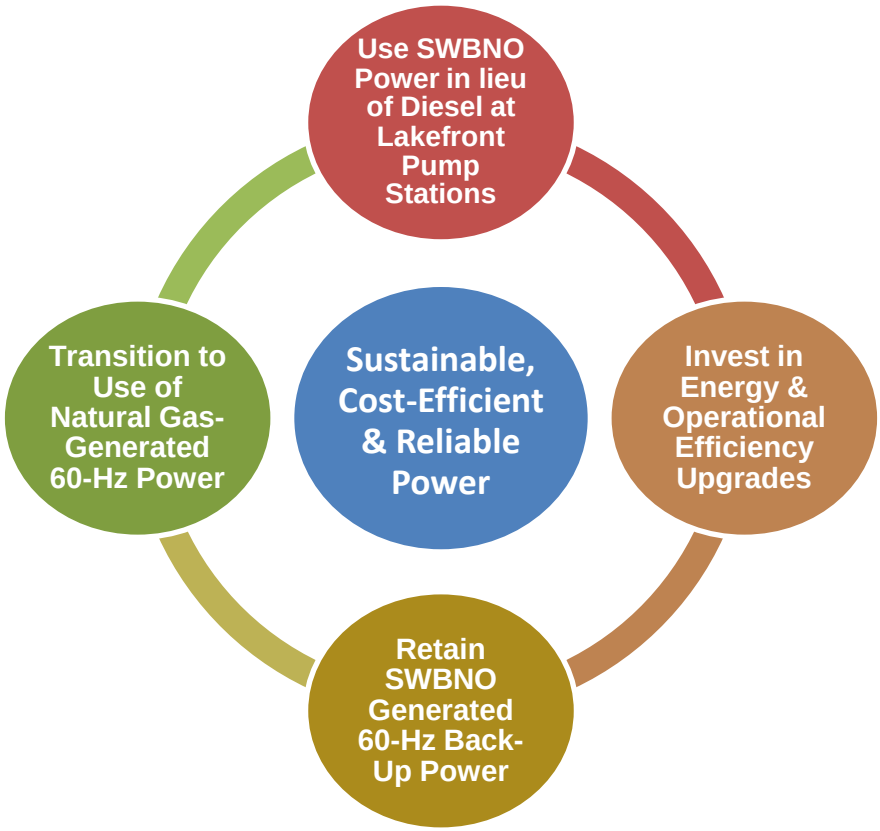
Integrate ♦ Cut Smart ♦ Reorganize ♦ Invest ♦ Grow

Assessing the Sewerage & Water Board of New Orleans: Recommendations for Sustainable and Cost-Effective Power Generation

New Orleans Citizen Sewer, Water & Drainage System Reform Task Force

THOMAS STRATEGIES

Water, Sewerage, and Drainage System Power Generation



The Sewerage and Water Board of New Orleans (SWBNO) stands at a crossroads in determining how best to power the city's stormwater pumps and drinking and waste water systems for decades to come. Nearly two-thirds of SWBNO's power is purchased as 60-hertz (Hz) frequency electricity, with the rest generated by SWBNO as non-standard 25-Hz power. Self-generated 25-Hz electricity powers SWBNO's oldest-designed water systems, including the city's largest drainage pumps, which use 25-Hz motors. Self-generated power also provides critical capacity when outside-derived electricity is interrupted. Nonetheless, the cost to produce 25-Hz power is significantly more than SWBNO's cost to purchase nearly two times more 60-Hz power from Entergy. SWBNO must now choose whether to invest FEMA and proposed bond revenue to expand its steam-driven 25-Hz power generation or begin transitioning to self-generated 60-Hz power. SWBNO must also assure more reliable power delivery off offsite, increase energy efficiency in managing its power, and reliably distribute power to all water system assets, including the city's new lakefront canal pump stations.

The *New Orleans Citizen Sewer, Water & Drainage System Reform Task Force* recommends that SWBNO forego further investment in 25-Hz power production and instead pursue a cost-effective, multi-tiered strategy for expanding offsite and self-generated 60-Hz power. Available funding should also be used to install transmission lines to more reliably deliver private-utility supplied power. In addition, more frequency converters should be installed so existing 25-Hz system motors can use 60-Hz power. Finally, SWBNO should develop an action plan for increasing energy and operational efficiencies throughout the power system, including selling excess self-generated power and using natural-gas fueled power for lakefront pump stations in lieu of onsite, polluting diesel generators.

Recommended Reforms to Augment SWBNO's Proposed Power System Improvements

Assessment of SWBNO's Power Generation System

System Overview

Effective power delivery underpins SWBNO's proposed $3.48 billion in water and drainage system improvements. Drinking and waste water collection, treatment and distribution, along with pumps moving stormwater against gravity, all require electricity from reliable sources and distributed without interruption. In this, SWBNO must supply two types of electricity: (1) 60-Hz frequency[1] electricity for water system motors using electrical current consistent with modern North American standards; and (2) lower-frequency 25-Hz electricity to power its motors based on older designs, including the city's largest and recently refurbished drainage pumps, which were designed in the early 1900's.

Typically, SWBNO requires approximately 5 megawatts (MW) of power to operate its systems. However, overall power needs can change dramatically as drainage pump capacity is needed. The most power SWBNO has ever generated was approximately 43MW to meet system needs on May 3, 1978 when nearly 10 inches of rain fell over several hours, at a peak rate of over 2 inches per hour.

Wisely, SWBNO derives its power from multiple sources to meet such dynamic demands. Nearly two-thirds of SWBNO's power is purchased from Entergy as 60-Hz electricity and delivered via above ground distribution lines to SWBNO's Central Power Plant ("Carrollton Plant") and directly to many drainage pump stations. This electricity is used to power water purification, wastewater treatment, 44% of SWBNO's drainage pumps (post 1970 installations)[2], and supplement other systems.

SWBNO can also generate up to 61MW of 25-Hz power and plans to generate up to 15MV of 60-Hz electricity. Self-generated 25-Hz electricity powers three pumps collecting river water, eight pumps distributing processed water, 56% of SWBNO's drainage pumps (pre-1970 installations), two sewer pump stations, and supplements other systems. More limited self-generated 60-Hz power will power post-Hurricane Katrina flood control systems implemented by the United States Army Corps of Engineers (USACOE). SWBNO's 25-Hz electricity is produced primarily by burning natural gas to generate steam in up to six boilers that are slated for repair and full re-use using federal hurricane disaster recovery and other funds. SWBNO also uses a "dual fuel" turbine engine, fueled directly by natural gas and, secondarily, fuel oil, to generate up to 20MV of 25-Hz power.[3]

Power needed for drainage and sewerage pump stations remote from Carrolton Plant is then distributed through approximately 112-miles of underground cables. As needed, SWBNO uses frequency converter devices to convert 60-Hz power to run 25-Hz-run motors and vice versa. The only planned exception to this framework are current plans to power the new permanent lakefront pumping stations being built by USACOE using diesel generators fueled by over three-quarters of a million gallons of stored onsite fuel.

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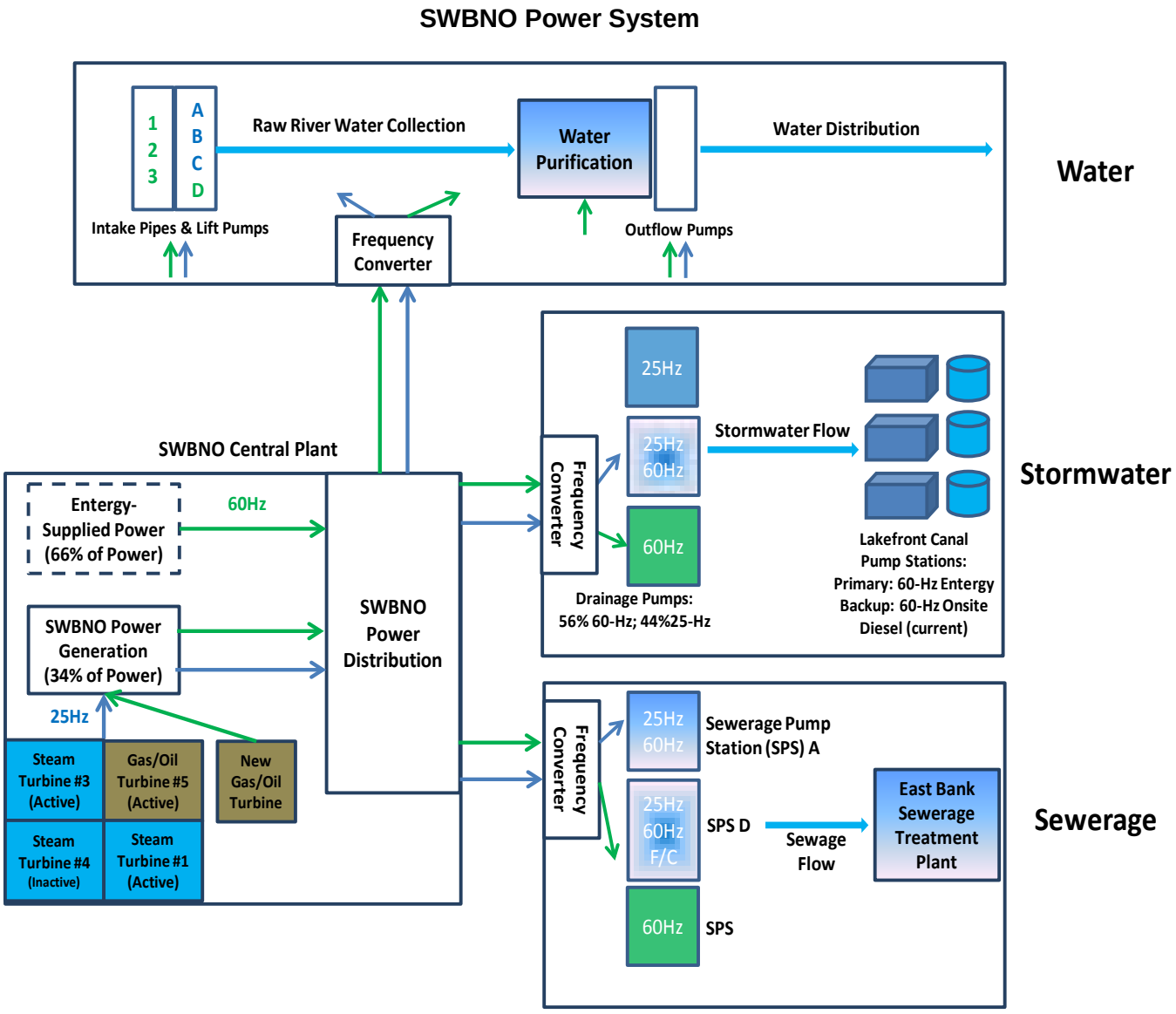
[1] *Hertz* measures the oscillations in a second of alternating current transmitted from a power plant to an end user; *see also*, Owen, Edward L. "*The Origins of 60-Hz as a Power Frequency*." IEEE Industry Applications Magazine. (November/ December 1997), pgs. 8-12. In North America, beginning in the late 1940's utilities began more uniformly using 60-Hz to allow for interconnection of power grids. 25-Hz electricity was prevalent in pre-1906 electrical systems and in the early 20th Century for large loads utilizing long transmission lines.

[2] SWBNO utilizes approximately 145 drainage pumps within 26 separate pumping stations.

[3] SWBNO's 61MW capacity includes its three steam-fueled turbines that can produce 20 MW, 15 MW, and 6 MW, respectively; and its 20MV "dual fuel" turbine.



Power System Challenges & Needs

With all drainage pump motors restored since Hurricane Katrina and billions in other proposed water system upgrades forthcoming, SWBNO is challenged to ensure that these investments are paired with reliable power generation and distribution. After nearly a century without service disruptions caused by major power outages, SWBNO's power system has experienced four major failures, and several more near failures, since Hurricane Katrina.

Two main factors contribute to such failures. Overhead distribution wires supplying SWBNO with Entergy-generated power are susceptible to failure during severe weather or can be de-energized by the utility during high sustained winds. Second, SWBNO's steam boiler-turbine systems, which produce its 25-Hz electricity, are beyond their functional lifespan and need to be replaced.

In a city that is mostly below sea level and saddled with a fractured network of water system pipes, water pressure and movement are all the more important to reliable stormwater protection and drinking water service. When power interruptions infringe on that dynamic, the impact is swift and sustained. Even brief disruptions elongate the time needed to drain stormwater and exacerbate flooding in the patchwork of neighborhoods in New Orleans that are repetitive flood risk areas. For safe drinking water, sustained power is needed to maintain 72 pounds per square inch (psi) of water pressure within purified water pipes. When pressure drops below 15 psi, a mandatory residential boiled-water order is issued.[4]

Compounding these problems, the sudden drops in water pressure caused by power outages create intense pressure waves known as a "water hammer" that propagates through the distribution network causing widespread breakages. This problem is so pervasive that the Federal Emergency Management Agency (FEMA) recently initiated the extraordinarily preemptive measure of directing over $30 million towards the implementation of devices to dampen shock waves caused by power outages because they are undermining investment in repairs to water system pipes.

Keenly aware of the need to improve SWBNO's power system, particularly systems for self-generating power, the City of New Orleans ("City") and SWBNO are grappling with the dilemma of balancing needs for continuous service, expedited action, long-term sustainability, and high expense for any option. Deliberations presently center on three options:

1) Replace all 25-Hz boiler-turbine systems with 60-Hz power generating systems and either upgrade 25-Hz system motors to 60-Hz capable versions or relay on frequency converters

2) Retain reliance on 25-Hz power and restore existing 25-Hz boiler-turbine systems through a combination of new equipment and replacement parts

3) Phase out SWBNO power generation and rely exclusively on power from private utilities

In addition to proposed rate and bond revenue, immediate funding opportunities towards power solutions include obligated and anticipated FEMA reimbursement, which is the dominant source of the approximately $114 million SWNBO seeks to invest in its power system through its proposed improvement plan.[5] In addition, the City has signaled that it will direct a significant portion of the nearly $247 million in additional Hurricane Katrina-related federal hazard mitigation grant funding (HMGP) that the City received from the State and FEMA towards power system improvements. These are significant investments towards; however, they, alone, will not completely modernize SWBNO's power system. Complete modernization that assures long-term cost effectiveness and reliability requires a protracted strategic investment and operating plan that addresses current and near-future power needs and increases energy and operational efficiency to reduce power costs.

[4] Hotels and restaurants must boil water if pressure goes below 20psi.
[5] SWBNO Financial Plan & Rate Study 2011-2020," Appendix C: Capital Programs Review Report (September 28, 2011) (*Hereinafter* SWBNO Rate Study).

By their own acknowledgement, SWBNO "has not performed a recent life-cycle cost analysis of [the] alternatives" being considered to improve its power system.[6] Nonetheless, SWBNO is already proposing over $35.4 million in repairs to its 25-Hz steam-fueled power generators and $25 million in related operations and maintenance (O&M) costs (see below chart).[7] Indeed, the only new major 60-Hz based power assets currently planned are FEMA-funded devices to be installed to reduce "water hammer" through the distribution system. According to FEMA, added expense was necessary to ensure that those devices are equipped with frequency converters to utilize SWBNO's 25-Hz power.

Repair Steam-Driven Components at High-Lift Water Pump Stations A & B	**$3,500,000**
Rehabilitate 20MW Turbine #4 (currently available for emergency use at 8MV)	**$20,000,000**
Rehabilitate Turbine #3 and related components	**$7,047,500**
Rehabilitate Turbine #1	**$2,900,000**
Rehabilitation of Steam Boilers 1 and 3	**$1,000,000**
Repairs to Boiler #2	**$1,000,000**
Boiler Room Related O&M (2011-2020)	**$12,021,623**
Steam Turbine Related O&M (2011-2020)	**$7,001,337**
Boiler Room Maintenance Staffing (2011-2020)	**$6,132,300**
Total Proposed Steam-Generated 25-Hz Power Investment	**$60,602,760**

Source: SWBNO Rate Study (2011)

In lieu of a full life-cycle analysis to assess the most prudent investment strategy, SWBNO offers the following in leaning towards maintaining the status quo:

> *[B]ased on the lowest initial capital outlay and ease of implementation, the Board staff currently favors the option to rebuild the SWBNO power plant with another 25-cycle plant until other alternatives are more cost effective and can be more easily implemented.[8]"*

The *Task Force* is cautious of this thinking. Whatever choice is pursued, it will define SWBNO's power system – for better or worse – for many decades given significant competing funding needs. As such, the *Task Force* that the following additional considerations guide power system investments:

- Purchasing 60-Hz power is nearly three times less expensive than generating 25-Hz power.[9]
- Self-generated power is needed because other utility power can be interrupted.
- Burning natural gas and oil to generate steam to create electricity is more expensive and less efficient than using natural gas directly to generate electricity.
- All SWBNO 25-Hz drainage pump motors are completely remanufactured and are operational.
- Converting 60-Hz pump motors requires additional space in drainage pump stations.
- Slower 25-Hz pump motors require less maintenance than comparable 60-Hz motors.
- 25-Hz power-generation systems are more expensive to procure and maintain than for 60-Hz.
- Technical and operations SWBNO staffing with experience maintaining 25-Hz systems is diminished and over 30% of remaining staff are eligible to retire with full pension benefits.

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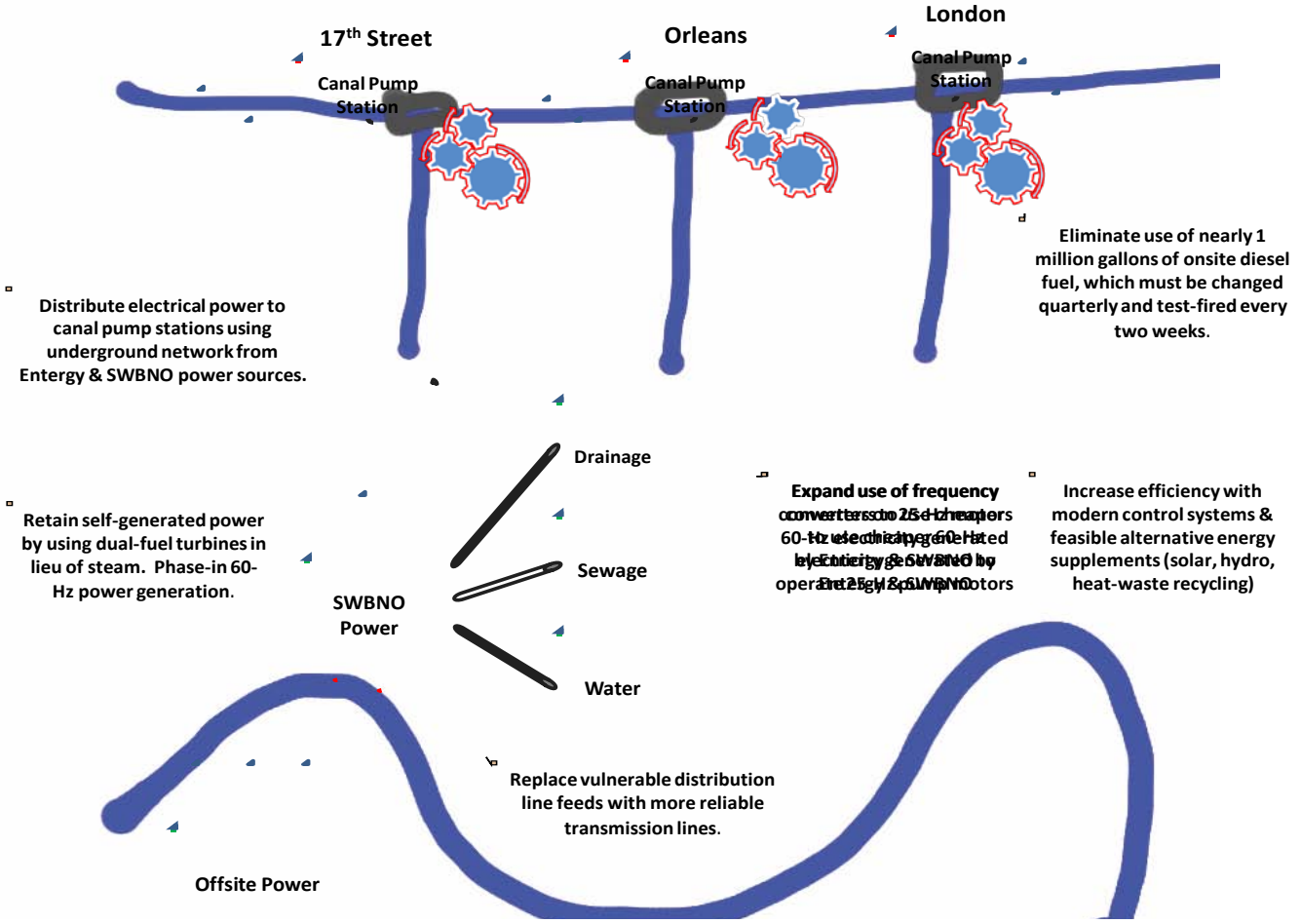
[6] *Id* at p.14.
[7] *See*, SWBNO Rate Study, Appendix C: Capital Programs Review Report (Proposed improvements related to steam-based power generation assets); *see also*, Appendix D: O&M Cost Allocations, p.D-3 and Appendix E: O&M Budget, p.E-4 (O&M estimate for steam assets based on SWBNO's 2011-2020 apportionment of 60% of total O&M to drainage dept.).
[8] *Id*.
[9] *See*, Sewerage and Water Board of New Orleans: *Analysis of Pumping and Power Department Power Purchased and Produced National Gas and Fuel Oil Consumed* (2001-2010) (*Hereinafter* "SWBNO Ten-Year Power Costs"). From 2001 to 2010, purchased 60-Hz cost $117,346,598. Generated 25-Hz power cost $376,278,022.

Recommended Reforms to Augment SWBNO's Proposed Power System Improvements

Available FEMA and HMGP funding paired with rate-based revenue, provide timely opportunities for SWBNO to evolve its power system from its century-old moorings and place it on more sustainable footing. SWBNO should rely more on 60-Hz power that is both derived from private utilities and self-generated, then converted to 25-Hz to power refurbished 25-Hz pump motors. SWBNO should also invest in systems to receive power from transmission lines in lieu of vulnerable distribution lines. Finally, SWBNO should develop consistent action plans for increasing energy efficiency and reducing operational costs, including selling excess self-generated power as a sustainable revenue source.



Among the most immediate opportunities for reform, SWBNO should refrain from using available FEMA funds to reconstitute steam-driven boiler-turbine systems and instead invest in new "dual fuel" power generators that produce more affordable 60-Hz electricity. Paired with this investment, SWBNO should install a static frequency convertor (60 Hz to 25 Hz) sop that existing 25-Hz motors can utilize 60-Hz sourced electricity and distributed via SWBNO's existing underground cable network. Equally timely, the *Task Force* strongly recommends that SWBNO, the City, and USACOE eliminate onsite diesel storage and generation as the only source of power for the lakefront pump stations. Instead, the pump stations should be powered using reliable and energy efficient electricity that is generated by natural gas fueled turbines at the Carrollton Plant and distributed using SWBNO's underground cable network.

Specific Recommended Power System Improvements

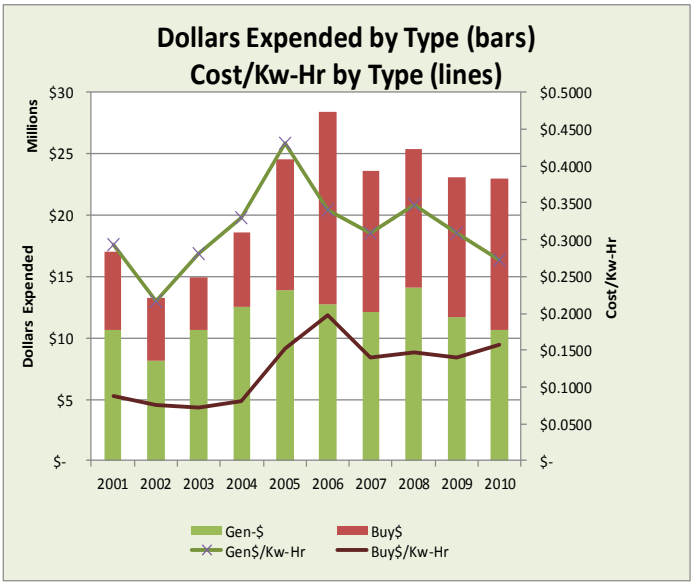
Goal: Transition to 60-Hz Electricity to Power SWBNO System Needs

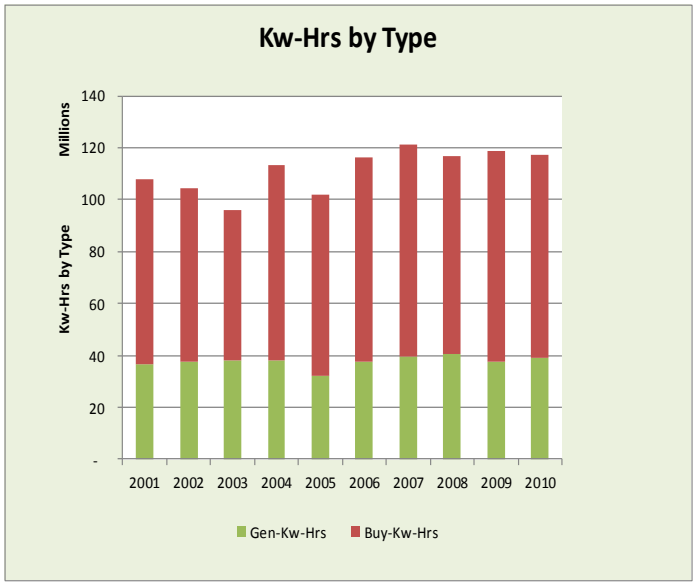
Recommended Action Items

- *Construct Static Frequency Converters to change purchased and self-generated 60-hertz electricity into 25-Hz power for use by 25-Hz system motors*
- *Expand capacity to receive 60-Hz electricity from power grid via a onsite substation that receives power directly from transmission lines based on changing system power needs*
- *Upgrade all system pump motors to 60-Hz models when repaired or replaced*

In lieu of using limited revenue to expand antiquated and inefficient steam-fueled power generation, the *Task Force* recommends that SWBNO expand investment in assets that generate and use 60-Hz electricity. In so doing, SWBNO can realize significant capital and O&M cost savings, while repositioning scarce resources to stormwater, drinking water, and sewerage system needs.

It costs SWBNO millions of dollars more to generate 25-Hz power than purchase 60-Hz power, despite purchasing twice more power than it generates. From 2001-2010, SWBNO purchased 737,979,883 Kilowatt-hours(KwH), costing $94,328,033. During that same period, SWBNO generated 376,278,022 KwH of electricity, costing $117,346,598.[10] This inefficiency is even starker when looking at prevailing rates for purchasing versus generation. At present, when factoring in related O&M costs, SWBNO pays approximately three times more to generate power ($0.40 per KwH) than to purchase it ($0.13 per KwH).[11] This is not a sustainable strategy for supplying long-term power needs.



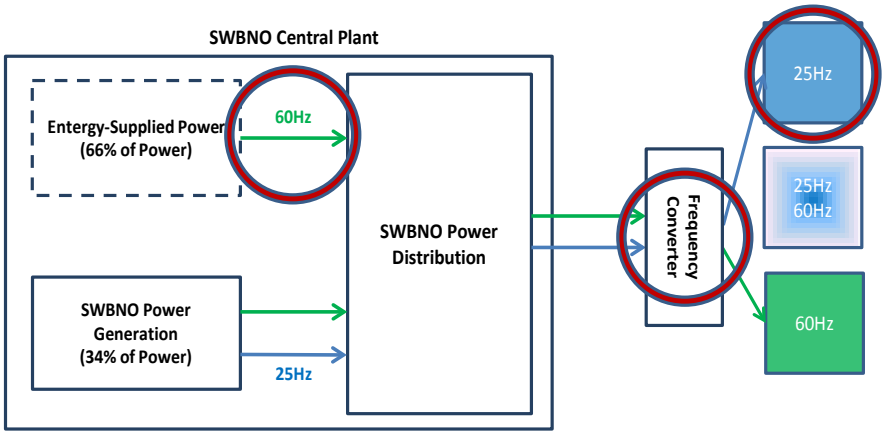


[10] *Supra n.8,* "SWBNO Ten-Year Power Costs."
[11] *Id*; *see also*, SWBNO Rate Study, Appendix D: O&M Cost Allocations, p.D-3 and Appendix E: O&M Budget, p.E-4. SWBNO's estimated total rate for produced power is based on $0.31 per KwH for the actual cost of production from 2001-2010. O&M costs from that period were not made available but SWBNO's Rate Study estimates $34,496,569 in power generation-related O&M between 2011 and 2020 (boiler operations, boiler staff, gas and steam turbine maintenance, and generation staff). This amount was added to the $117MM production cost to derive a total produced-power rate.

Compounding this inefficiency, replacement parts and equipment for SWBNO's 25-Hz generators are increasingly rare and expensive to source. Further, technical and operations staff levels within SWBNO's power plant is greatly diminished, a disproportionate amount of remaining staff are eligible for retirement and full pension, and it is difficult to find new personnel with experience operating rare 25-Hz power systems.

Nonetheless, these disadvantages to relying on 25-Hz power must be reconciled with the fact that SWBNO has nearly reconstituted all 25-Hz motors within its drainage, water, and sewerage systems. The functional life of these motors will now extend another 50 to 75 years. As such, any power system reforms must enable the use of these refurbished motors for the foreseeable future.

In this context, the *Task Force* recommends a multi-tiered strategy to transitioning to the fuller use of 60-Hz power. This strategy embraces SWBNO's continued use of its 25-Hz motors, while expanding use of more affordable 60-Hz power generated offsite and reliably delivered.



Referencing the above illustration, this strategy focuses on investment in three core areas: (1) reliable transmission of 60-Hz power from offsite; (2) expanded use of frequency converters to allow 60-Hz electricity to power 25-Hz motors; and (3) a long-term capital investment policy of replacing aging or defective 25-Hz system motors with comparable 60-Hz versions.

Investing in Reliable Transmission:

The *Task Force* recommends that SWBNO partner with Entergy-New Orleans and Entergy-Louisiana (La) to construct an onsite power substation that allows for purchased offsite electricity to be delivered directly via more reliable transmission lines in lieu of current distribution lines, which are more vulnerable to disruption. Unlike distribution lines, which can be interrupted by a single point of failure, transmission lines can bypass failed lines ensuring reliable delivery.

Investing in Frequency Conversion:

The *Task Force* recommends that SWBNO use funding earmarked for its power system to begin expanding its use of frequency converters to change 60-Hz electricity to 25-Hz power for use among system motors. It is recommended that SWBNO ultimately install 45MV of conversion capacity beginning with an initial investment of 30MV using a central frequency converter unit at the Carrollton Plant and field units as warranted at system motor locations (i.e., pump stations, etc.).

Using medium voltage frequency converters will enable SWBNO to purchase less expensive 60-Hz power, while still realizing a return on earlier investments to repair and replace its 25-Hz system motors. The *Task Force* believes this is a more prudent investment in long-term sustainability and affordability than SWBNO's multi-million dollar proposal to repair and expand steam boilers, which entail millions of dollars more in related annual maintenance. The expanded use of frequency conversion drives will realize significant savings in the process. Specifically, given the large cost differential between purchased or even self-generated 60-Hz electricity versus generated 25-Hz power, the *Task Force* estimates that SWBNO could save approximately $5 million in annual production costs and millions more in saved O&M costs.

Use of frequency conversion also increases overall energy efficiency while relaying on existing infrastructure to distribute affordable power. Finally, expanded use of frequency conversion relies solely on SWBNO's existing, valuable underground S&WB distribution system.

Instituting a Long-Term Policy for Phasing-Out 60-Hz System Motors:

The *Task Force* recommends that SWBNO gradually phase-out 25-Hz system motors as they age or otherwise malfunction to the point where they must be replaced. Paired investments in reliable 60-Hz power transmission and expanded frequency conversion will enable SWBNO to use 25-Hz motors for a considerable amount of time. Nonetheless, a more fully sustainable power system will only be achieved as excessive O&M costs attributed to maintaining expensive 25-Hz assets are lessened.

Goal: Self-Generate "Dual-Fuel" 60-Hz Back-up Electricity

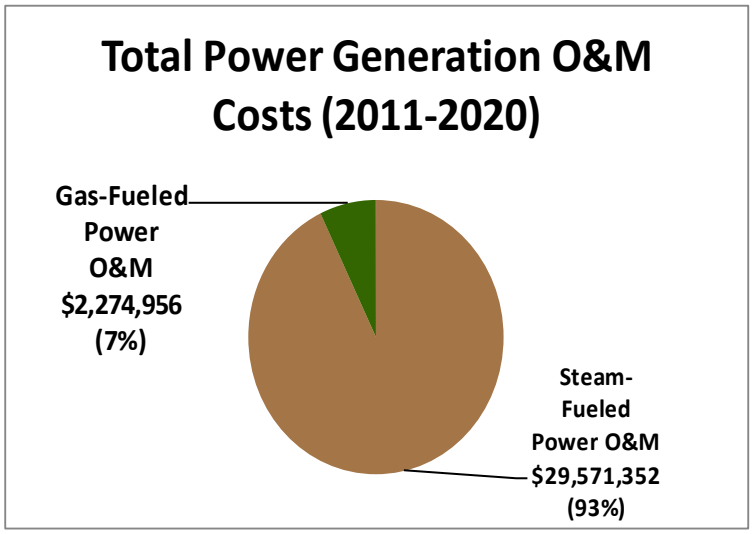
Recommended Action Items

- *Phase-out 25-Hz steam-fueled power generation with less costly 60-Hz power generated using natural-gas*
- *Develop strategic plan for selling excess self-generated electricity on national power grid*

The *Task Force* recommends that SWBNO generate electricity to assure redundant power availability. In so doing, there are significant environmental, operational, and financial benefits to generating 60-Hz electricity using engines powered directly by natural gas and diesel ("dual-fuel") in lieu of steam-generated 25-Hz power. Moreover, SWBNO should capitalize on its power production capacity by selling excess produced power on the national power grid.

At present, the high cost of generating 25-Hz power is exceeded only by the fuel costs associated with producing it. From 2001-2010, SWBNO paid $120.6 million in fuel to generate power costing another $117.3 million to produce.[12] This is in large part because SWBNO employs a four-part process for generating its power as seen below. Each part of this process entails fuel and power costs, operating inefficiencies, and wasted energy streams.

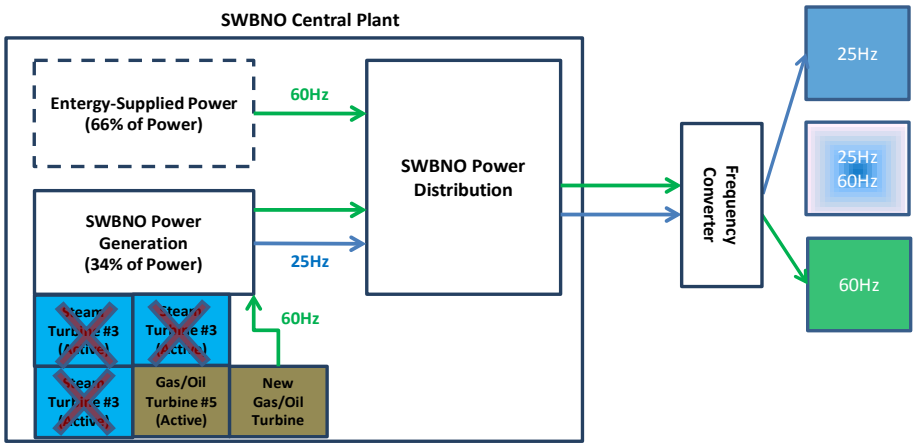
SWBNO's proposes to double-down on this inefficient process by using FEMA and bond financing to reconstitute two offline and semi-inactive steam-fueled turbines to expand capacity to steam-generate 25-Hz power. In all, SWBNO proposes to operate three steam-based turbines producing up to 41MW of 25-Hz power and two dual-fueled turbines producing 20MW of 25-Hz power and one producing 15MW of 60-Hz power.



The chart to the left comparing anticipated O&M costs between SWBNO's planned dual-fuel and steam-driven turbines illustrates the inefficiency of steam-fueled power.[13] Despite only moderately more steam power planned for production, its related O&M costs, including handling steam boilers and turbines, will dwarf comparable costs for dual-fuel derived power. Heat waste loss, added fuel costs, and more expensive labor and parts further exacerbate the cost gulf between these two options for power generation. Based on this, the *Task Force* reiterates that funding now intended for repairing stream-related boilers and turbines should instead be used to expand use of dual-fuel generators for 60-Hz power.

[12] *Supra n.4,* "SWBNO Ten-Year Power Costs."
[13] *See*, SWBNO Rate Study, Appendix D: O&M Cost Allocations, p.D-3 and Appendix E: O&M Budget, p.E-4

Invest in Dual-Fuel 60-Hz Power Generation Turbines to Create Back-Up Power:



The *Task Force* recommends that investments in added frequency conversion be paired with additional dual-fuel engines, which are more energy efficient, less costly to maintain, and less fuel intensive than SWBNO's current four-part power generation scheme. Simply put, three steps for generating power are more efficient than four. This is particularly true given the significant O&M and energy efficiency costs attributed with generating steam intense enough to generate electricity. Removing that component from SWBNO's power production process will realize tremendous savings that can be directed towards other pressing water system needs.

Additional savings are realized from the more modest investment needed to fully establish dual-fueled turbines as SWBNO's exclusive means for self-generating back-up power. With 35MV of existing and already planned dual-fuel power, less than 10MV of additional onsite power generation is needed to meet SWBNO's historical high-mark for system power needs. For all the above reasons, there is considerable return on investment to be had in SWBNO changing directions with its power investments before it is too late.

Enable Means for Selling Excess Generated Power Via the National Power Grid:

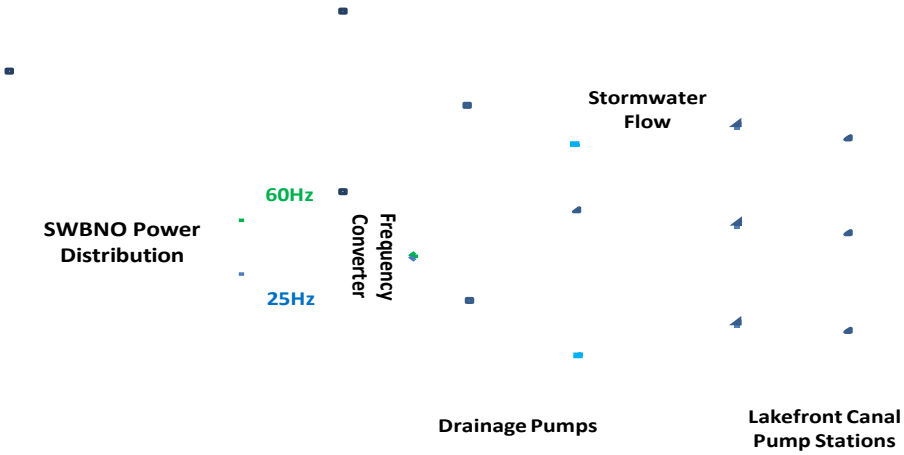
The *Task Force* recommends that SWBNO and Entergy negotiate and execute a legal framework whereby SWBNO can be considered a "co-producer" of electricity in order to sell excess generated power back onto the national power grid to recoup production costs, offset the purchase price of power from Entergy, or merely generate supplemental revenue.

Goal: Use SWBNO Generated Electricity and Underground Distribution to Power the City's Permanent Canal Closure Pump Stations in lieu of Onsite Diesel-Power Generation

Recommended Action Item

Assess the cost, energy, and environmental savings of using dual-fuel generated 60-Hz electricity from SWBNO as back-up electricity for lakefront pump stations

The *Task Force* recommends that 60-Hz electricity produced by SWBNO be used to power the three planned Permanent Canal Closure Pump (PCCP) stations along the city's lakefront in lieu of considerably more expensive and polluting diesel-fueled power generation. This alternative solution will save SWBNO and its customers over $27 million in O&M costs over ten years, while providing equal reliability.



USACOE's current design for the PCCP stations would utilize diesel generators to power station pumps when moving stormwater from outfall canals to the lake. This design also includes storing over 750 thousand gallons of diesel fuel among the three PCCP stations. According to USACOE guidelines, proposed diesel generators will need to be operated at least every two weeks to minimize degradation. Further, onsite stored diesel needs to be replaced several times annually, given diesel fuel's limited lifespan, thus increasing the volume of heavy vehicle traffic in adjacent neighborhoods.

Transporting, storing, and emitting millions such large volumes of diesel fuel in dense residential communities should be avoided to the extent feasible. Resulting emissions from operating large diesel generators at least every two weeks will reduce air quality by adding significant amounts of carbon dioxide, nitrous oxide, sulfur dioxide, and particulate matter into the atmosphere. Compounding this, the steady volume of heavy transport vehicles will compromise local streets that are not constructed to accommodate heavy vehicle traffic, therein requiring millions in additional cost to either restructure those streets or routinely repair them.[14] Moreover, the planned generators and heavy vehicle transport will add significant noise pollution to surrounding communities.

[14] Based on a comparison of *Robert E. Lee Boulevard*, which is constructed to accommodate heavy vehicle traffic, versus adjoining roads enroute to PCCPs that are not currently constructed for such traffic.

In addition, diesel-generated power will be considerably more expensive for SWBNO to operate and maintain than using SWBNO generated power. SWBNO estimates that diesel-fuel related O&M will cost up to $57.8 million over ten years versus an estimated $30.85 million in O&M costs using natural gas-fueled power generated by SWBNO. Further, based on the present value of diesel and natural gas over the next ten years, the cost of the amount of diesel needed to produce 58MV of power – the estimated amount of power needed among all PCCP generators – will be nearly 53 times more expensive than the amount natural gas needed to supply equivalent power.[15]

With construction of the PCCP stations halted pending the outcome of bid dispute litigation, the *Task Force* strongly urges SWBNO, the City, and USACOE to formally evaluate cost-effective alternatives to using stored onsite diesel as back-up power. Specifically, the *Task Force*'s initial investigation reveals that constructing 58MV of dual-fuel power generation at SWBNO's Carrollton Plant and distributing it to PCCP stations via underground cable network is as reliable and of comparable or less expense than onsite diesel generation and storage. Complementing this solution, additional Entergy-derived power should be used to provide additional redundancy and be distributed through SWBNO's conduit network.

The *Task Force* believes that powering planned PCCP stations using SWBNO generated power and underground distribution will maintain critical reliability, while assuring superior energy efficiency, environmental quality, and considerable SWBNO O&M cost advantages in lieu of storing and burning vast stores of diesel fuel within lakefront neighborhoods.

[15] Total power need estimate among planned PCCP stations is based on interviews with USACOE. Based on that estimate, SWBNO will need to spend approximately $53.2 million over ten years to purchase the requisite amount of diesel needed based on prevailing rates (see, http://www.eia.gov/petroleum/gasdiesel/) versus approximately $242,000 for natural gas during that same timeframe (*See*, http://www.eia.gov/dnav/ng/ng_pri_sum_dcu_nus_m.htm).

Goal: Invest in Technical Upgrades and Management System Reforms to Increase Energy and Cost-Efficiency

Recommended Action Items

- *Analyze cost and operating efficiency of third-party management of power generation*
- *Invest in system upgrades that reduce overall system energy demand, reduce heat waste streams, and increase energy recycling*

SWBNO must pair power infrastructure improvements with management and operational techniques that significantly reduce the amount of power needed to operate the city's water systems. According to estimates by the U.S. Environmental Protection Agency (EPA), SWBNO's operations, alone, account for up to 40% of the electricity consumed in New Orleans and is the largest emitter of greenhouse gases.[16] Equally relevant, long-term revenue needs for SWBNO's operations can be greatly reduced by SWBNO instituting more aggressive methods for routinely tracking annual energy use, streamlining usage, and increasing the use of renewable and recycled fuel where practical.

The *Task Force* recommends that SWBNO supplement its proposed improvement plan with details as to how it would complement improved power system infrastructure with policies and practices that improve the operation of its power systems and increase system-wide energy efficiency. Specific recommendations for addressing include the following:

Evaluate Alternative Power System Management Structures:

The *Task Force* recommends that SWBNO continue to own power generating infrastructure. However, given increasingly significant and long-standing staff deficiencies, it is also recommended that SWBNO assess alternative means for operating its power system, including through partnerships with Entergy or other appropriate third parties. Third-party management of SWBNO's power system could achieve much-needed O&M savings, while introducing new and innovative strategies for efficiently generating and utilizing power from SWBNO facilities.

Invest in Techniques and Technology to Routinely Determine Energy Use and Needs:

The *Task Force* recommends that SWBNO develop transparent and routinely-conducted protocols for conducting energy audits and operational assessments that establish and track baseline energy needs and usage relative to operating its water and power-generation systems. At a minimum, SWBNO should develop a long-term, comprehensive infrastructure investment strategy that is based on achieving customer service goals and established targets for energy savings, carbon emission reductions, and related operational costs. Those targets should be established in consultation with appropriate third-party and public input and performance tracking should be instituted to allow the public to monitor ongoing efforts to those aims.

[16] *See*, generally, http://water.epa.gov/infrastructure/sustain/energyefficiency.cfm.

Institute a Comprehensive Energy Management Program to Reduce Usage & Inefficiency:

The *Task Force* recommends that SWBNO institute a permanent program to evaluate infrastructure and operating systems and recommends options for reducing energy usage and inefficiency, while maintaining output needs to meet customer service aims. For example, relative to generating and distribution power among SWBNO systems, the *Task Force* strongly recommends that investments in expanding the use of natural-gas fueled, 60-Hz power be complemented with investments in system to capture and recycle waste-heat from power generation equipment and system motors. SWBNO's extensive reliance on steam generation and its power-intensive array of motors provide excellent opportunities for recycling and reusing heat for energy purposes. To support SWBNO in this endeavor, the *Task Force* recommends that SWBNO establish partnerships among the numerous federal government initiatives within EPA, the Department of Energy (DOE), and other entities that are focused achieving improved energy efficiency among water utilities.[17]

Strategically Invest in Opportunities to Use Renewable Energy to Power Operations:

The *Task Force* recommends that SWBNO establish quantifiable short- and long-term goals for incorporating the use of renewable energy sources within its operations. Affordable and readily available technologies related to waste energy recycling, solar power, and other sources of renewable energy provide SWBNO with immediate opportunities to supplement its current electrical power sources with these more efficient sources.

In the short-term, it is recommended that SWBNO commit to a minimum level of renewable energy use for basic operating services and facilities. Longer-term, the *Task Force* recommends that SWBNO partner with applicable public and private entities to plan and invest in opportunities to supplement major power production needs with renewable sources. For example, it is strongly recommended that SWBNO partner with DOE to explore pilot project options for generating power using turbines that generate power using the flow of the Mississippi River, which is immediately adjacent to SWBNO's Power Plant.

Looking ahead, SWBNO's immediate proposed improvement plan presents an excellent opportunity to address how it would use additional revenue to pair existing and planned power systems with the above recommended action items for increasing energy efficiency and related cost savings.

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[17] *See*, for example, U.S. DOE"s "Gulf Coast Clean Energy Application Center" (http://www.gulfcoastcleanenergy.org/); U.S. DOE's "Save Energy Now" Initiative to reduce industrial energy intensity, which offers no-cost energy assessments.; and EPA's Clean Water and Drinking Water State Revolving Funds (SRF), which are sources of financing for drinking water and wastewater infrastructure. SRF funds can be used to conduct energy audits.

SWBNO Management Solutions *CHECKLIST FOR CHANGE*						
Recommended Reform		**Lead Entity**	**Partner Entities**	**Applicable Policies**	**Applicable Funding**	**Recommended Next Steps**
Transition to 60-Hz Electricity to Power System Needs	*Construct Static Frequency Convertor to change purchased and self-generated 60-Hz electricity for use by 25-Hz motors*	SWBNO			Water & sewer rate-based revenue, FEMA funding, other public funding sources	Within Next Year: (1) Develop an implementation strategy and timeline for phased installation of variable frequency drives, including budget, power amount with each increment, and systems to be benefitted; and (2) design conversion unit(s).
	Expand capacity to receive and transmit 60-Hz electricity from via an onsite substation that receives power directly from transmission lines based on changing system power needs		Entergy		Water & sewer rate-based revenue; other public funding sources	Within Next Year: (1) Develop implementation strategy and installation timeline for onsite substation; (2) develop agreement and funding structure with Entergy for directing transmission lines to substation; and (3) initiate substation design
	Upgrade system motors to 60-Hz models when repaired or replaced				Water & sewer rate-based revenue, other public funding sources	Within Next Year: Develop an implementation strategy that includes identifying motors nearing or exceeding lifecycle capacity and a process for initiating design and financing to replace motors.
Self-Generate "Dual Fuel" 60-Hz Back-Up Electricity	*Phase-out 25-Hz steam-generated power with less costly 60-Hz natural gas-generated electricity*	SWBNO			Water & sewer rate-based revenue, FEMA funding, other public funding sources	Within Next Year: (1) Redirect proposed funding for boiler expansion to frequency conversion and added dual-fuel turbine capacity; (2) develop a timeline and related design and financing structure for complete phase-out of steam-produced 25-Hz power by 2020.

Self-Generate "Dual Fuel" 60-Hz Back-Up Electricity	*Develop strategic plan for selling excess self-generated electricity on national power grid*	SWBNO	State Legislature, Entergy			Within Next Year: (1) Identify existing laws and agreements to revise to designate SWBNO as a "co-producer"; (2) confect agreement with Entergy and any needed legislation; and (3) identify infrastructure needed to enable Entergy to resell unused generated electricity and a related design and funding strategy for implementation.
Use Centralized SWBNO-Derived Power for City's Permanent Canal Closure Pump Station in lieu of Onsite Diesel-Power Generation	*Assess the cost, energy, and environmental savings of using dual-fuel generated 60-Hz electricity from SWBNO as back-up electricity for lakefront pump stations*	SWBNO	City, USACOE		Water & sewer rate-based revenue, USACOE funding	Within Next Eight Months: (1) Conduct a formal analysis of comparing infrastructure and environmental quality financial costs of diesel generation versus SWBNO generated power; (2) develop a supplemental EIS to assess SWBNO power option; (3) amend procurement process to separate power generation component; and (4) design modifications to SWBNO distribution network.
Invest in Technical Upgrades and Management System Reforms to Increase Energy and Cost-Efficiency	*Analyze cost and operating efficiency of third-party management of power generation*	SWBNO	Entergy			Within Next Year: (1) Conduct a comprehensive audit of SWBNO power systems and energy needs to identify management structures and operating methods and infrastructure designs that can reduce energy demand and related costs, while maintaining output needs to meet customer service
	Invest in system upgrades that reduce overall system energy demand, reduce heat waste streams, and increase energy recycling	SWBNO				

Power Generation Advisory Group

Members:

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- **Billy Marchal, Director, New Orleans Flood Protection Alliance (Vice-Chair)**
- **Conner Ellis, President, WJ Barnes Electric Co., Inc.**
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- **FreeFlow Power**
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- **IMC Consulting Engineers, Inc. – Ken McLaughlin PE**
- **Nolan Power Group**
- **Sewerage and Water Board of New Orleans**
- **Tulane University, Energy Center**
- **University of New Orleans**
- **U.S. Army Corps of Engineers**
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