3% of all households (about 610,000 households composed of 1.36 million people) are to receive policy attention.

Energy welfare policies, plans and programs

Lower level income households tend to rely on energy options such as relatively cheap LPG or kerosene. Most do not have access to town gas infrastructures and family appliances are relatively energyinefficient because of modest family purchasing power. Thus, relative spending on energy expenses is around 2.3 times that of the middle quintile household and nearly 4 times that of the upper quintile (see Figure 1. above).

The SMG clearly recognizes the basic energy rights of all citizens and tries to guarantee them. It prepared a Citizens' Charter for Basic Energy Rights and Energy Welfare Ordinance to expand the responsibilities of the Seoul government to act on this pressing problem. The "Seoul Sustainable Energy Action Plan" includes specific actions to support the city's energy poor through energy welfare projects. A distinctive feature of the SMG approach is to act on the problem as a community-wide one with citizens sharing their saved energy with the energy-vulnerable (Seoul Metropolitan Government, 2014). To implement this policy perspective, Seoul has organized several projects and has sought to integrate national projects into the City's program infrastructure. Energy welfare projects carried out by the SMG can be classified into three categories (Seoul Metropolitan Government, 2014):

- Programs implemented by the Climate and Environment Division which can be further classified into –
 - Projects involving public support (especially fuel vouchers and the distribution of LED lamps to replace conventional lighting)
 - Private resource networking projects which engage the business sector and citizens in assistance to households that can include technical and financial support and draw support from Seoul's energy welfare civil fund
 - Projects conducted by a newly created government workforce which ensures that energy welfare needs of energy vulnerable families is leaned (for example, through surveys and outreach activities) and these needs are then communicated to the government for action
- Programs implemented by the Social Welfare Division which focus on emergency funding support and assistance to enable, repair or maintain Korean ondol (underfloor heating) strategies
- Programs implemented by the Bureau of Housing and Construction, in which house repairs and energy efficiency improvements of government-subsidized rental units are targeted.

South Korea's central government mainly relies on centrally administered energy voucher and fuel payment systems managed by the government-owned "Korea Energy Foundation." Local governments have not been encouraged to work on energy welfare initiatives customized to address local circumstances. In response, SMG has undertaken important efforts to realize its own energy welfare policies. It plans to enact a Charter of Basic Energy Rights and an Energy Welfare Ordinance to complement existing local laws and to the gap left by the central government's energy welfare policy system. SMG has pledged to promote residential energy efficiency improvement and solar power expansion projects for the energy poor. This includes offering its own energy vouchers and direct subsidies of renewable energy project costs. SMG has also undertaken the pioneering step of trying to connect citizen involvement in building a sustainable energy transition which includes sharing the benefits of energy efficiency and renewable energy use with the energy-vulnerable. SMG has created a workforce energy welfare social workers, who conduct regular surveys among the energyvulnerable and give advice, in order to enhance the capacity of all citizens to participate in a sustainable energy future.

Representative examples of energy welfare through energy sharing projects under OLNPP

Citizens' Energy Welfare Fund (Climate and Environmental Headquarters, 2017) SMG created an Energy Welfare Fund based on citizen contributions of energy savings to be shared with energy-vulnerable families. Citizens have been deeply involved in the creation, operation, and distribution of the Energy Welfare Fund since 2015. Sharing comes in several forms, including citizen donations of a portion of bill savings generated from the conservation of energy and generation of energy services from renewable energy. This sharing process takes advantage of City promotions of solar power, LED lights, Building Retrofits Program, and Eco-Mileage projects. The Citizens Council composed of 100 citizens has launched fund raising initiatives to complement these government-supported efforts. SMG is mobilizing citizen participation with a goal of 100,000 sharing members by 2018 and 200,000 by 2020. The donation target from all efforts is 1.7 billion KRW (Korean won) and 3 billion KRW, respectively. The Fund is being used to improve energy efficiency and replacement of inefficient appliances of the energy-poor. In 2016, 754 million KRW was collected through efforts by more than 27,000 citizens.

Beyond simply supplying energy vouchers and quick-fix weatherization strategies (such as wallpapering and replacement of floor mats) which are the foci of central government efforts, a City-supported initiative is forming to improve the energy efficiency of the energy-vulnerable through the replacement of balcony windows, elevators, security lights, and boilers with high energy-efficient products. This deep-retrofit approach will pay significant dividends because housing performance is often quite low for those at risk of energy poverty. In addition, this effort can in some cases abate energy-related environmental and health problems and reduce national energy insecurity by lowering demand for energy imports.

The SMG-created Fund commits the city to these important initiatives while also enabling it to assure basic energy benefits including emergency aid for heating costs. Plans are in place to target the new programs to the specific needs of single-parent households, households with handicapped members, and the city's poorest households.

ENURI Program: Supporting Energy Welfare and Renewable Energy Sharing through Shared Savings from Participating Businesses (Climate and Environmental Headquarters, 2017)

SMG is creating vehicles for the mobilization of its business community to support energy welfare and renewable energy sharing programs. In a manner similar to the Citizens Energy Fund, SMG is asking companies to donate to a share of energy cost savings from energy-efficiency improvements and the generation of renewable energy (which lowers their utility bills to a fund that helps to lower energy bills) to projects which help the energy poor. This program connects the principles of corporate social responsibility with energy welfare and renewable energy sharing. However, this approach is not a simple donation but sharing of energy saved through sustainable energy investments of companies. More than 25 company donations were made during 2015-16. Specific examples include: participating company donation support of products to protect community child welfare centers from winds, cool roof painting for poor communities, PV installation for the energy-vulnerable communities, insulation retrofits for older homes, etc. These activities can stimulate a sharing culture and contribute to energy justice. Also, this project can help companies to become involved in the citywide OLNPP effort without costly regulation.

Seoul's innovations are promising and welcome. Of course, as with the situation internationally, we will need more policy creativity and we will need to learn better how to produce results at a large scale.

Possible Steps to Strengthen the OLNPP Strategy to Meeting Energy Welfare and Renewable Energy Sharing Challenges

The strategies reviewed in the US, UK, and Seoul can ameliorate the problem of energy inequality but they can also leave certain problems unaddressed. For example, the fuel payment programs in all three societies mainly subsidize utilities and fuel companies, rather than reducing energy costs per se for at-risk households. These subsidies represent income for the conventional energy structure that is failing to meet the needs of a sustainable energy future and can offer little hope, by themselves, of making the energy system of the future more democratic and fair.

Energy vouchers and fuel payments leave intact an underlying social inequality, namely, that the most economically vulnerable households often occupy the poorest performing homes because better, including more energy-efficient, housing is unaffordable to families. While weatherization assistance can contribute lower costs, no national program is currently funded to a level that would result in a significant reduction in energy poverty. Additionally, weatherization programs too often sacrifice savings for ease of administration. Specifically, there is a tendency to adopt technical 'one-size-fits-all' solutions, ignoring different energy consumption patterns, demands and needs depending on a household's situation. To accommodate lower program costs per project (thereby increasing the number of families served when program funds are small), weatherization assistance can too often focus on 'low-hanging fruit' options that create immediate but relatively small reductions in energy use, leaving at-risk households with enduring problems of high heat and air conditioning losses, inefficient water heating systems, unaddressed building envelope issues, and inefficient appliances. Unless we 'dig deeper,' families are left with increasingly more costly living conditions, growing threats to family health in some instances, and disproportionate environmental burdens.

We offer below strategies to address three key problems in the hope of strengthening the impact of the OLNPP strategy.

Redirecting investment toward sustainable energy development

There is an evident need in the near term for modern society to address energy poverty by making conventional energy services affordable. Cutting energy voucher or fuel payment programs would be morally wrong and socially irresponsible.

At the same time, underinvestment in sustainable energy options lengthens the time spent sending funds to the energy system we intend to replace. As noted above, energy vouchers and fuel payments do not change the underlying conditions of energy poverty. Rather, they simply provide income to the conventional energy system so that the energy poor have access to its services.

How can we address this problem? SMG has created an innovative platform for an answer with the launch of the Citizens' Energy Welfare Fund (CEWF). Our suggestion is to expand this effort in three ways. First, the platform could be encouraged to pursue specific annual targets tied to concrete goals of energy poverty reduction — for example, a reduction of 20% by 2020 in energy poverty (measured by the ratio of income share needed by the middle and lowest income quintiles to meet basic energy service needs).⁴ Second, perhaps with management support from the newly created Seoul Energy Corporation, the Fund could be managed as a mutual bank or credit union in which members own and govern the assets — namely, the deposits of members. If the City deposited funds for at least some of its energy welfare and renewable energy sharing initiatives in the CEWF and citizens placed some of their savings in the Fund as well, this would create a continuing investment vehicle to support democratic, energy-fair sustainable energy projects. Vehicles of this kind exist in other countries but they

⁴ An annually produced version of Figure 1 could be helpful in stating and measuring this goal.

often lack a sovereign investor like a city. Further, OLNPP's success to date in attracting exceptionally high levels of participation of other programs, if marshalled to transform CEWF into a community institution, could leverage the creditworthiness of SMG deposits to enable the Fund to become a viable driver for sustainable energy development. Third, current efforts to involve the business community in the OLNPP initiative might be expanded to include encouragement of company deposits in the Fund with the commitment to dedicate a portion of the business deposits each year to projects designed to hasten the shift among business energy equipment and services to ones consistent with sustainable energy development. With South Korea's recent adoption of a policy on socially responsible investment, this would furnish companies with an attractive compliance opportunity.

These steps create an opportunity to organize the sizable investment capacity needed to meet several of the ambitious energy welfare and renewable energy sharing goals of OLNPP.

Overcoming the one-size-fits-all tendency in implementing weatherization and community renewables strategies

A key feature of sustainable energy development is its reliance on distributed energy-supply, energy-saving and energy-storage approaches. This feature is a strength because it means that energy development can be built according to community choices and needs. Hopes for democratic governance of the energy system, moreover, depend upon this feature. But the democratic, distributed model can also be seen as complicated and planners can sometimes look for ways to standardize decision structures and program implementation. A practical example of this tension is the struggles countries have undergone in building significant weatherization and community renewables programs. The challenge has been as a technical one and planners look for ready-made, 'one-size-fits-all' solutions. Such a development path can compromise the key benefit of sustainable energy development, namely, its ability to recognize and respond appropriately to different energy consumption patterns and demands depending on a household's or a community's situation.

A practical solution to this problem can be found in US experience — a responsive system built to rely on a network of over 900 community-based, non-profit organizations who managed over US\$900 million of annual investments in deep-retrofit weatherization of low- and moderate income housing. OLNPP has already been busy building the rudiments of community-based agency networks to perform regular energy needs assessments. This could be expanded to include the management and implementation of the City's own weatherization program.⁵

This approach would have an important advantage for local economic development. By a partnership of (a) community non-profit agencies representing each of the City's 25 administrative divisions

⁵ Using the US system as an example, CMEJ (Citizens for Environmental Justice), with the assistance of the Center for Energy and Environmental Policy, University of Delaware launched the first city-based weatherization initiative in Seoul in 2006.

(and perhaps additional agencies to represent many of the 200 or so sub-administrative divisions) with (b) associations of local building contractors, renewable energy installers, and engineering firms (as states in the US like Massachusetts and New York have done), a sustainable energy development network can be organized and coordinated with CEWF playing its expanded role as sustainable energy investor. This would replace the 'one-size-fitsall' model with a 'made-to-suit' or 'made-to-order' approach. This solution has the singular advantage of empowering a key feature of the network model: local job creation. Organized in this manner, the City's weatherization and community renewable generation projects can be expected to create 4-5 times as many jobs as investments in conventional energy use (Byrne et al., 2015). This benefit would, in turn, spur an even more rapid transition to the sustainable energy future that OLNPP envisions. The added jobs would strengthen local economies, leading to higher investment rates in the CEWF, and thereby fostering increased investment in an energy future that citizens desire. OLNPP's aim to realize energy justice could be captured in an "End to Energy Poverty" Initiative as an economic development as well energy campaign.

Renewable energy - from an elite option to a democratic option

Finally, SMG can also take practical steps to remove barriers to renewable energy use by building access to options for community renewable energy services, rather than depending on private transactions in a market to own individual renewable energy technology. By combining the expanded CEWF function with a sustainable development network, it is possible for SMG to think about its buildingscape as an infrastructure for renewable energy development for all communities. One configuration of this infrastructure is the use of rooftops to host solar power plants across the buildingscape.

This strategy is under active investigation for the City. Using Seoul's actual rooftop real estate, the country's current retail electricity prices, the city's hourly and daily receipt of insolation, current solar electric power installation costs in the South Korean market, and current national and city policy incentives, the technical potential for a nearly 1.0 GWp network of solar power plants has been identified using 30% of the rooftop real estate of public and commercial buildings only and a capacity topping 3.8 GWp if 30% of all of the City's rooftop area hosts solar power facilities (Byrne et al., 2016, Table 3.). To realize this transformative case, an additional policy incentive would be needed if a 12-15 year payback is to be achieved (Byrne et al., 2017). Estimation of the policy incentive is underway.

[Figure 3] Seoul as a Solar City



Sources: Load data supplied by KEPCO. Estimates by [https://sam.nrel.gov]. Note: Published in Byrne et al. (2015)

As shown in Figure 3, this project would indeed be transformative. During midday hours in months such as May, Seoul Solar City (SSC) could actually export electricity from its community-based, distributed plant network. During the typical peak period of electricity use for this vertical city (which usually occurs in August), over 75% of its peak load could be served by the Solar City plant network. Overall, SSC offers the promise of providing more than 60% of the daylight needs of the cut annually, and nearly one-third of its all-hours annual need.

In the near term, community renewable energy projects could be hosted by public buildings which can serve as test beds (see the solid green area of Figure of 3. for technical potential). Pricing models per kWh delivered

3.34

by this public buildings-based network could be designed which allow the cost of investment to be paid from infrastructure bonds sold to enable the project. A share of the output of the system hosted on public buildings could be dedicated to reducing the cost of electricity to low- and moderate-income households. Utilizing the Seoul Energy Corporation to design and organize investment, a Solar Power for Prosperity Campaign can be launched in phases which includes an effort to significantly lower electricity poverty, and perhaps end its existence, in the city. Locating the test bed plants in neighborhoods that include at-risk communities, this test bed approach could, as well, create needed jobs and local economic development.

Conclusion

On the one hand, the right to basic energy services must be embraced by modern society. On the other, protection of the right to basic energy services must be pursued in a manner that observes the carrying capacity of the environment. This means any society's intention to plan an energy transition needs to be measured by metrics of justice as well as sustainability (Byrne et al., 1998; Agyeman et al., 2003).

SMG's OLNPP expressly takes responsibility for meeting the twin challenges of energy welfare and renewable energy sharing in its Phase 1 and 2 plans. SMG has created promising tools to realize its goal of an energy-sustainable and energy-fair Seoul, including the CEWF, its impressive framework for citizen participation (Lee et al., ²⁰¹⁴), the launch of the Seoul Energy Corporation, the creation of ENURI to spur business participation, the multi-dimensional program development and implementation it has employed, and the ordinances passed to bind the city to goals of justice and sustainability.

More actions are needed, as OLNPP's recent report recognizes (Seoul Metropolitan Government, 2014; Climate and Environmental Headquarters, 2016). We hope that suggestions offered in this chapter for additional policy, organizational, and institutional efforts can assist this highly ambitious plan for Seoul prove helpful.

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