LOUISVILLE'S ENERGY FUTURE
A Path to 100% Renewable Energy by 2040

Planning Proposals by 100% REAL (Renewable Energy Alliance of Louisville)

Renewable energy is the only future available to humanity.

Louisville Metro Council's Resolution R-102-19v.3,[i] passed in February 2020, calls for 100% clean renewable electricity for Metro Government operations by 2030, 100% clean energy for Metro Government operations by 2035, and 100% clean energy community-wide by 2040. These goals are ambitious but they are based on the best available science, and the time frame is generous provided a commitment to the urgency of action is maintained throughout the time frame.

Climate change caused by carbon pollution has already brought devastating impacts in our nation and world and, if unchecked, will fundamentally undermine the stability of economic, natural, and social systems. The likelihood of massive disruptions to human life on Earth is real. These findings were powerfully presented in the United Nations 2018 Intergovernmental Panel on Climate Change (IPCC) Report[ii] representing the consensus of hundreds of scientists from around the globe. The Report delineates that unless rapid and major actions are taken, the frequency and severity of floods, storms, heat waves, and droughts will increase dramatically. Such challenges pose severe threats to the stability of Louisville, including adverse health impacts, business and economic disruptions, exacerbation of inequalities, and infrastructure collapse.

Science shows that renewable energy is the only future available to humanity. The thrust of efforts by the volunteer members of 100% REAL (Renewable Energy Alliance of Louisville) will be to re-orient the social, political, and financial priorities of our home community to align with communities around the nation and world who recognize the critical urgency of transitioning rapidly away from fossil fuels to carbon-free energy. Most of the technology for the transition already exists and advancements will continue to be made; technical limitations, therefore, should not be considered a primary obstacle. Furthermore, the inevitable costs of inaction or delayed action would far exceed the cost of actions taken to accomplish the necessary transition.

This is a brief outline for initial steps toward achieving 100% renewable energy in our city. The ideas presented here are preliminary and will be subject to extensive review and development by the City and community. Considerations include utility regulation; legal and financial issues; energy management and conservation; utility-scale renewable energy installation(s); and a community solar demonstration project.

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ACKNOWLEDGEMENTS: Contributors to this paper include Sam Avery, Jean Christensen, Tim Darst, Drew Foley, Nancy Givens, Diana Klem, Roger Ohlman, George Perkins, Wallace McMullen, Margaret Stewart, and Gary Watrous.[iii]

I. THE ENERGY LANDSCAPE

Louisville's Current Electricity Sector

Addressing the challenge of transitioning Louisville to renewable energy requires an understanding of the current energy landscape for the state and city. Electricity in Kentucky is produced and distributed by monopoly utilities. Louisville is in the service area of an investor owned utility (IOU), Louisville Gas and Electric (LG&E), which has a legal monopoly for the sale of electricity to retail customers in its service area. In exchange for this legal monopoly, the utility has accepted being regulated as to its rates and large capital expenditures.

LG&E and Kentucky Utilities (KU) have a joint maximum generating peak-capacity of 7,561 MW (million watts). About 79% of the electricity generated in LG&E's service area is from coal, 20% is from natural gas, and 1% is from hydroelectric.

LG&E has about 418,000 retail customers. Its maximum generating capacity is only fully utilized at peak times during summer heat waves.[iv]

Currently, there are about 400 solar installations, mostly rooftop, in the LG&E service area. Solar generating capacity presently is about 3.5 MW in Jefferson County.

Legal Basis for Metro Louisville Electrical Supply

In order for Louisville to meet its goals for renewable energy adopted with the Resolution, the City must deal with LG&E. As a private monopoly business, LG&E has primary responsibility to maximize profits for its shareholders, which may present an inherent conflict of interest with the City's need to transition to renewable energy. This raises questions about whether the City has legal grounds to challenge the current arrangement and to separate energy generation from energy distribution so that a competitive basis for rapidly expanding renewable energy–*now the cheapest form of energy nationally*[v]–can be achieved in the City's energy portfolio. A review of historical records reveals the following:

In 1890 the General Council of the City of Louisville enacted an ordinance granting the Gooch Electric Company, "its successors and assigns," the right to erect and use the infrastructure for distributing power to the City of Louisville. A copy of this ordinance is available on the PSC website.[vi]

Daniel Hinton, staff of the Public Service Commission (PSC), writes in an email, "I reached out to LG&E and they indicated that this was still the franchise they were operating under. It is my understanding that Gooch Electric Company is a predecessor to Louisville Gas and Electric. As the successor, LG&E would be able to operate under the 1890 ordinance granting Gooch the franchise."[vii] The assumption of the line of succession could perhaps be questioned or challenged.

Kenya Stump, Executive Director of the Kentucky Office of Energy Policy, makes the distinction that the Gooch franchise only gives LG&E the sole right to use the City's infrastructure, not to be the sole provider, and adds that although similar franchises elsewhere incorporate a fee paid by the utility, *there is no fee paid by LG&E*.[viii] She explains that the restriction on who can provide power is set by a statute known as the Certified Territory Act.[ix]

This information is corroborated by Metro attorney Jeff Derouen via Natalie Vezina, Office of Advanced Planning and Sustainability, writing "…the Certified Territory Act really doesn't give us much choice of who our provider is unless we buy them out." Sam Avery notes that the Certified Territory Act deals primarily with establishing geographic territories for competing utility companies, not with energy generation.

In a subsequent conversation, Mr. Derouen states that there are grounds on which the franchise might be challenged, but such action would not be undertaken unless the City anticipates a beneficial outcome; it currently is not interested in undertaking this. This brings us to the granting of a legal monopoly which is regulated by the PSC as a possible avenue for redress.

Working with LG&E

Currently 99% of Louisville's energy is generated from fossil fuels. To achieve the City's 100% renewable energy goal it will be essential to have a cooperative relationship with LG&E, or alternatively, to alter the utility regulatory environment sufficiently to permit working outside of the monopoly arrangement with LG&E as mandated by the state. The City has initiated discussions with LG&E and with the state to clarify the franchise agreement to determine if there is a legal means to pressure LG&E to work cooperatively with the City in achieving the goal.

LG&E is our traditional energy supplier and our hope is to keep it as such, but other options must be considered if necessary to reach the City's renewable energy goals. The 21st century urgency for a renewable energy economy supersedes any traditional practice of monopoly electrical production dating back to 1890. 100% REAL seeks more direct involvement in the City's negotiations with LG&E and will also work with allies to impact state policies and PSC regulations to open up pathways more conducive to energy efficiency and renewable energy advancements.

Takeaway: The legal basis of LG&E's monopoly for electrical *production,* as opposed to electrical *distribution*, is unclear. LG&E is our traditional energy supplier and we hope to keep it as such, but there are other options.

Kentucky Regulation of Electric Utilities

Electricity in Kentucky is produced and distributed by monopoly utilities, as previously stated. Louisville is in the service area of an Investor Owned Utility (IOU), Louisville Gas and Electric. LG&E (and several other Kentucky IOUs) have legal monopolies in their service areas for the retail sale of electricity to retail customers. In exchange for these legal monopolies, the utilities have accepted

being regulated as to their rates and capital expenditures. This agreed upon balance of the electric utilities both being regulated and having a monopoly in an assigned service area is often referred to as the "Regulatory Compact."

The agency assigned that regulatory authority by law is the Kentucky Public Service Commission (PSC). The PSC sets rates of return, approves or disapproves of large investments (like a new pipeline), and determines the rates charged to consumers by monopoly utilities. The statute requires that rates must be "fair, just, and reasonable." There is some latitude in determining what meets that standard. However, nearly everything the PSC does is subject to review by the courts. Case law has produced an interpretation that KY electric utilities should primarily seek the *lowest cost* method of providing reliable electric service.

In Kentucky the PSC is created by legislation, and its mission or its interpretation of policy can be changed by legislation. Legislation also structures how utilities are reimbursed for environmental compliance. In the past two legislative sessions, bills have been introduced to add affordability to the criteria the PSC should use for setting rates. These bills have not passed.

The IOUs in Kentucky operate as vertical monopolies, which means that they generate, transmit, and distribute electricity. In order to facilitate more rapid adoption of renewable energy, some communities are now working to decouple the generation from the transmission and distribution of electricity. Currently, LG&E is authorized to prohibit other entities from selling electricity in their service territory. This prevents standard Power Purchase Agreements (PPAs) whereby a company would install and sell directly from a generation source to the end user. Electricity which is generated must be sold to LG&E for the utility to then sell and transmit to the end user, an arrangement known as a "sleeved PPA."

Takeaway: To enable Louisville's Metro government to determine its own energy future, we will need to work with other advocates and the Kentucky legislature to create a proper legal framework for renewable energy in our city and the rest of the state.

Benefits of Renewables for Louisville

We find ourselves in challenging times. The complex intersection of the human-caused climate crisis that threatens all species, now overlaid with a global pandemic (the novel coronavirus), is also deeply marked by outcries for justice in response to systemic racism and intergenerational inequality which has engendered horrific violence toward black and brown citizens in our country. Marginalized poor people bear a disproportionate brunt of these associated catastrophes, as evidenced by higher incidences of pollution-related illnesses, asthma and COPD; higher morbidity rates from COVID-19; greater susceptibility to climate extreme impacts; shorter lifespans; and higher unemployment. Furthermore our young people and future generations will inherit the burdens of problems we fail to address today.

By working together to create a clean, green and sustainable future city, Louisville can raise the circumstances of all. The conscious inclusion and representation of those most vulnerable in our community–especially those who have suffered most from the overload of fossil fuels as well as those in future generations–will benefit all of Metro Louisville.

As Louisville transitions to 100% renewable energy, we may anticipate a cascade of interrelated and increasing social, health, and economic benefits including the following:

- Improvements in public transit offering greater mobility for all—especially for low income, disabled, and elderly citizens as well as youth
- Increased energy resilience, reliability, and self-sufficiency from a more diversified energy economy
- Increased grid flexibility from distributed energy sources that can also allow microgrids to harden against extreme weather disasters
- Economic development and good jobs in energy efficiency sector work, renewable energy installations, design work, sales and delivery
- Mitigation of Louisville's heat island effect, which will especially benefit those who live in proximity to the city center, often including people of color and lower incomes
- Cleaner air, soil, and water as a result of decreases in particulate matter and toxins
- Improved public health from lower rates of COPD, asthma, and heart disease; lower overall morbidity rates; and fewer missed days of school and work annually
- Retention of more energy dollars in Louisville from more locally based renewable energy and energy efficiency work
- Reduction of some of the most severe climate change impacts such as extreme flooding, heat waves, and other life-threatening weather events (this could also represent significant cost savings)
- Reduction of the possibility of gas pipeline leaks and explosion
- Ability as a green city to attract more green industries
- Significant energy cost savings for the City and citizens

As evidence of potential savings consider this example:

Northern Indiana Public Service Commission (NIPSCO) recently completed a 2018 Integrated Resource Plan study which found that eliminating coal from its portfolio would be its *cheapest* option. A portfolio of solar, storage, wind and demand management, with a small amount of market purchases, was found to be its most cost effective option–*even cheaper than converting to natural gas*. NIPSCO projects that by moving from 65% coal in 2018 to 15% by 2023 (in 5 yrs.) and entirely replacing its coal by 2028 (in 10 yrs.), it can provide electricity to its 460,000 customers while saving them more than $4 billion over 30 years.[x]

In short, transitioning to clean energy will create economic, social, and health benefits for Louisville. In addition to keeping billions of dollars in the city and adding numerous well-paying local jobs, switching from high carbon-emitting electricity sources to local, low-emission sources will produce major benefits through reduced air pollution and avoided damages associated with carbon emissions. Transitioning to clean energy will create a better future not only for ourselves, but for our children and our children's children.

Takeaway: Local, state, national, and global economies along with multinational corporations are rapidly transitioning to 100% clean renewable energy. Louisville will benefit by taking full advantage of the new 21st century clean energy economy.

II. GETTING STARTED

Metro Council Commitment – Action beyond Words

Passage of the visionary Resolution in February 2020 was an important start toward achieving 100% clean renewable energy for Louisville. Now Council actions, including budget allocations for needed studies, contracts, and staffing are necessary to ensure specified goals are attained. 100% REAL will monitor the Metro Council's budgeting process to ascertain that necessary funds are appropriated, and we will work with City officials and others throughout the community to make sure the vision becomes a reality. Further, 100% REAL will work to support Louisville Metro's Goal 1 to "Decrease energy use citywide 25% by 2025" and Goal 2 to "Decrease energy use in city-owned buildings 30% by 2018" as set forth in the "Sustain Louisville"[xi] plan.

Overview of Needed Actions

Cities and states that have similar plans to achieve 100% clean energy goals are taking a fairly consistent series of steps:

- Set the vision and include the 100% Clean Energy goals in the City's Climate Action Plan.
- Prioritize public participation and set up a working process and Working Advisory Group that involves all key stakeholder groups
- Hire an Energy Manager
- Install one or more public pilot projects on Metro buildings to demonstrate renewable energy technologies, show cost and energy savings, and educate the public
- Establish binding targets, interim goals and milestones to measure progress
- Allocate resources, funding and staffing
- Identify and address barriers to, and lack of incentives for, implementation
- Align business plans and energy strategies of Metro government, LG&E, businesses, community groups, and nonprofits to facilitate success in moving to 100% clean electricity
- Incorporate energy efficiency and renewable energy as requirements in RFP/Bids for Metro projects
- Work with state government to revise building codes and bidding requirements to mandate high standards for energy efficiency and renewable energy in new buildings
- Change state statutes to encourage and incentivize renewable energy
- Investigate aggregate purchasing to bring costs down

- Build upon other sustainability strategies already in use to reduce energy demand—e.g., plant trees, install cool roofs, decrease pavement, engage in energy performance contracting, etc.
- Continue public education on the importance of a rapid transition to renewable energy in the City and on ways the public can engage with this publicly mandated process

Energy Manager

The City seeks to hire an Energy Manager to create and guide many of these ideas, and Metro Council has approved the position. 100% REAL recommends that one be hired as soon as possible. An initial task for the energy manager can be to help negotiate an Energy Services Contract (ESC) that could save millions in utility costs for the City almost immediately. These savings could more than cover the salary of the Manager.

Energy Services Contracts

Energy services contracts, also known as energy performance contracts, can be an excellent tool for financing energy efficiency projects at larger businesses and institutions. The principle of these contracts is that the contractor provides the upfront capital for efficiency improvements—improvements which reduce energy expenditures sufficiently to offset the contract payments. This arrangement allows the contractor to profit while the business or institution saves energy and money.

For example, the University of Louisville worked with Siemens to upgrade their lighting systems, which reduced electricity consumption by 14%, and to install occupancy sensors, which reduced energy consumption by 20-40%. Energy performance contracts enabled the University to obtain financing for over $45 million in improvements with no upfront costs, and the payments were scaled to the amount of expected savings.[xii]

Metro Louisville signed an energy performance contract with Johnson Controls in 2012, and the savings have been significant. The most recent report indicates this efficiency strategy saved the City $1.97 million in 2018 alone.[xiii]

Power Purchase Agreements

Power Purchase Agreements (PPAs) provide a way for a city (or company) to implement major renewable energy projects with no upfront costs. In this type of agreement the installation company finances the project in full, and the city signs a 20 or 25 year contract to purchase the energy, with payments scaled to the expected savings. The upfront cost is thereby paid back over the term of the contract, so the purchase is cost neutral or begins to save money immediately—making it possible to undertake projects that would otherwise be cost prohibitive. In Kentucky, a modified arrangement is required since the energy must be sold first to the monopoly utility, which then will sell it to the City in a “sleeved PPA.”

The PPA recently entered into between LG&E-KU and Rhudes Creek Solar LLC is an example of this type of arrangement. A 100 MW solar farm to be constructed in Hardin County will be the largest of at least four utility-scale projects coming online in Kentucky in the next three years. Through agreements with the utilities, 50% of the energy output from the Rhudes Creek Solar facility will be used by Toyota Motor Manufacturing in Georgetown, KY; 25% will be used by Dow Corning in Carrollton, KY; and the remaining 25% will be used to serve the utilities' electric customers. Twenty-year contracts will lock in a flat price per kilowatt hour—a price that is based on anticipated energy savings and is expected to translate into cost savings for the two manufacturing customers over the life of the agreements.

Louisville Metro would benefit from being able to set up standard Power Purchase Agreements for renewable electricity generation, but this option is not currently supported by law. A restructuring of the legal framework of the electric utility industry in Kentucky to allow Metro Louisville and other customers to purchase electricity generation from multiple provider-generators while using a single distribution grid is desirable. As mentioned above under Kentucky Regulation of Electric Utilities this will require passing major legislation in the KY General Assembly.

Takeaway: Louisville would benefit from the ability to enter into PPA's to enable the city's transition to renewable energy (while potentially saving money). LG&E's vertical monopoly raises barriers that must be overcome.

Metro Street Lights

A kWh (kilowatt/hour) and cost spreadsheet from the City's Office of Management and Budget shows that in 2019 street lights accounted for 33% of Metro's total kWh usage and 43% of Metro's total electric cost, or $5.5 million. According to information provided, there are 25,000+ street lights in Louisville, of which only 150 are LED. An evaluation of one type—the 294 watt HPS street lamp—shows that switching all 8,800 of those lamps to a comparable 194 watt LED would result in a yearly savings of 3,522 MWh and $377,249. LGE also has a 122 watt LED in the same category that may provide adequate light. Using it would increase the yearly savings to 6,058 MWh and $582,252.[xiv]

Takeaway: The possibility of installing LED streetlights should be explored, along with other strategies, as the potential savings are great.

III. PLANNING LARGE SOLAR INSTALLATION(S)

Feasibility and Implementation

How feasible is a large-scale solar installation for Louisville? Consider the example of Northern Indiana Public Service Company (NIPSCO) 2018 Integrated Resource Plan mentioned on page 6. As an integral step toward achieving its goal of delivering a customer-centric, more affordable, reliable and sustainable energy mix for the future, NIPSCO has finalized two 20-year power purchase agreements (PPAs) with subsidiaries of renewable energy developer NextEra Energy Resources LLC to add two new solar farms in central Indiana. These will represent approximately 300 MW of electricity generation capacity and are expected to be in operation by mid-2023.[xv]

> The question of how to generate renewable energy on a utility-scale opens the question of the relationship between Louisville and LG&E. If the management of LG&E/PPL is willing to retire functioning fossil fuel assets and build large solar arrays in their place, Louisville could meet its 2030 and 2040 renewable energy goals and be in complete compliance with new global realities as outlined by the 2018 Intergovernmental Panel on Climate Change report. If LG&E does not take this step, it will be pressured to become Louisville's transmitter, distributor, and retail seller of electrical power, while leaving generation of electricity to other parties.

It is highly desirable to begin the initial stages of planning for a large-scale solar installation(s) to enable the city to achieve its goal of eliminating fossil fuel electric generation for city operations by 2030 (and city-wide by 2040). This can be accomplished with a single large field array or with a combination of field, parking lot, and/or rooftop arrays in appropriate locations. Conducting a feasibility and implementation study is a recommended early step and would not be expensive.

In addition to the purchase price of the land, estimated costs of a utility-scale solar installation range from $1.00[xvi] to $1.62[xvii] per watt. The lower end of the range includes the solar installation itself, whereas the upper end includes likely additional site-specific costs such as access roads, fencing, demolition of existing structures, leveling, utility buildings, and construction of high-voltage transmission lines to the nearest grid connection. Additional costs may include storage and will include operation and maintenance. Adjustments to the 84 megawatt power requirement will be affected by the extent of the following: vehicle electrification; technology improvements (500 watt panels); conservation (up to 30%); wind, hydro and/or geothermal energy; renewable gas; and rooftop solar on government buildings, warehouses, parking areas, etc.

Proposed Outline for Installation

To illustrate, a starting point for a single large field solar array is presented below.

Current Metro Electric Usage:

City of Louisville Electrical Usage in 2019*	100,741,679 kWh
Metro Cost per Year:	$12,806,603

Solar Project:

Solar wattage required (approx):	84 MW (megawatts)
Solar panels required, 385 watts each:	218,182
Acreage required at 500 panels/acre:	436
Cost for solar installation at $1.00/$1.62 per watt	$84,000,070/$136,080,000
Simple Payback period	6.7 years/10.6 years

* The kWh/year figure cited was provided by Catina Rivera at the Louisville Office of Management and Budget.

Credit: Unsplash.com, Andreas Gücklhorn, photographer

Financing

A solar bond issue would have two advantages as a financing option. Public interest in solar would make bonds attractive to investors, and the predictability of electrical usage would guarantee coupon payments, keeping risk extremely low. A solar bond issue could be sold initially for a demonstration project and eventually for a utility-scale installation.

The 2020 Revenue Bill, HB 351 Senate Committee Substitute 1, includes solar-generated electricity as an activity as defined in KRS 103.200 for which a city or county could issue bonds for financing the project under KRS 103.210.

Alternatively, the guaranteed income stream may make a large solar project attractive to a developer in the form of a power purchase agreement, which would not burden the City with upfront financing.

Takeaway: More specific data is needed to design the size and wattage of a utility-scale solar installation. A feasibility and cost study should be commenced. Additionally, Louisville should begin now to look for appropriate sites for a large solar installation, explore legal ramifications with LG&E and the KY PSC, and investigate funding options.

IV. ESTABLISHING AN ADVISORY COUNCIL

A review of peer cities shows that establishment of a multi-stakeholder climate advisory group that is directly connected to local government decision-making enhances the likelihood for success in attaining renewable energy goals. An ideal structure would be to directly report to the Mayor's office and the Energy Manager. Stakeholder representatives might include from large and small businesses, utilities, renewable energy and green building companies, healthcare and educational facilities, nonprofits, churches, community groups, youth, economists, and citizen leaders (especially from the communities most impacted by climate change). These entities will work together to align energy strategies and chart a new energy path for the community so that Louisville can, within the specified time frame, achieve the goals set by the Resolution.

The Metro Office of Advanced Planning and Sustainability welcomes the establishment of such a group. The climate issue is global and too consequential to fall strictly on City government to solve; rather, the entire community must be engaged. Due to its official connection with Metro government, its extensive network of groups, and its skill to host the multi-stakeholder group and convene its meetings, the Louisville Sustainability Council (LSC) has been invited by City staff to convene and chair this advisory council.

Takeaway: 100% REAL will work with the LSC to encourage Metro Government to form a citizen's advisory group to implement the Resolution for 100% Renewable Energy in Louisville.

V. EDUCATING THE COMMUNITY AND BUILDING COMMUNITY SUPPORT

100% REAL seeks to work with the City and diverse community agencies and businesses to mobilize the entire community. Success will involve continuing to build public awareness and support through speaking engagements, media and social media activity, yard signs and billboards, workshops, public demonstration projects, the arts, and more.

100% REAL will work to promote public awareness of Metro Louisville's progress toward achievement of Goal 1 to "Decrease energy use per capita citywide 25% by 2025." Initial progress toward this goal and related initiatives can be found in the City's "Sustain Louisville Progress Report 2017-2018."[xviii]

Levels of Greenhouse Gas (GHG) Emissions ultimately define the progress of any efforts to slow global warming. In order to achieve Louisville's 25% by 2025 Goal 1, we must engage each of five sectors generally identified as major GHG emitters: Manufacturing, Commercial and Institutions, Residential, Transportation, and Utilities. Renewable energy and energy efficiency and conservation solutions are available for each.

VI. ESTABLISHING AN ELECTRIC USAGE BASELINE

Advanced Meters

The Installation of Advanced (Smart) Meters in all Metro buildings could provide clear benefits. Advanced Meters, offered by LG&E, track energy use in 15-minute, 30-minute, hourly, daily, weekly, monthly and yearly intervals, with hourly and daily outdoor temperature included. Data can be viewed online in both numerical and chart form, and email notifications can be sent if a user-defined threshold has been exceeded. Ability to access this information could provide invaluable data to building managers and allow them to pinpoint high and low kWh anomalies. For example: Have lights, space heaters or pumps been left on overnight? Is an HVAC register running excessively? Managers could also use the data to establish baselines for a variety of time periods and occupancy, set kWh goals, and measure kWh improvements from building changes.

LG&E is not currently offering Advanced Meters for Metro buildings. From the LG&E website: "The voluntary Advanced Meter Program is available to the first combined 10,000 LG&E and 10,000 KU residential electric (RS rate) and small commercial (GS rate) customers who sign up." LG&E reports a sizeable backlog on requests for Advanced Meters at this time.

Takeaway: Louisville Metro could benefit from installing Advanced Meters now in partnership with LG&E in all Metro buildings to gather data on City energy usage in order to create baseline information, identify high and low use areas, and set goals.

VII. RENEWABLE ENERGY FOR LOCAL GOVERNMENTS

Reducing Solar Soft Costs

The SolSmart Program funded by the U.S. Department of Energy (DOE) Solar Energy Technologies Office is designed to help cities attract new businesses, promote economic growth, and foster the creation of new local jobs. This program cuts red tape and streamlines permitting for solar installations in order to help local governments "go solar" more quickly, easily, and affordably.

Metro Louisville has set up a web-based resource designed to walk businesses and individuals through the steps necessary to successfully install residential and commercial solar. Significant parts of the SolSmart Program are adopted to ease the permitting process. Interested parties can access the "Installing Solar in Louisville" website to learn more about installing solar in historic and special use districts, obtaining a permit, completing an inspection, choosing a solar installer, connecting to the grid, choosing a financing option, and more at https://louisvilleky.gov/government/sustainability/installing-solar-louisville.

Grow Solar also offers resource toolkits by state for any community seeking to address barriers to solar energy.[xix] The "Grow Solar Toolkits" are a set of resources to assist city, county, community and electric utility leaders in the implementation of solar program best practices. The toolkits include model ordinances for solar regulation in zoning codes, information about how to incorporate solar into comprehensive planning, sample contracts, a local government permitting checklist, and other valuable resources.[xx]

VIII. ADDITIONAL METHODS FOR REDUCING ENERGY CONSUMPTION

One of the most cost-effective measures any city can take is to reduce the amount of energy required for city operations. Energy use reductions lower generation and distribution needs, save operational costs, and reduce emissions. The following provides a brief overview of key strategies for reducing energy usage through energy efficiency.[xxi]

Lighting Retrofits

About 25% of a commercial/non-residential facility's energy consumption is driven by lighting. Replacing old incandescent and CFL light bulbs with light-emitting diodes (LEDs) and adding motion detection sensors to lighting fixtures can reduce energy consumption substantially. (Refer to the Street Light section above for more detail.)

Smart Street Lighting

Smart Street Lighting employs sensors that dim the lighting when no activity (i.e. moving vehicles, pedestrians, etc.) is detected and brighten the lighting when movement is detected. With an energy savings potential of 50% and operational savings potential of 20%, smart street lighting can provide a unique avenue for cities to reduce energy consumption.

HVAC Retrofits and Controls

Space cooling and heating make up about 30% of a facility's energy consumption. Installation of modern HVAC systems can therefore significantly improve energy efficiency and building control. Retrofit options include chiller improvements and heat and cooling equipment upgrades.

Plug Load Management

Plug Load Management refers to the management of a facility's electric outlets through the tracking and controlling of electricity usage. Incorporating smart plugs, advanced power strips, computer management software, and timers are all part of a "Plug Load Management" strategy. A 50,000-square foot building can usually save about $10,000 a year on energy through the application of plug load management.

Water Utility Optimization

Utility water systems use substantial energy for the various operations, including the pumping and distribution of water. Management of wastewater also uses major energy. The most energy-intensive component is the pumping process—55% to 90% of a water or sewage facility's overall energy use is associated with water pumping. Therefore, efficiency measures that reduce pumping costs can provide considerable savings.

Another important component of water utility optimization is leakage management. Modern water management systems are moving away from a "find and fix" approach to a "predict and prevent" approach. Sonic canvassing (leak detection survey), automated leak noise monitoring, and minimum hour flow analysis are all examples of ways to "predict and prevent" active water leakage. This prevention approach can result in energy savings overall.

IX FINANCING CLEAN ENERGY

Green Bank Project

A green bank is an institution or financial structure for financing renewable energy and energy efficiency projects which would otherwise be unaffordable, or for which conventional lenders would be unwilling to assume the risk. A green bank financed project has both economic (lowered upfront energy costs) and environmental (reduced emissions and energy use) advantages.

In ideal cases, projects pay for themselves with no net cost to the client, or they save the client money. This is accomplished by structuring loans so that payments are less than anticipated savings in utility expenses. An essential part of the process is the initial use of energy audits to establish need and potential savings, and later use of audits to monitor post-project results.

Potential green bank clients range from individuals and small businesses to large companies, and from low- to high-income entities. Projects for low-income clients have the greatest relative economic advantage; those for high-end clients have the greatest potential for emissions reduction. Projects could range from the simple replacement of an energy-inefficient appliance to HVAC upgrades, building-wide energy efficiency improvements, and solar panel installations.

100% REAL is working with Metro Advanced Planning and Sustainability to first assess the demand for this financing and then develop a program that links with one or more local financial institutions. Once a green bank is established, education of, and marketing to, potential clients will be needed.

Third-Party Ownership for Solar

Third party ownership or financing of solar primarily occurs through two models: 1) lease; and 2) Power Purchase Agreement (PPA). In third-party leasing arrangements, a solar developer/contractor owns and maintains the system, while the customer offsets their energy bills from the electricity produced by the solar system. For a PPA (as previously discussed on page 8) the customer pays a negotiated fixed rate for 20-25 years for the electricity generated by the system. Both leasing and PPA models allow business owners and homeowners the opportunity to have the benefits of a solar system without the upfront costs.

Third party leasing has been very helpful to the solar industry, and has been used most widely in some Western states. Its use has been declining for residential systems but is on the rise for commercial applications. More information on this topic can be found in the Solar Energy Industries Association's (SEIA) article on Third Party Solar Financing.[xxii] Kentucky statutes restrict solar leasing arrangements to utility-negotiated agreements.

X. OFF-SITE RENEWABLE ENERGY PROCUREMENT

On-site installation of renewable energy sources such solar panels or geothermal systems may be possible at some–but not most–city facilities. Therefore, off-site renewable energy must be procured. According to the National Renewable Energy Laboratory (NREL), communities may employ four different pathways to renewable energy: 1) Utility partnerships; 2) Community Solar; 3) Renewable Energy Credits; 4) Power Purchase Agreements. More information on these various pathways can be found on the NREL website.[xxiii]

Local governments are often the largest or one of the largest customers for their local utility. As such, they can have a strong influence on utility planning and investments in renewable energy. If the utility shifts away from fossil fuels and toward renewable energy, all of the local electricity purchased through the utility will be cleaner and emissions will be lowered.

The challenge before us on the path to 100% Clean Renewable Energy for Metro Louisville by 2040 is great. Much work is required. Obstacles must be overcome. The clock is ticking and there is no time to waste. The decisions we make, and the actions we take—or neglect to take—will make a world of difference for ourselves, for our fellow citizens, and for posterity.

100% REAL is 100% committed to doing everything we can to make the vision set forth in the Resolution 100% real.

XI. OTHER CITIES AND COUNTIES WITH RENEWABLE ENERGY RESOLUTIONS AND IMPLEMENTATION PLANS:

Cities

Ann Arbor, MI
https://www.mlive.com/news/ann-arbor/2020/03/ann-arbor-unveils-1b-plan-to-go-carbon-neutral.html

Arkansas Co-op announces plan to cut rates because of savings from solar power projects
https://ieefa.org/arkansas-co-op-announces-plan-to-cut-rates-because-of-savings-from-solar-power-projects/

Atlanta, GA: Clean Energy Atlanta: A Vision for a 100% Clean Energy Future
http://www.100atl.com/

Austin, TX
www.citizen.org/news/austin-energy-resource-generation-and-climate-protection-plan-update/

Cincinnati, OH: Green Cincinnati Plan for 100% Renewable Energy by 2035
https://www.cincinnati-oh.gov/oes/citywide-efforts/climate-protection-green-cincinnati-plan/

Salt Lake City, UT
https://www.utilitydive.com/news/a-red-state-template-for-100-renewables-utah-bill-unites-rocky-mountain-p/573692/

San Francisco, CA
sfenvironment.org/climate-plans-reports

KY Counties

Garrard County, KY (50 MW solar)
https://psc.ky.gov/agencies/psc/press/032020/0331_r01.pdf

Hardin County, KY (100 MW solar with PPA for Toyota and Dow Chemical)
https://wfpl.org/lge-proposes-largest-solar-field-in-kentucky/

Henderson, KY (1000 Acres)
https://www.thegleaner.com/story/news/2019/12/17/henderson-could-home-1-000-acre-commercial-solar-farm-more/2603593001/

Metcalfe County, KY (55 MW solar)
https://psc.ky.gov/agencies/psc/press/032020/0331_r02.pdf

XII. RESOURCES

1. Louisville Metro Region: Climate Change Trends and Projections. https://louisvilleky.gov/sites/default/files/sustainability/louisville_climate_change_factsheet.pdf

   This is a good two-page summary by the Metro Office of Advanced Planning and GEOS Institute

2. Intergovernmental Panel on Climate Change (IPCC). Summary for Policymakers of IPCC Special Report on Global Warming of 1.5°C approved by governments (2018) https://www.ipcc.ch/2018/10/08/summary-for-policymakers-of-ipcc-special-report-on-global-warming-of-1-5c-approved-by-governments/

   "One of the key messages that comes out very strongly from this report is that we are already seeing the consequences of 1°C of global warming through more extreme weather, rising sea levels and diminishing Arctic sea ice, among other changes." -Panmao Zhai, Co-Chair of IPCC Working Group I

3. Pathways to 100: An energy supply transformation primer for U.S. cities, Meister Consultants Group (MCG) https://cdn2.hubspot.net/hubfs/472557/Publications/Cadmus-Pathways-to-100_Energy-Supply-Transformation-Primer-for-Cities.pdf?__hstc=121325015.f679b57a516ecdf7473379ecbcb4e12e.1597695782316.1597695782316.1597695782316.1&__hssc=121325015.1.1597695782318&__hsfp=1785651830

   Pathways to 100 lays out a three-step process designed to help cities plan for and enable their unique energy supply transformation: 1) map the city's energy landscape; 2) identify available strategies; and 3) organize capacity, resources, and partnerships.

4. 100% RE Building Blocks: A practical toolkit for a sustainable transition to 100% Renewable Energy, Global 100% Renewable Energy campaign, ICLEI (Local Governments for Sustainability)

   100% renewable energy (RE) is gaining momentum among cities globally. Political decision makers and local champions need tools and a roadmap that builds on the experience of other cities committed to 100% RE to implement the targets, assess progress, and achieve the transformation within local contexts and a sustainable development framework.

5. Low Income Solar Policy Guide https://www.lowincomesolar.org/toolbox/pace/

   "Fully enabling low-income solar participation requires policies and programs that are specifically designed to address the unique barriers faced by these communities. This guide provides an overview of those barriers, as well as underlying principles for successful programs, existing policy tools that can be used to create programs, and examples of state and local models that have successfully improved access."

6. NAACP Just Energy Policies and Practices Action Toolkit naacp/climate-justice-resources/just-energy/

The toolkit has eight modules of practical, used-friendly guidance on how to phase out toxic energy sources including coal, nuclear, and oil facilities and transition to clean energy including wind and solar.

7. Simmens, Herb (February 28, 2019) A Climate Vision for Montgomery County (MD) http://www.herbsimmens.com/a-zero-greenhouse-gas-climate-vision-for-montgomery-co-by-2030/

   An imaginary view of how the County will have achieved its zero percent greenhouse gas emissions and 100% renewable energy by 2030 goals "through the transformation of its energy, transportation, building and agricultural systems while strengthening the ability of its residents and businesses to withstand the increasingly frequent and severe physical and socio/economic shocks resulting from accelerating climate change."

XIII. ENDNOTES

[i] A Resolution for 100% Clean Renewable Electricity for Metro Government Operations by 2030, 100% Clean Energy for Metro Government Operations by 2035 and 100% Clean Energy Community-wide by 2040 (as Amended) https://louisville.legistar.com/LegislationDetail.aspx?ID=4324981&GUID=F850C816-ED26-46C5-B313-4107CF4C18B3

[ii] Intergovernmental Panel on Climate Change (IPCC). Summary for Policymakers of IPCC Special Report on Global Warming of 1.5°C approved by governments (2018). https://www.ipcc.ch/2018/10/08/summary-for-policymakers-of-ipcc-special-report-on-global-warming-of-1-5c-approved-by-governments/

[iii] Excerpts from the WISCONSIN CLEAN ENERGY TOOLKIT, Developing a Clean Energy Plan for Your Community, by RENEW Wisconsin and the Wisconsin Sierra Club (March 10, 2020).

[iv] Detail on LG&E's summer peak, versus KU's winter peak:

Year	Company	Summer Peak (MW)	Winter Peak (MW)
2018	KU	3,933	4,790
2018	LG&E	2,618	1,909

System total: 6,5516,699

Source: Justin Bencomo, LG&E staff, email on 6/23/2020.

[v] International Renewable Energy Agency (IRENA) (June 2, 2020). Renewables Increasingly Beat Even Cheapest Coal Competitors on Cost. https://www.irena.org/newsroom/pressreleases/2020/Jun/Renewables-Increasingly-Beat-Even-Cheapest-Coal-Competitors-on-Cost

[vi] An Ordinance in regard to the Gooch Electric Light Co., Approved August, 26, 1800. https://psc.ky.gov/tariffs/Electric/Louisville%20Gas%20and%20Electric%20Company/Franchise/City%20of%20Louisville/1890-08-26.pdf

[vii] Per March 30, 2020 email exchange between George Perkins and David Hinton, staff at PSC, in regard to LG&E and Gooch Electric Utility.

[viii] Per March 30, 2020 phone conversation between George Perkins and Kenya Stump in regard to Gooch electric utility and franchise fees.

[ix] See https://apps.legislature.ky.gov/law/statutes/statute.aspx?id=14041

[x] NIPSCO (2018). Your Energy Your Future: 2018 Integrated Resource Plan Executive Summary. https://www.nipsco.com/docs/librariesprovider11/rates-and-tarriffs/irp/irp-executive-summary.pdf

[xi] Sustain Louisville, Louisville Metro's Sustainability Plan, March 2013. https://louisvilleky.gov/sites/default/files/planning_design/general/sustain_louisville.pdf

[xii] Justin Mog, University of Louisville, Sustainability Initiatives office. Interview with Tim Darst, Executive Director, Kentucky Interfaith Power and Light, November 2016.

[xiii] Report on Johnson Controls 2012 contract with University of Louisville. Measurement and verification report, Year 5, Jan. 1, 2019-Dec. 31, 2019. Submitted by: Johnson Controls, Inc., February 28, 2020.

[xiv] Calculations came from the City's OMB 2019 spreadsheet and the LGE Rate Schedule for street lights, and were verified through an actual bill containing street light kWh and cost.

[xv] Mercure, Matthew (July 20, 2020). NIPSCO Adds Two Indiana Solar Projects to Portfolio. Solar Industry Magazine. https://solarindustrymag.com/nipsco-adds-two-indiana-solar-projects-to-portfolio?utm_medium=email&utm_source=LNH+07-22-2020&utm_campaign=SI+Latest+News+Headlines

[xvi] Energy Sage, Solar Farms and How Do You Start One? (May 2019). https://news.energysage.com/solar-farms-start-one/

[xvii] Per Sam Avery to 100% REAL, in regard to proposed outline of a large solar installation.

[xviii] Sustain Louisville Progress Report 2017-2018, https://louisvilleky.gov/sites/default/files/sustainability/sustain_louisville_2017-18_progress_report_final.pdf

[xix] Grow Solar Toolkits. https://www.growsolar.org/toolkit/

[xx] Three State Regional Analysis: Creating "Solar Ready Communities", https://www.growsolar.org/wp-content/uploads/2015/05/Three-State-Regional-Analysis.pdf

[xxi] Excerpts from the WISCONSIN CLEAN ENERGY TOOLKIT, Developing a Clean Energy Plan for Your Community, by RENEW Wisconsin and the Wisconsin Sierra Club (March 10, 2020).

[xxii] Solar Energy Industries Association (SEIA). Retrieved August 8, 2020, https://www.seia.org/initiatives/third-party-solar-financing

[xxiii] Heeter, Jenny; Cook, Jeffrey, J.; and Sauer, Jennifer (Feb., 2019). "Existing and Potential Corporate Off-Site Renewable Procurement in the Southeast", National Renewable Energy Laboratory (NREL) Technical Report NREL/TP-6A20-72003. https://www.nrel.gov/docs/fy19osti/72003.pdf

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