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# Energy for the Future

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## Introduction

The core mission of The Metropolitan Water District of Southern California is to provide its service area with adequate and reliable high-quality water supplies to meet present and future needs in an environmentally and economically responsible way. Strategic, long-range planning allowed Metropolitan many decades ago to make investments in low-cost hydropower from the Hoover and Parker dams. These investments have provided Metropolitan with a base load of very inexpensive power (10 times less than current retail electricity rates), which assists in allowing Metropolitan to deliver water at an economical price for its member agencies.

However, the future of energy is facing pressures such as diminishing resources (fossil fuels), changing regulations, and societal pressure to reduce greenhouse gas emissions. These pressures are likely to have an upward impact on energy costs and could change the methods that energy is produced. Historically in the United States, energy (especially electricity) has been abundant and very cheap compared to the rest of the world. As a result, electricity has been treated merely as an operating expense for Metropolitan.

The energy industry will experience significant transformations in the future, which will increase costs and change the way that energy is generated. Future projections for electricity show potentially dramatic increases in electric rates. This threatens Metropolitan's ability to deliver water at an economical price. Because of this risk, Metropolitan has begun strategic, long-term master planning to hedge against this potential risk and develop a sustainable plan to deliver water into the future. The master plan addresses actions to mitigate cost increases and provide for a dependable energy supply.

It is also evident that the growing nexus between water and energy will need to be considered in long-term planning as well. The California Energy Commission has estimated that the state's energy consumption related to the conveyance, treatment, storage, and distribution of its water supply is approximately 19 percent of the total statewide energy usage. Importantly, the vast majority of this amount (14 percent) is consumed by end users to heat, cool, process, pump, and treat water on their own premises. For Metropolitan, in 2005 the energy consumption as a percentage of the State's total energy use was approximately 2 percent for State Water Project supplies, and approximately 0.5 percent for Colorado River supplies.

The emergence of affordable, clean, renewable energy sources such as solar, wind, geothermal, and other technologies looks promising for the future. Energy consumers may be afforded the opportunity to invest in these sustainable energy sources and become more energy-independent, creating more localized on-site electricity generation, storage, and consumption. The combination of new, affordable renewable energy technologies along with decentralized energy markets is expected to dramatically impact energy markets in the future.

### Energy as an Asset

A shift could be emerging in the energy sector where energy resources are considered an asset and not an expense. For Metropolitan, there is an increasing need to actively manage energy needs and resources given the changing landscape of the energy industry. Metropolitan will not only need to control energy costs, but will have to ensure reliable energy supplies to convey, treat, and distribute water. Metropolitan must plan for a robust energy program that shifts energy from an expense to an investment, while responding to growing demands. Metropolitan has already taken a step in this direction with the construction of a 1-megawatt (MW) solar power generating facility at one of their water treatment plants, design of up to nine additional

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megawatts at the remainder treatment plants, and continued investment in their existing small hydropower facilities. Metropolitan is currently evaluating larger renewable energy projects (50-100 MW) for immediate implementation and considering other investments in energy projects in their Energy Management Master Plan.

This paper will present Metropolitan’s current position on energy and will present a summary of the following topics:

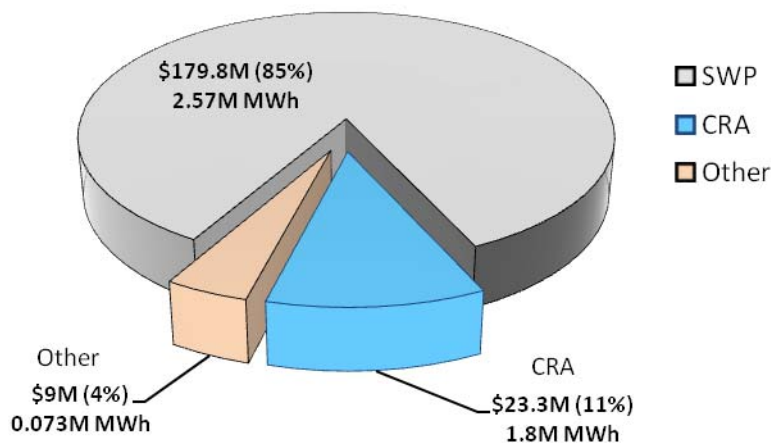
- Current and future projections for energy costs
- Metropolitan’s energy management strategies
- Immediate, near-, and long-term recommended actions
- Implementation plan and strategies through 2030
- The future of energy (2030-2060)

## Background

Metropolitan’s water delivery operations have historically been very energy intensive. The importance of the water-energy nexus will become even more important in long-term master planning of water resource supplies in an environmentally and economically responsible way. From the large-scale standpoint of pumping vast amounts of water from the Colorado River into Southern California to the more moderate scale of treatment of its wholesale water supply using cutting-edge technologies (e.g., ozone disinfection), it is evident that master planning “Energy for the Future” will be an essential component of Metropolitan’s core business functions.

As shown below, Metropolitan’s historical power costs are dominated by the energy-component costs associated with the State Water Project (SWP), which in 2008 accounted for approximately 85 percent of Metropolitan total energy costs. Looking closely at the pie chart reveals an important feature – the substantially higher unit cost for water from the SWP as compared to the Colorado River. Although Metropolitan does not have direct control over these costs (as it is a SWP contractor) it is important that Metropolitan work diligently with the state Department of Water Resources to control these costs, as initiatives such as AB-32, Bay-Delta solutions, and other infrastructure improvements move forward.

**2008 Total Direct and Indirect Power Costs and Use**



The SWP has a substantially higher unit cost for energy as compared to other Metropolitan water sources. As programs such as the Bay-Delta solution moves forward, it is crucial that Metropolitan take a very active role to control these energy costs.

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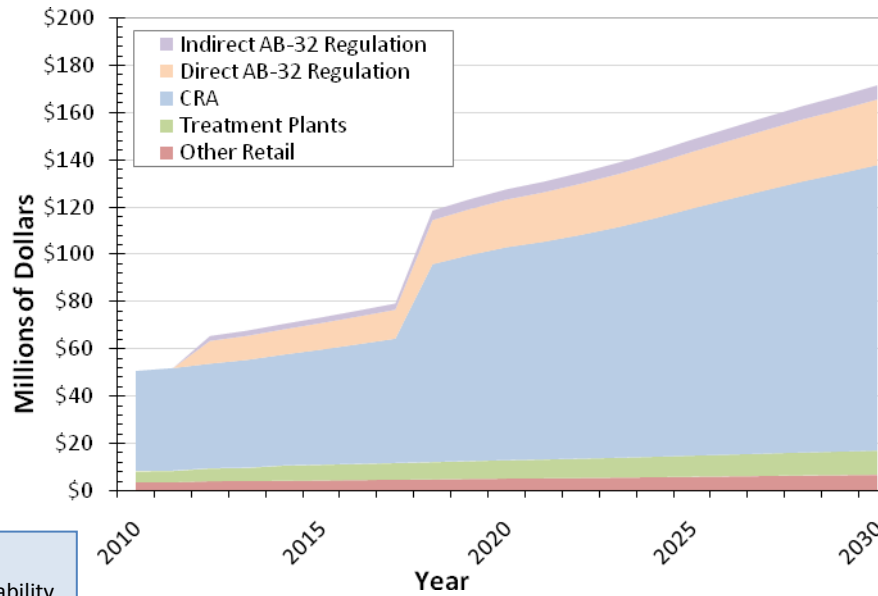
Conversely, to meet the energy-intensive conveyance of water from the Colorado River, Metropolitan has historically relied on the lower unit cost of energy from Hoover Dam, as well as a mutually beneficial supplemental power contract with Southern California Edison to move water from the Colorado River into southern California. Each of these contracts expires in 2017 and new contracts will be negotiated to allow for an uninterrupted power supply to Metropolitan. However the subsequent contracts will likely result in substantial operational cost increases for Metropolitan. In particular, Metropolitan expects to lose 5 percent of its Hoover power allocation, and any subsequent supplemental power agreement with SCE or other entities may not have the current contract's mutually beneficial energy banking and transfer provisions.

Finally, Metropolitan's retail-level energy costs – for treatment of water at each of the treatment plants as well as energy usage at Headquarters and other operational facilities within Metropolitan's service area – accounts for less than 5 percent of its annual energy expenses. This could change however as electricity rates increase under regulations born from AB-32 and other greenhouse gas (GHG) laws take effect.

In addition to the CRA contractual issues that will affect Metropolitan by 2017, as well as SWP and retail-level energy cost increases, there is also concern that current and future regulations (i.e., GHG legislation), questions concerning energy price volatility and reliability, and the impacts of climate change may be factors likely to accelerate future operational cost increases. The factors were considered in future electricity projections out to 2030 for Metropolitan's electricity usage for the Colorado River Aqueduct (CRA) supply. Cost projections for two scenarios are presented in the figures on the following page. The first figure represents a scenario where GHG-type regulations place upward pressure on the cost of energy. The second figure represents a scenario where a carbon cap and trade market exists and the impact of climate change reduces reservoir levels, thereby reducing the availability of low-cost hydropower from Hoover Dam. In order to be well-positioned to maximize current and future water delivery needs while minimizing economic impacts and expanding resource stewardship goals, Metropolitan is proactively engaged in developing an Energy Management Plan to serve as a blueprint to guide immediate-, near-, and long-term projects and decision-making processes. The Energy Management Plan lays the foundation for aggressive master planning to control operational costs while reducing Metropolitan's contribution to GHG emissions.

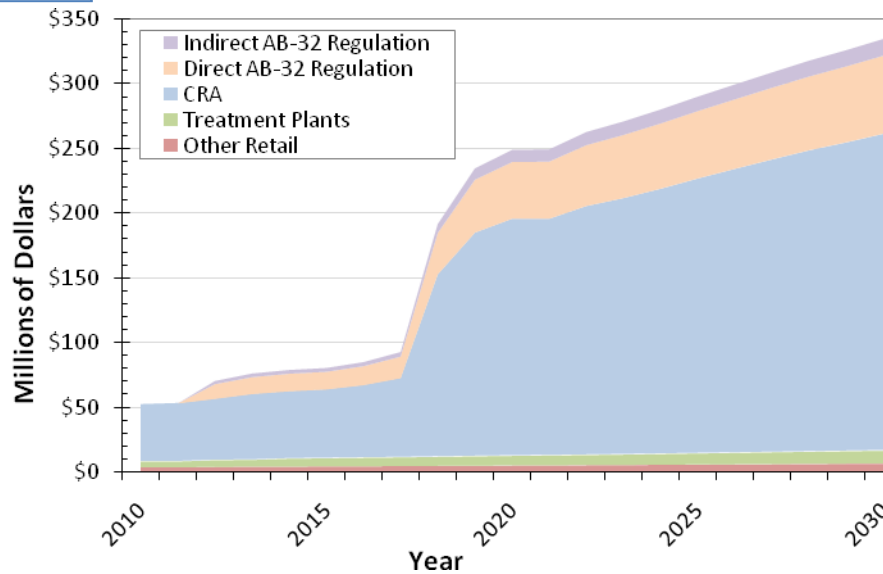
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*Projected Cost of Electricity with Regulatory Changes*



Metropolitan’s Energy Management and Reliability Study projects that the CRA and retail-level energy costs could increase by 2 to 5 fold in the next ten years (by 2020).

*Projected Cost of Electricity with Climate Change*



In order to move forward with planning and implementing “Energy for the Future.” a variety of Board policies, management directives, and challenges exist that warrant a high-level effort by Metropolitan to assist in controlling costs while demonstrating Metropolitan’s stewardship role in water and energy conservation. These are broadly defined below:

- **Energy Management Strategies** –The Energy Management strategies provide overriding objectives for energy-related projects to: (1) Control cost and reduce exposure to energy

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price volatility; (2) Increase operational reliability by providing system redundancy; (3) Provide a revenue stream to offset energy costs; and (4) Reduce carbon emissions.

- **Laws and regulations** – While Metropolitan is uncertain of the direct impacts greenhouse gas regulations would have on operations, it is apparent that these regulations will affect the very core of energy providers Metropolitan relies on to provide a low cost water supply. As outlined in the Energy Management and Reliability Study (Metropolitan – January 2010) this will result in wholesale and retail energy rate increases. The projected electricity costs for Metropolitan's CRA and retail system could increase by two to five fold by 2020.
- **Resource challenges (staffing, skill sets, budget)** – Although Metropolitan has staffing and organizational units to manage its power resources; there is involvement critical need to focus on energy management as one of the priority initiatives of Metropolitan. Metropolitan will require dedicated resources with the appropriate skill sets, appropriate staff levels, and dedicated budget (both capital and operational) in order to manage the master planning process.

### Objectives

Metropolitan's core mission is the delivery of an adequate and reliable supply of high-quality water to meet current and future needs in an environmentally and economically responsible way. However, the Energy Management and Reliability Study identified various challenges – broadly listed below – that must be addressed in order to position Metropolitan to continue its mission of delivering water in an economically-responsible way.

- Electricity price escalation and volatility is expected to increase in the near future
- The emergence of GHG-related regulations will place pressure on the energy sector and will result in dramatic price changes
- The long-term results of climate change may negatively impact the levels of hydropower reservoirs along the Colorado River and subsequently reduce the availability of low-cost electricity from Hoover Dam

To address these challenges, Metropolitan will perform energy management master planning, within the context of following overriding objectives which are also consistent with the Energy Management Strategies:

- **Reduce overall energy costs** – As stated earlier, Metropolitan's CRA and retail-level energy costs could expand two to five fold over the next ten years. Similar energy cost increases could occur on the State Water Project as well. Development of energy programs, projects, and initiatives needs to occur to hedge against these cost increases.
- **Enhance energy reliability** – Metropolitan is primarily dependent on energy produced and transmitted via the investor-owned electrical utilities (i.e., SCE), the locally public-owned electrical utilities (i.e., LADWP, Riverside Public Utilities), and the federal government (i.e., Hoover Dam). Metropolitan needs to position itself to develop economical, long-term power resources that can provide redundancy to the grid-connected systems or potentially deliver off-grid power to Metropolitan facilities.
- **Reduce carbon emissions** – As Metropolitan is not currently a power producer, it is uncertain how greenhouse gas regulations will affect Metropolitan. Nonetheless, Metropolitan could in the future be regulated for indirect greenhouse gas emissions, and as a public steward is interested in both water and energy conservation. Much as it has

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with water, Metropolitan aspires to show leadership in the areas of energy resource sustainability and conservation.

## Strategies

Metropolitan's proposed Energy Management Strategies recognize the upward pressure on cost caused by the expiration of advantageous contracts (Hoover, SCE), evolving power markets, and increased regulatory pressure to reduce GHG emissions. These strategies will better prepare Metropolitan for an environment in which the reaction to GHG regulations negatively impacts both water supply and power cost. The proposed strategies as well as a Road Map for achieving long-term energy management goals form the basis for a comprehensive Energy Management Plan (EMP) that will allow Metropolitan to move forward with controlling costs, reducing its carbon footprint, and establishing itself as a steward of the public from both a water and energy perspective.

Staff intends to bring back viable energy projects that meet energy management plan objectives. The specific strategies are:

- **Regulatory:** Manage and track Federal and State GHG regulations to hedge against price and regulatory risks towards Metropolitan
- **Legislation:** Pursue legislation to increase net metering, feed-in-tariffs, energy wheeling, or other means to allow expansion of renewables
- **Contracts:** Maintain maximum flexibility on existing and future contracts with Hoover and other energy contracts to hedge against cost and regulatory risks
- **Projects/Partnerships:** Pursue cost-effective renewable energy projects and partnerships to hedge against energy price increases, regulatory risks, and move Metropolitan towards carbon footprint reductions
- **Revenue Stream:** Pursue revenue stream renewable energy facilities on operational lands to assist in cost containment, provide reductions in carbon footprint, and provide a hedge against renewable portfolio standard (RPS) regulations
- **Carbon Reduction:** Develop cost-effective projects and programs identified in the EMP which, if implemented, could reduce Metropolitan's carbon footprint at the retail level in 2015 by 50 percent, at the retail level in 2020 by 100 percent, and at both retail and wholesale levels in 2030 by 100 percent
- **Economic & Operational Benefits:** Demonstrate the economic and operational benefits of the proposed projects based on cost effectiveness/efficiency, affect on water rates, and system reliability.

**These strategies allow staff to move forward with the Energy Management Master Plan – bringing cost-effective and environmentally responsible programs, projects, and initiatives back to the Board on a case-by-case basis.**

## Energy Projects and Master Plan

Metropolitan expects energy cost impacts to be substantial within 10 years and could become acute by mid-century.

There is higher confidence in the immediate and near-term impacts and recommended projects because there is more certainty in the factors of influence. Long-term horizons can be impacted by future decisions and factors that are difficult to predict at this time. However, trends indicate

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that in the long-term there are significant price and reliability risks to Metropolitan that are not easily mitigated unless action begins in the near term.

Recommended actions are broken into three distinct planning phases: Immediate (2010-2012), near-term (2013-2020), and long-term (by 2030).

There are several immediate actions recommended to move forward within the next two years that are consistent with the Energy Management and Reliability Study, are consistent with the energy management strategies, and require short-time frames to put into practice (1-2 years). These recommendations are cost-effective, economically feasible, form the basis of a comprehensive energy management strategy, and are summarized below.

### Recommended Energy Management Master Plan Actions

#### Immediate Recommended Actions (fiscal years 2010/11, 2011/12).

1. Create organizational unit within Metropolitan to oversee long-term energy management master planning activities
2. Construct 10 Megawatts (MW) of Solar at water treatment plants, per Plant-wide Solar Feasibility Study and Preliminary Design Draft Report
3. Construct 10 MW Yorba Linda Power Plant conversion to meet all Diemer loads
4. Begin the design of four new small hydroelectric generation plants with a total capacity of 7 MW (per draft report of Hydroelectric Plant Feasibility Study)
5. Enter into partnership with SCPA to develop 50-100 MW renewable energy project that will provide supplemental power along the CRA
6. Enter into partnerships with SCPA and other energy organizations and work actively with its members to address energy-related risks and address master planning activities
7. Proceed with energy-related efficiency and conservation projects at Metropolitan's facilities as well as demonstration projects at Metropolitan's Headquarters Building
8. Proceed with updated comprehensive energy audits at all Metropolitan facilities and identify potential operational improvements
9. Develop strategy for addressing energy risks associated with the SWP

#### Near-term Recommended Actions (within next 5-10 years).

1. Begin construction of four new small hydroelectric generation plants with a total capacity of 7 MW (per draft report of Hydroelectric Plant Feasibility Study)
2. Negotiate new small hydroelectric contracts to maintain flexibility to retain environmental attributes in the form of Renewable Energy Certificates (RECs) and renegotiate (if applicable) existing hydroelectric contracts on an as-needed basis to retain all RECs
3. Begin power use along CRA of 50-100 MW renewable energy facility
4. Install additional 10 MW solar at Lake Skinner
5. Install additional 70 MW solar at Foothill Power Plant, Etiwanda Power Plant, DVL, Lake Mathews, Eagle Valley, and Arrow Highway
6. Perform conceptual evaluation studies for utility-scale solar and wind facilities on Metropolitan property. Install wind data logging systems necessary to determine site feasibility
7. Develop other candidate projects as shown on the attached Energy Master Plan Road Map (attached at the end of this section) as needed and on a project-by-project basis.

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**Development of the near-term recommendations will assist in achieving a 50 percent carbon reduction across Metropolitan’s purchased retail power supply by 2015 and a 100 percent carbon reduction by 2020.**

### **Long-term Recommended Actions (2020-2030).**

1. Partner/construct additional 100-200 MW renewable energy projects
  - a. Sited along CRA
  - b. Utilize economies of scale for capital purchase or market competitive Power Purchase Agreements (PPA)
  - c. Candidate sites would serve large load/consuming pumping plants 24/7

**Development of the long-term recommendations will assist in achieving a 100 percent carbon reduction across Metropolitan’s entire (non-SWP) power supply by 2030.**

As outlined in Metropolitan’s 2010 Energy Management Policy, long-term actions will be defined by various elements (e.g., regulations, legislations, contracts, etc.) that will dictate appropriate response measures by Metropolitan. Long-term energy management goals are to control energy costs, strive for energy independence, and become carbon neutral.

In order to accomplish these goals, staff will actively manage the Energy Management Master Plan – as specific trigger points appear on the horizon, staff will return to the Board to outline programs, projects, and initiatives to meet the long-term goals.

### **Trigger Points**

A variety of trigger points that will dictate moving forward with the recommended actions are identified below. Recommended actions, based on these trigger points, and which will drive the decision-making process at Metropolitan are broken into three distinct planning phases: Immediate (2010-2012), mid-term (2013-2020), and long-term (by 2030).

1. Green house gas regulations become applicable to Metropolitan (i.e., Metropolitan must reduce GHG emissions)
2. Increase in net metering, virtual net metering, direct access or energy wheeling occurs, allowing Metropolitan to develop renewables, store energy on grid, and offset consumption in various locations
3. Renewable Portfolio Standards (RPS) hits 33% by 2020 and Metropolitan becomes directly regulated
4. Carbon price hits \$60/ton affecting wholesale and retail rates
5. Hoover contract ends; loss of up to 5% low-cost Hoover power
6. Loss of supplemental SCE power contract on CRA – Metropolitan supplemental energy costs increases
7. Cost for larger-scale solar or wind power reach parity with retail/wholesale rates due to technological advancements and market pricing reductions
8. Enhanced RPS Standards hit energy industry: 50% by 2030, 80 percent by 2050
9. Wholesale electricity hits \$200/MWh
10. Carbon price hits \$160/ton affecting wholesale and retail rates
11. Reduction of Hoover power supply due to climate change, i.e., water supply cannot drive hydroplant turbines at full load

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### Business-Related Benefits

Several significant business-related benefits can be realized through implementation of “Energy for the Future.” These business-related benefits will assist in maintaining a low-cost dependable water supply, will enhance and supplement Metropolitan’s operational flexibility, and will demonstrate Metropolitan’s commitment to the environment through conservation of water and energy resources.

In particular, implementing energy management strategies will:

1. Reduce bottom-line operational costs
  - Development of renewable programs, projects, and initiatives will reduce Metropolitan’s wholesale and retail energy costs; and
  - Will assist in hedging against energy price and greenhouse gas risks to Metropolitan’s water rate structure and its member agencies water rate structures
2. Enhance energy reliability
  - Development of renewable programs, projects, and initiatives will provide system redundancy at the power resource level; while Metropolitan will always be tied to the grid, development of these energy management initiatives will position Metropolitan to be able to use its own power resources and increase reliability by providing on-site generation or
  - potentially sell excess renewable resources at a premium to power entities who are regulated, thus providing a market commodity on any excess energy
3. Reduce carbon emissions
  - Development of cost-effective renewable programs, projects, and initiatives will demonstrate public stewardship role from an environmental perspective; and
  - Will provide hedges against potential regulations for indirect greenhouse gas emissions used by Metropolitan

### Implementation Plans and Strategies Through 2030

Metropolitan currently has a sophisticated staff of energy managers and traders that handle Metropolitan’s unique role as a retail energy user and wholesale purchaser. Given the growing importance and cost of energy in pumping, treating, and distributing water in California, Metropolitan needs to have staff dedicated to implementing the Energy Management Master Plan. As energy costs rise due to pending regulations and/or water supply changes, Metropolitan will have to address the potential upcoming organizational alignment, budgets, and staffing levels. In addition, Metropolitan must address and plan for the development of long-term energy programs, projects, and initiatives to strategically position Metropolitan to continue its role in delivering adequate and reliable water supplies to southern California in an economical and environmentally responsible manner.

- 1) Organizational Alignment
- 2) Organizational alignment for managing energy initiatives should reflect the growing significance of energy on water.
  - a. Staffing: Determine required skill sets – skill sets needed would include project management, engineering, and legal and legislative staff who are well-versed in the power industry and greenhouse gas regulatory climate, and who have a demonstrated knowledge base to work on renewable energy initiatives.

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- b. Energy Management Responsibilities: tracking and monitoring of legislative and legal affairs related to the energy industry; making recommendations on strategic legislative positions for Metropolitan to support of pursue at the state and federal level; tracking technological advancements; manage and update Metropolitan's energy portfolio and development of energy assets.
  - c. Budgeting: Develop annual and long-term budgets – annual budgets would include operational budgets as well as capital budgets tied to the specific programs, projects, and initiatives. Long-term budgets would be used for future CIP and operational projections as the Energy Management Program unfolds and develops.
- 3) Milestones & Reporting
- a. Annual Board Updates are envisioned to demonstrate movement and accomplishment on the master plan and to report on industry trends, changes to trigger points, and new renewable energy technologies and advancements. The annual update would include at a minimum:
    - i. Report on status of immediate, near-term, and long-term projects
    - ii. Report on costs
    - iii. Energy market update
    - iv. Update on legal and legislative matters
  - b. Produce Annual Energy Management Master Plan Update
    - i. An annual update to the Energy Management Master Plan is recommended. The annual Master Plan would be delivered at the beginning of the fiscal year and would document all of the activities undertaken over the previous year, focusing on the previous year's accomplishments, goals for the next year, and illustrations of energy management cost control and relationships to Metropolitan's water rate structure.

Staff should report to the Board bi-annually and produce a comprehensive annual report indicating accomplishments and future goals and activities with respect to Metropolitan's strategic energy initiative.

By making energy management a strategic priority, Metropolitan would uniquely position itself to develop a robust energy program, shifting energy from an expense to an investment. The development of this program would be geared to control long-term costs, provide energy reliability, and establish Metropolitan as a leader not only in the water industry, but also in the development of strategies governing the ever evolving nexus between water and energy.

### The Future of Energy

By 2030, it is expected that a shift will emerge in the energy sector resulting in decentralization of the electrical energy supply. This will occur through deregulation, i.e., direct access being fully reinstated allowing smaller energy firms to supply energy more efficiently at localized community sites; or via technological advancements, i.e., advancements in renewables (and in particular onsite energy storage), allowing current electricity end users to generate, store, and use energy directly on-site. In effect, this would move these end users towards theoretically being "off the grid." although for redundancy and emergency purposes a grid connection will almost always be required. This decentralization of the energy sector would also lead to a fundamental shift occurring, where for most large energy users energy resources are considered an asset and not an expense.

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## Decentralization of Electricity supply

Emerging issues related to climate change and sustainability has thrust electricity generation under the socio-political spotlight. Our current centralized electricity system dominates the developed world. Yet it is the embodiment of a static technology, performing little better today than it did in the 1970s.

The debate over the United States' energy future routinely overlooks an issue that is key to our rising emissions – the huge wastage inherent in our centralized electricity system. Because large power stations are typically far from our cities, almost two-thirds of primary energy inputs to the system are wasted– partly from the wires that transmit the electricity around the country (transmission and distribution are in the area of 15 percent), but mostly in the form of waste heat from the power stations themselves. If this could only be used, it would be more than enough to meet the entire space and water heating needs of every building in the country. In the face of climate change, mounting security concerns, and overall economic efficiency, such wastage is indefensible.

Reform of the centralized electricity system is now becoming more critical to a sustainable future. The potential to reduce wastage and emissions by remodeling our electricity system around a decentralized pathway are significant. A decentralized energy system has two key characteristics. Firstly, buildings (from terraced houses to industrial units) would serve also as power stations because they have within them one or more energy generating technologies such as solar panels, wind turbines or cogeneration units. Secondly, local energy networks will proliferate, distributing heat and power. These networks will be supplemented by community scale plants generating close to the point of demand. These systems would not likely completely eliminate central power suppliers but may transform their business model.

## Decentralized energy – the benefits and challenges

Electricity was originally generated at remote hydroelectric dams or by burning coal in the city centers, delivering electricity to nearby buildings and recycling the waste heat to make steam to heat the same buildings. Rural houses had no access to power. Over time, coal plants grew in size, facing pressure to locate far from population because of their pollution. Transmission and distribution wires carried the electricity many miles to users with a 10 to 15 percent loss, a difficult but tolerable situation. Because it is not practical to transmit waste heat over long distances, the heat was vented. There was no good technology available for clean, local generation, so the wasted heat was a tradeoff for cleaner air in the cities. Eventually a huge grid was developed and the power industry built all-new generation in remote areas, far from users. All plants were specially designed and built on site, creating economies of scale. It cost less per unit of generation to build large plants than to build smaller plants. These conditions prevailed from 1910 through 1960, and everyone in the power industry and government came to assume that remote, central generation was optimal, that it would deliver power at the lowest cost versus other alternatives.

This model slowly began to evolve once the environmental impacts of the central state's coal generation were recognized. Acid rain in the northeast states resulted in new clean air regulations that forced up the price of coal generation in the midwest, resulting in greater nuclear and gas fired generation.

Today, decentralizing the electricity systems represents an opportunity and likely evolution of getting to grips with local and national greenhouse gas emissions during the next 50 years. By

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enabling the effective use of heat and by establishing a more appropriate infrastructure and regulatory regime which encourages renewables and other low-emission technologies, a decentralized model could halve the electricity system's contribution to climate change in the planning period. Challenges of dealing with redundancy, reliability and the movement of low emission sources from remote power generation sites to urban areas and the effects on air pollution will be major counterpoints that will have to be carefully incorporated into any new power approach for any given region.

To summarize, overhauling outdated electricity infrastructure and pursuing a decentralized pathway would enable:

- slashing of CO2 emissions
- decrease per capita water demand
- decentralized water recycling
- bring down energy consumption levels
- deliver enhanced energy security
- drive technological innovation and real competition in energy markets
- foster the inherent economic advantage of renewable technologies
- save consumers money in the longer term
- increase public involvement in tackling climate change
- increase opportunities for local political leadership in the energy sector

### Emerging Power Generation Technologies & Trends

Metropolitan's Energy Management Plan has identified several immediate projects as well as trigger point for future decision points through 2030. Options for how the region will develop become increasingly broad moving through to 2060, but current trends suggest that investment in changing the way the energy sector functions is likely to undergo large transformations. Investments in wind, solar, geothermal are already high and new investments are likely to emerge, from the local scale (energy storage technologies) to the regional scale (Smart Grid technologies).

As these technologies develop, Metropolitan will need to adjust its energy management planning accordingly. Integration of energy and water planning will become increasing more prevalent and as such Metropolitan will likely need to adjust its management systems to account for the nexus between water and power, particularly from an economical and technological perspective.

Through to 2060, as the regional water wholesaler, Metropolitan will likely take a larger role in investing in new water and power technologies and initiatives. Examples of this include maximizing use of renewable generation on Metropolitan-owned lands – from meeting its own power needs to possibly being an energy exporter to member agencies or other entities. It would also be prudent to explore the concept of Metropolitan as a regional power supplier providing power for water supply and treatment activities throughout Southern California like desalination and wastewater reclamation.

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## Conclusion

Metropolitan faces many uncertainties with respect to its energy supply over the next several decades. Energy – where it comes from, what it costs, and the type of energy – will be essential to delivering a dependable water supply to Metropolitan’s customers in an economically and environmentally responsible way. Contrary to its past involvement as a lower-tier operating expense, energy is now viewed as an intrinsic component of water – the water/energy nexus – where energy and water are linked. This linkage is not only associated with pumping and treating water on a regional level, but has important implications at the consumer level where a majority of the consumption occurs.

It is well recognized that the energy industry will experience significant transformations in the future, which will increase costs and alter the manner that energy is generated. Potential legislative and regulatory triggers are on the horizon that could increase Metropolitan’s operating costs. Future projections related to these triggers indicate Metropolitan’s CRA and retail system could increase by two to five fold by 2020.

Energy management will continue to evolve and should become a strategic priority for Metropolitan. To this extent, Metropolitan must implement a long-term energy strategy to manage its energy portfolio and its affect on the water supply. The energy strategy needs to focus on cost-effective renewable energy projects, utilizing partnerships with both public and private enterprises, as well as with member agencies and other local or regional governments. The strategy should be nimble and adaptive, and should consider energy exchange agreements, power purchase agreements, or non-traditional energy agreements. Grants to fund research and development for water efficiency should be pursued as well as other funding sources for implementation of self generation projects by Metropolitan. Although Metropolitan will be connected to a regional electrical grid for redundancy and emergency purposes, it should strive to become more energy independent, to control costs, provide for long-term reliability, and to reduce its unit energy cost.

To meet its commitment to provide a dependable water supply to its customers in an economically and environmentally responsible way, Metropolitan should plan for a robust energy program while responding to growing demands. Metropolitan has led the way with new technologies and some of the most innovative water conservation programs in the nation. It is clear that the water/energy nexus provides Metropolitan with yet another opportunity to show leadership and demonstrate stewardship towards energy management.