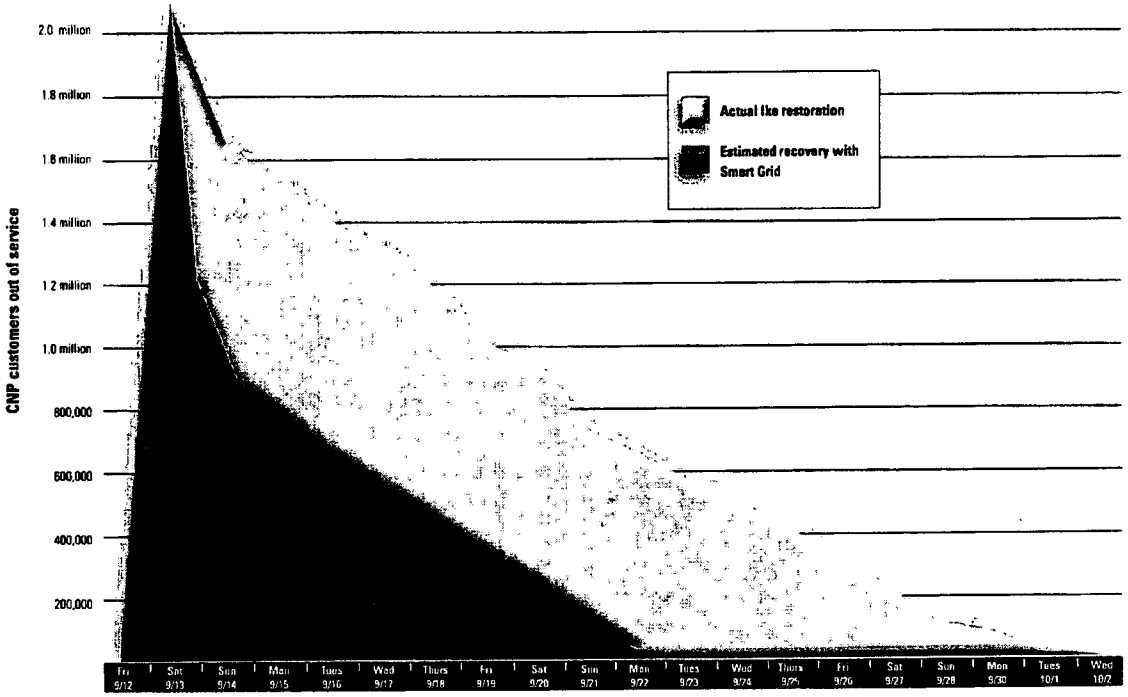
become much less wide-spread, affecting fewer customers, and would be repaired or power restored more quickly because of the information relayed to the utility from the smart-grid. As an attempt to quantify the individual benefits of this new technical capability, the Task Force has searched for a definitive mathematical formula to represent the percentage improvement in electrical reliability when you merge the existing circuit redundancy with the mid-grid intelligence. That formula is elusive because the nature of any given outage is so different from another. What we can say, however, is that after mid-grid intelligence is fully implemented, any given address should have at least a 73% chance of doubling its electric reliability opportunity.

Restoration Timeline

CenterPoint Energy – Smart Grid (SG) Estimated



The graphic shows the actual Ike experience on the orange line, and the blue line represents a hypothetical Ike experience after mid-grid is installed. Obviously the restoration intervals are dramatically shorter for any outage event with mid-grid in place, and in most common events (tree falling, pole hit by car, etc.) most customers would not suffer a noticeable outage at all. What is unique about the hurricane scenario is that the grid operator will often choose to turn down the system near the very height of the storm in order to prevent the system itself from being overwhelmed by thousands of reconfiguration commands at once as the software tries to keep up with a hugely dynamic set of inputs.

A mid-grid strategy with remote switching could begin quickly, and could be fully implemented within five years. The grid and customers will begin to benefit as soon as the first RTU's are deployed, since the old grid and the new grid can operate in parallel. Houston would not have to wait for full deployment to see the benefit of this activity. Logically it would seem that mid-grid technology should be installed first in the parts of town where there is the least amount of undergrounding, and therefore the largest exposure to falling trees. Those areas happen to correspond to the locations where smart meters and their communications networks will be installed first.

Current Status of Intelligent Grid Deployment in Houston Area

Without any preemptive action on this issue, the City of Houston would likely see a deployment of mid-grid technology that would commence about 2012. That cost would be borne by ratepayers on top of the roughly $900 million already being spent on smart meters and their enabling technologies. CenterPoint Energy's existing internal estimate of the schedule for full deployment of the intelligent grid is a minimum of eight years.[15] ***The most emphatic recommendation of the Task Force will be to cut that interval in half, something that CenterPoint Energy is prepared to endorse.***

> In the absence of federal stimulus dollars, an expedited rate case for the intelligent grid devices will be a critical element in shortening the current estimate.

What is fortuitous about this moment is that several things have happened that now make mid-grid intelligence more practical and more commercial to deploy at scale. The first of those milestones is that the aforementioned communications network is under construction; the second is that the devices necessary for mid-grid intelligence are only recently mature enough to be both affordable and commercially reliable.

The Stimulus Opportunity

The third fortuitous circumstance may be that the American Recovery and Reinvestment Act of 2009 (a/k/a Stimulus Package) has $4.5 billion appropriated for just this type of purpose. CenterPoint Energy and the City of Houston are already active in the rule making process for the award of smart grid intelligence dollars. To the extent that a 20 percent local match would be required, it is highly likely that the ongoing smart meter deployment would qualify.

CenterPoint Energy's service area is the ideal situation for stimulus dollars to have an immediate impact because Houston area ratepayers have already made the investment for nearly 73% of electric customers to have multiple feeds, and we have committed to install the basic components of the communications backbone and central grid brain systems. Coupled with that investment in redundancy, federal stimulus dollars could immediately stimulate equipment manufacturing and skilled labor demand, while quickly resulting in a more reliable electric distribution network – more resilient to weather events, and even able to heal itself by rerouting power automatically. Those new jobs and improved electrical infrastructure are among Congress's most explicitly stated stimulus goals.

[15] *As we harden the grid through the use of intelligent devices, we need to remember to confirm that the communications devices imbedded in the grid and at the endpoints (smart meters) have some degree of redundancy and self healing that is independent of the grid itself. The industry standard for that aspect of grid hardening is a wireless protocol known as "Zigbee" which is a technology similar to Bluetooth (but with greater range). Each Zigbee enabled device can seek other Zigbee devices in range and reroute its signal if a primary communications path fails for whatever reason. The batteries inside each Zigbee device have a design capacity for more than three weeks of operation without recharge .*

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With stimulus monies to facilitate that critical incremental investment, the suggested program could begin immediately, with a fully deployed mid-grid network in five years or less. Representatives of the City of Houston, CenterPoint Energy, and the Texas Congressional delegation have all requested federal funds in order to accelerate the development and deployment of this network. If those efforts are successful, widespread power outages would become increasingly rare, and the duration of the outages would be much shorter as a result of having a two-way power and information network in the enhanced distribution network.

TF Recommendation #4: *Intelligent Grid Implementation*

The Task Force recommends that CenterPoint Energy begin deploying mid-grid technology as quickly as possible, and accelerate the planned full deployment across the Houston region. Depending on actual equipment, enhancements and needed redundancies, the total cost of the project should range from $200 to $400 million. Even 12-13 strategically placed RTU's in Houston, would improve reliability for up to 80% of the Inner Loop and Galleria, and could possibly be accomplished before the next hurricane.

With stimulus funding, this program could begin in calendar year 2009, with partial mid-grid improvements being realized in 2010. Without stimulus funding the total net cost for the mid-grid (and its effect on rates) will only be known after the operational savings associated with the mid-grid and other factors (like the cost of debt capital) is determined by CenterPoint Energy and the PUCT.

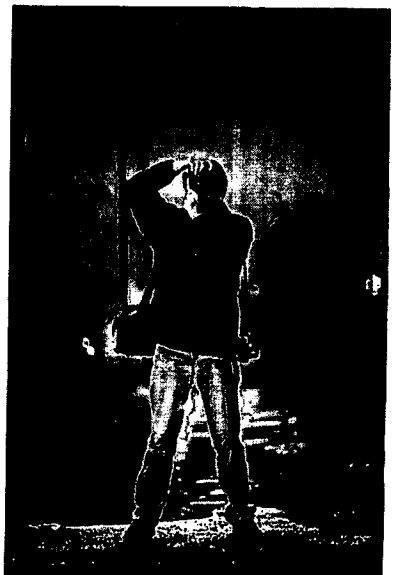
Method of Finance: *The rate base is already absorbing the cost of smart meters and their attendant equipment, so there is limited capacity to impose any additional current cost on ratepayers. However, there should be some operational savings for CenterPoint Energy that mid-grid devices will make possible, and those savings can help finance some of this cost. For any number of reasons, federal stimulus dollars seem perfectly suited to help defray the capital cost of this project.*

Enhanced Public Information Possibilities with a Grid that can Communicate

As smart meters and intelligent grid technologies begin to install across the CenterPoint Energy network, significant attention should be paid to how that centralized information is made available to the public. During Ike's aftermath, CenterPoint Energy made valiant efforts to communicate with the public through zip code based maps that made rough predictions about service restoration intervals. Given the crude information available to the grid operator, that was likely the best choice at the time. Part of the promise of new improved communications from the grid to the grid operator, however, is the ability to share a simplified version of that technical information in order to assist rate payers who are trying to make life choices in a crisis scenario. Therefore, CenterPoint Energy should, as soon as possible, present the City of Houston an enhanced communications plan to share relevant outage-related information with the public and municipal officials, as well as grid monitoring information generally.

In addition to the possibilities for distributing information from the grid to the public, the Task Force believes that commonly available technology can help the public to assist the grid operator in its repair efforts. Houston is full of technically gifted people who can add meaningful citizens' assistance through a CenterPoint Energy administered website that allows the public to upload, to a central website, images of grid damage and associated time and location such that CenterPoint Energy can utilize the "eyes of the community" in grid restoration efforts. The interface should require three things in order to accept an image: i.) identity of the citizen, ii.) a precise time that the image was captured, and iii.) detailed latitude and longitude coordinates such that the image can be plotted automatically by the system.[16]

As previously noted, the Task Force does appreciate that web-based information may be difficult for some to obtain in a power outage. Continued enhancement of wireless broadband capabilities should mitigate that difficulty for those who have access to a smart wireless device. Voice-based interfaces to that information may prove difficult to create and access given the intensely location-specific nature of each inquiry. However, the Greater Harris County 911 Network does have an automated outbound calling system that could be useful. The system is organized by jurisdictional public safety answering points but is able to target physical blocks within the city, and Harris County 911 is willing to design interfaces with CenterPoint Energy that would allow that system to assist in the public information function after a grid outage. A potential limitation of utilizing this system for our purpose is that the database for outbound calling only contains landlines, many of which may be disabled by a power outage. Once that interface is designed, however, other agencies of government will be able to extract information that they need to accomplish their respective missions.



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[16] *There are at least two existing iPhone applications that include time and location stamps for smartphone images: iCaption and Location Recorder*

TF Recommendation #5: *The Task Force recommends that CenterPoint Energy create and maintain a web-based system to make detailed information available to the public as data is received from smart meters and intelligent grid elements. This would obviously include real time information about where outages are occurring – and any forecast that can be made with respect to expected restoration intervals. That site should also include the capability of citizens to upload properly identified photographs to assist the grid operator in diagnosing outage causes or hazardous situations.*

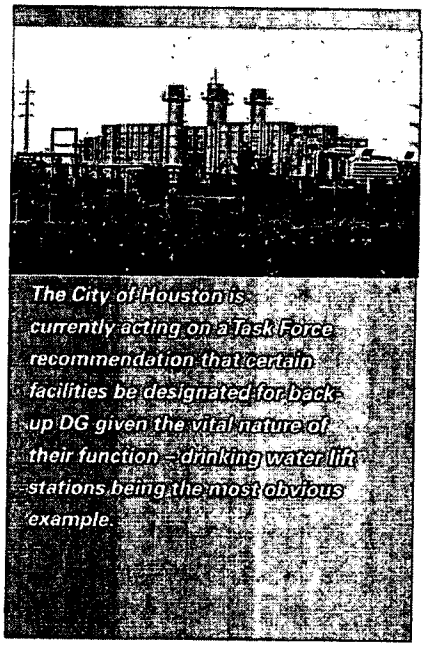
Method of Finance: *Pre-emptive FEMA grant?*

TF Recommendation #6: *That CenterPoint Energy explore the use of a proactive, outbound calling interface utilizing the existing Greater Harris County 911 Network database for use in distributing localized information about an outage and the expected restoration interval.*

Method of Finance: *TBD*

SECTION TWO: SPECIAL USERS OF THE GRID

There are two distinct user-types on the grid that deserve specific preparation assistance and priority restoration: municipal facilities that provide vital shared services (such as water pressure and sewage treatment), and facilities serving vulnerable populations (such as hospitals, elder care homes, and assisted living facilities).[17] In order to serve these facilities it is, of course, necessary to identify them accurately in advance.



The City of Houston is currently acting on a Task Force recommendation that certain facilities be designated for back-up DG given the vital nature of their function – drinking water lift stations being the most obvious example.

For municipal facilities and traffic lights, CenterPoint Energy does maintain a "Do-Not-Disconnect" list, and the City of Houston is currently acting on a Task Force recommendation that certain facilities be designated for back-up DG given the vital nature of their function – drinking water lift stations being the most obvious example. It should be generally understood that there is a hierarchy of facilities in any municipal infrastructure, and that not all lift stations, for example, can be equipped with back up generators without driving water and sewer fees dramatically higher. In addition, there is another option beyond back up DG that is being considered for least one city facility. That option is known as Combined Heat and Power ("CHP"), and it is discussed more fully in the appendix. CHP is used as a primary generation capability where there is a large load, an available fuel source, and some ability to use the thermal energy that is otherwise wasted in any combustion-based generating process. There is a Request For Proposal currently out for the Almeda Simms wastewater treatment plant, and the City would like to consider CHP at other places for heating, cooling or drying operations. While the upfront cost is significant, the efficiency is high for the right location, and each installation has the effect of raising the state's Reserve Margin by effectively removing load demand from the grid.[18]

Universities, hospitals and other institutional grid customers will also want to understand the CHP option in coming years, and the Houston Advanced Research Center has a Department of Energy grant to help drive awareness of CHP's capabilities through outreach.

With respect to vulnerable populations, there are currently two lists maintained by the City of Houston that the Task Force has been able to indentify. The first list is kept by the City of Houston's Code Enforcement of the PDS Division of the Public Works and Engineering Department and is the list of permitted facilities that identifies the broad category of "Institutions" and a category of multi-person (+12) care facilities. The second list is kept by the City of Houston Drinking Water Operations of the Public Utilities Division of PWE and is a list of locations where dialysis machines are in use.

While CenterPoint Energy also maintains a constant effort to catalogue these types of customers, it is quite difficult to maintain complete accuracy in this listing as billing addresses are not often street addresses, and in a deregulated environment it is often impossible for the grid operator to have complete knowledge of the customer's exact function. *The Task Force therefore recommends the creation of a master registry for critical facilities that includes a*

[17] *Traffic lights are also a vital shared service but due to their distributed nature it will be difficult to consider them for DG consideration until they are all converted to LED. At that time a solar with battery solution may be achievable.*

[18] *Reserve Margin is an ERCOT calculation that aggregates total certified generation capacity feeding the grid and forecasted peak demand events.*

Any procedure for self-application that will require applicants to certify their own preparation based on category of user. Those requirements may include a vegetation audit for tall trees occurring near the right-of-way, pre-wiring of the electric service panel to accept mobile generator power, or even on-site DG in some circumstances.

web-based self-enrollment capability. One important purpose for identifying critical facilities (beyond disaster response priority) is for continuing information dissemination and collection. For example, a current inventory of DG at each critical site that included capacity and fuel supply would be enormously helpful. Likewise, a master list of critical facilities allows for education of government and private sector building managers about measures they can take to increase their likelihood of weathering a grid-down event.

The self-enrollment function for master registry should be integrated or linked with the public information portal recommended in the previous section, but the Task Force does acknowledge that security concerns dictate that the master list itself will not be public or searchable. Any procedure for self-application will require applicants to certify their own preparation based on category of user. Those requirements may include a vegetation audit for tall trees occurring near the right-of-way, pre-wiring of the electric service panel to accept mobile generator power, or even on-site DG in some circumstances. In that sense, application for inclusion on the master list may become a readiness exercise in itself.

It is important to distinguish our notion of "vulnerable population" from the "critical care" status offered through the Public Utility Commission of Texas. While certain facilities may qualify for both lists, the PUCT list relates only to potential disconnection for nonpayment, not to reliability or emergency response priority. The PUCT process is a form of economic protection for some consumers, but will not be useful where the actual availability of power is the issue. To the extent the City of Houston and the PUCT want to explore a combination of those lists the Task Force would encourage it, but the PUCT critical care list for our area is at present quite small.

Finally, none of the Task Force recommendations with regard to vulnerable populations is intended to supplant valid evacuation orders from proper authorities.

TF Recommendation #7: *The Task Force recommends that CenterPoint Energy – in consultation with city officials – develop, host and maintain a master critical facilities database that identifies clearly the types of facilities that are meant to be included, along with a straightforward self-enrollment option that grants automatic list status to healthcare facilities licensed by the State of Texas, incarceration facilities licensed or operated by Texas Department of Criminal Justice, Harris County or other legitimate authority. Non licensed facilities would petition for enrollment based on published criteria. It is important to note that mere identification of critical facilities does not guarantee that grid power would be restored any sooner, but perhaps a generator-distribution priority could be established. Inclusion on the list would be conditioned on the pre-wiring of the facilities' electrical panel to be able to accept generator power.*

Method of Finance: *No Meaningful Incremental Cost*

TF Recommendation #8: *The Task Force recommends that the COH identify its most critical municipal locations (law enforcement, communications, municipal water, sewer and others, and to the extent that those locations do not already have back up generation or other DG, install that capacity.*

Method of Finance: *Municipal water and sewer fees and general revenue.*

SECTION THREE: PERSONAL ELECTRIC RELIABILITY PREPARATION

Houstonians aren't victims. Within hours of Ike's passing, the growl of private chainsaws clearing public streets became a common sound. Neighbors were out helping neighbors, marveling at nature's power but generally counting their blessings and getting about the clean up chore.

Houstonians aren't victims. Within hours of Ike's passing, the growl of private chainsaws clearing public streets became a common sound. Neighbors were out helping neighbors, marveling at nature's power but generally counting their blessings and getting about the clean up chore. Not surprisingly, many homeowners chose to self-generate during the service outage, generally through small gasoline or diesel generators. Spontaneous, low-tech micro-grids appeared as neighbors snaked extension cords over back fences and across lawns, highlighting the fact that the availability of even a modest supply of power can assist significantly in easing the impact of power outages. Just as Houston is renowned for helping others, Houston helped itself.

Whether Houston is the most generous, most capable city on Earth is for others to judge, but the more we believe it, the truer it will become. Part of that vision of ourselves involves personal empowerment and the self determination that comes with hardening our homes and businesses for electric reliability just as we harden the grid itself.

This final section of the report will suggest ways that homeowners and small businesses can – with a little help from various directions – prepare their environment for a little personal energy independence, if they ever need it again. We will also demonstrate that some of these investments can start to pay collateral benefits even if the grid never goes down again.

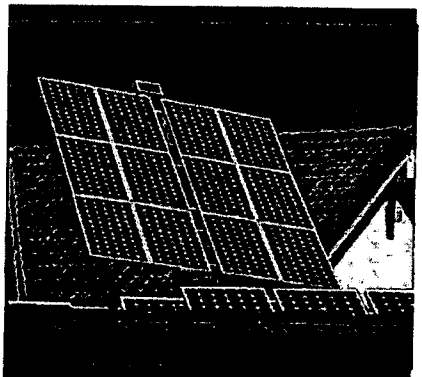
A Portal for Centralized Reliability Information

Just as the City of Houston created a consumer friendly website for comparative health insurance purchasing and retail electric purchasing, the Task Force recommends a central portal for assisting citizens who wish to maximize their chance to maintain some measure of electric reliability in an outage. This portal could combine information about domestic vegetation management and help to calculate and combine the available incentives for personal power investment. This information resource could simplify what can be a complicated technical and financial equation.[19] If this website could be combined with the earlier recommendation for a self-enrollment option for the master list of special users, as well as the interface to consumer information flowing out of the intelligent grid, it could be a powerful tool for all citizens. There may be a possibility to enlist one of the local universities to create an interdisciplinary seminar (including technology, design, marketing and finance students) that could accomplish large parts of this consumer portal through a contract with the City.

[19] *Whenever connecting any DG device to existing electrical wiring it is very important not to "back feed" the grid because linemen working on an outage could be injured by alien energy forms inadvertently energizing a line that has otherwise been isolated for purposes of repair.*

Common Incentives for Personal Investment in DG

Congress has recently renewed (and uncapped) the Federal Tax Credit for investment in solar DG, a common, renewable form of DG in many parts of the world. Another common solar DG incentive in major cities across the world is some sort of solar panel installation rebate. The City of Houston is working on such a rebate, and the Federal Government has recently re-authorized its tax credit for solar installation. The Task Force has already issued an interim recommendation that City Council craft at least a pilot program here that would provide some form of solar rebate. With respect to solar DG as a reliability resource it needs to be noted that solar is an intermittent resource by definition. If the sun is not shining on a solar panel it will obviously not provide power; it must be married with a battery or some type of storage device before it can be considered "firm" DG.



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Net metering (discussed in more detail below) can be another incentive for households to install supplemental DG. While net metering will rarely be a positive revenue generator for a homeowner, if it can be made into a straightforward process as ratepayers receive smart meters, it can lower everyday power bills and therefore help justify the investment that any supplemental DG requires. The same can be said of shedable load payments (also discussed in more detail below).

Wind power is another intermittent DG option, but is not generally viable in the Houston area.

Electric Vehicles as a DG Option

Hybrid vehicles are becoming an increasingly popular choice for many drivers. Those vehicles use a gasoline engine to charge a large battery, and simple aftermarket equipment described below can convert that power into useful household electricity. Plug-In Hybrid Vehicles ("PIHV") and electric cars are also emerging as a viable transportation option and are easier to convert to useful household power than regular hybrid vehicles because they already contain an inverter capability to convert alternating current (AC) to direct current (DC). So long as those inverters have "two way" capabilities, these vehicles can discharge power from their battery and can therefore be pressed into service for reliability devices when necessary. No one should conclude that any electric vehicle will be able to power an entire house, it will be a very limited – but potentially lifesaving – DG option.

Technical Requirements for Citizens Who Wish to Invest in DG

The use of residential supplemental DG generally requires some preparation, such as wiring of a home to accept generator or DG input between the meter and the service panel. That input must be isolated from the grid by an automatic transfer switch that will disconnect from the grid when there is a loss of upstream voltage. If direct current is to be used, as in the

case of drawing power from the battery of a hybrid vehicle, a simple power inverter would also be necessary to convert direct current into alternating current that would be useful in the household. These inverters are already present in a number on non-hybrid trucks that have factory-installed AC power plugs. The aftermarket versions are classified by wattage and range from simple cigarette lighter interfaces for low wattage applications and $4 K high wattage inverters for certain hybrid vehicles.[20] For intermittent resources like solar PV there would need to be a battery to act as a buffer to smooth out the power flow. A civic initiative that would inform homeowners (and perhaps even pre-negotiate a packaged price with private participating electricians) could help people to install the simple electrical interfaces.

Local Government Initiatives

As discussed in Section One of this report, during 2008, the City of Houston along with other stakeholders, including Retail Electric Providers, recently settled with CenterPoint Energy to support the roll out of advanced meters to Houston homeowners and businesses. This is an important first step in enabling the electric grid to manage and create a market place for distributed generation. There will be 150,000 meters deployed in 2009, and 500,000 meters deployed annually until 2013 when all 2.2 million customers will have advanced meters at their locations.

The roll-out of advanced meters is an important step to enable the infrastructure for DG; however, there are more things the City and stakeholders can do to accelerate the adoption of DG in the community. This section outlines policy initiatives and areas of coordination required to remove barriers and encourage the deployment of DG solutions.

The City of Houston can help citizens implement small scale DG solutions in the following ways:

Municipal DG Financing: One option for the City of Houston for accelerating adoption of DG is a structure called municipal financing. Under this scheme, a homeowner borrows from the City to pay the up-front cost of installing DG (solar PV, micro-wind turbine or fuel cell typically) on his/her home. The "micro-mortgage" is secured by property taxes; the obligation to pay the loan attaches to the property as with any other lien.[21] If the house is sold before the loan is paid out, the new owner inherits the obligation. This financing structure works for both parties. The homeowner avoids the large up-front cost of installing a solar or other DG system, while reaping the benefit of reduced electricity charges immediately. The City achieves its public policy goals by sharing its low cost-of-capital to foster DG investment by making loans secured by property taxes, a relatively safe bet. Municipal financing of solar PV started in California at Berkeley, has been adopted in Palm Desert, and is being introduced in a dozen other states. In Palm Desert, the financing is structured as a 20-year loan with a 7% interest rate. The city tapped into $7.5 million of its reserves to fund the program and quickly sold out due to consumer interest.

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[20] *In the case of Toyota specifically, the proper use of an inverter does not void the manufacturer's warranty.*

[21] *State law changes may be necessary to enable this incentive.*

Code Enforcement Training and Process Enhancements: The City can take affirmative steps to ensure that Code Enforcement personnel are knowledgeable and processes are efficient in permitting DG solutions. Whether it is roof-top PV or natural gas micro-turbines, City officials need to be trained and capable of fast response when addressing structural, electrical, and environmental issues related to the deployment of DG. The City has taken a leadership role in Green Building practices and Code Enforcement has recently upgraded the energy code to IECC 2006 plus 15% energy efficiency for residential and to ASHRAE 90.1 for commercial buildings in an effort to "green the codes". The City can show the same leadership to upgrade Code Enforcement so that when a citizen wants to implement DG, the code permitting process is quick and straightforward.

Removing Barriers with Homeowners Associations: Many citizens that are interested in installing solar systems find their Home Owners Associations (HOAs) do not allow their deployment. Mayor White sent a letter to all HOAs in the region on November 21, 2008 urging them to review their practices and make changes to allow solar systems In addition, there is a House Bill introduced during the current legislative session that allows HOAs to regulate, but not deny, the homeowner's deployment of a solar system. The City should work with stakeholders including DG installers, homeowner associations, and others to develop model guidelines for solar and other forms of DG deployment in Houston neighborhoods.

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Net Metering – Private Power Feeding the Public Grid

The Federal Energy Policy Act of 2005 encourages each state to create standards for net metering service to any electric consumer served by an electric utility. The term "net metering service" means service to an electric consumer under which electricity generated by that consumer can offset electric energy provided by the electric utility. While net metering will rarely be a positive revenue generator for a homeowner, if it can be made into a straightforward process as ratepayers receive smart meters, it can lower everyday power bills and therefore help justify the investment that any supplemental DG requires.

Some form of net metering is now available in forty one states, and Texas has had a statute that authorizes net metering since 2005, PUCT Substantive Rules Sec. 23.66 (f) (4). The PUCT has implemented net metering through a stakeholder rulemaking process, the latest of which concluded in April 2008. The State of Texas, pursuant to the Public Utility Regulatory Act 39.916 and PUC Rule 25.213 requires the utility to separately measure both inflow and outflow of power to the homeowner. The rule does not allow the use of roll-back meters that turn in both directions – roll-back meters "net" the power consumed for a resident, but cannot separately capture the amount of power that has flowed in or out of the meter specifically.

The result of this requirement is that CenterPoint Energy must install either a smart meter, or a dual channel meter, to measure power flowing into and out of the home before a customer can practically qualify for net metering. The roll out of those meters will take place over a period of years.

We should also be realistic about how much personal DG investment net metering – on its own – might generate; it is rather a relatively small aspect of the several factors that will spur investment in DG.

Beyond the metering issue – which is important to grid operators for the measurement of "line charge" as electrons flow in both directions – are the pricing and counterparty issue – or what is the price and who is the buyer of consumer generated power? In a December 18, 2008 PUCT open meeting, the PUCT states "The Commission does not have the authority to prescribe a price for this energy or require a REP to buy it". Accordingly, Texas recently received a "worst practices" designation from a renewable energy industry organization called the Network for New Energy Choices (Freeing the Grid 2008) because the Texas version of "net metering" leaves it up to the DG owner to negotiate individually the sale of the excess output to his or her Retail Electric Provider ("REP").

Despite the fact that there is a minimal number of customers who have installed DG with enough capacity that there is excess energy to deliver back to the grid, at least two REP's have implemented programs to buy back this power. Other REP's have also announced similar plans in development. It is expected that even more REP's will develop products that incorporate buyback of excess DG power after ERCOT implements settlement of residential and small commercial customers on 15 minute increments.

Stakeholders including the City, CenterPoint Energy, the REPs and others should continue to monitor these buyback programs as they develop in the competitive marketplace.

The legislature may need to enable other counterparties such as ERCOT, or even perhaps the City of Houston, that DG owners may look to as the 'buyer of last resort' for excess generation supplied to the grid. For example, ERCOT currently purchases ancillary services called "spinning reserves" to balance the system and they make capacity payments to those providing the services. That framework may be expandable to include net metering purchases.

We should also be realistic about how much personal DG investment net metering – on its own – might generate; it is rather a relatively small aspect of the several factors that will spur investment in DG. Even Austin Energy, the integrated municipal electric utility that offers the state's most aggressive rebate and excess output purchase program has fewer than 350 homes participating. Likewise Bluebonnet Electric Cooperative in suburban/rural east Austin, despite a DG program praised by the industry, has only a handful of takers for their published tariff. CenterPoint Energy, who follows the PUCT prescribed program for DG, has only a few customers behind their system selling their excess output – primarily with industrial users. Based on these observed results, there is no reason to think that net metering in and of itself will incentivize widespread installation of DG.

The Task Force issued an interim recommendation in December of 2008 that the existing Texas Net Metering statute be clarified and standardized so that consumers can realistically participate in net metering. A quick review of the experience and current issues with respect to net metering in Texas are as follows:

- Current Local Law: CenterPoint Energy's tariffs related to DG are right out of the PUCT Substantive rules sections 25.211-213. Customer metering schemes are divided into two categories. For less than 50 kW customers can choose either a single meter installation that measures in-flows only (i.e., exports to the grid are not measured) or for a small fee a dual meter installation that measures both in-flow and out-flows. For 50 kW and higher, metering is done on a 15-minute interval basis, which records both in-flows and out-flows. Out-flows to the grid are not purchased by CenterPoint Energy. The DG owner must negotiate with his REP the terms and conditions of the sale of such out-flows although REPs in Texas are under no obligation to purchase.

- Bluebonnet Electric Coop's tariff divides users into less-than and greater-than 10 kW and mandates a bi-directional meter for the smaller category. At the end of a year, if the small DG on the whole has generated more energy than consumed, then Bluebonnet will buy the excess at the average price Bluebonnet paid for wholesale power during such year. For DG greater than 10 kW, Bluebonnet settles net power exports to the grid on a monthly basis. If the DG is a "Qualifying Facility" under the federal PURPA rules, then Bluebonnet pays at its average wholesale power cost. Non-Qualifying Facilities are paid at a negotiated rate.

- Austin Energy's net metering procedures provide for the customer and AE to tailor the metering to the customer's installation so that both inflows and outflows are measured. AE pays a price equal to its fuel costs per kWh (currently 3.6¢/kWh) for the net outflows from the DG customer.

- In the case of Austin Energy, above net metering is somewhat easier than in Houston because the power generator, the grid operator and the retail provider are all one entity.[21] Key net metering issue: In the Houston area, this is more challenging where the generation, the grid owner, and the retail provider are legally distinct entities due to Texas's partially deregulated environment. As ERCOT can provide every 15-minute settlement information, the competitive market could turn that limitation into an asset.

In conclusion, despite the Network for New Energy Choices criticisms that in Texas "there is no net metering; there is simply metering" we do in fact have pockets of net metering. But it is a clunky and primitive sort of first generation net metering, that the Legislature and the PUCT can improve it quickly by dealing with two fundamental issues – who will pay (or credit) the

[21] *In the case of Bluebonnet Electric they own the grid and the retail contracts, but not the actual generation.*

DG owner for excess or supplemental generation, and what the pricing mechanism will be. The legislation should also clarify that a residential or small commercial customer that has DG is not required to register as a power generation company in order to sell power back to the grid.

The use of roll back vs. smart meters is a transitional issue that should be solvable if the first two are resolved.

While not an option for most homeowners, there is a trend towards the use of direct current lighting systems (as opposed to alternating current) in commercial buildings. While not strictly an investment in reliability, DC light grids can encourage DG investment because they emit less heat, and are more flexible in operation – saving cooling costs and remodeling expense.

Residential Shedable Load Programs

CenterPoint Energy currently offers a pilot program that makes a market-based payment to customers using their grid who can surrender load during grid emergencies such as load imbalances, grid congestion, peak demand or brownout events. Owners of DG facilities can benefit from and participate in this program by switching a portion of their electric load to their on-site DG equipment. Currently as a pilot, program participation is limited, but given the success over the past two years the Task Force recommends expansion of the shedable load program to homeowners. ERCOT has a similar program that has also had a measure of success called Load Acting as a resource for customers connected to the transmission system. Participation in similar shedable load programs by homeowners could free up capital for investment in back up DG.

DC Lighting Grids in Office Buildings

While not an option for most homeowners, there is a trend towards the use of direct current lighting systems (as opposed to alternating current) in commercial buildings. While not strictly an investment in reliability, DC light grids can encourage DG investment because they emit less heat, and are more flexible in operation – saving cooling costs and remodeling expense. Solar PV is a DG technology that creates DC , so the ability to use that power in its original form (without inverting to AC) is a natural companion to DC lighting solutions.

TF Recommendation #9: *The Task Force recommends that the City of Houston establish a citizen-friendly interface where all of the financial and environmental benefits of various conceivable DG investments are expressed. This should include Federal Tax Credits, any local incentives, available net metering benefits, any available shedable load payments, any avoided carbon emissions and other value propositions beyond electric reliability. We would also challenge the local schools to develop a middle school module that students could take home so that the entire family can participate in an "Electricity Fitness" assessment using this online decision tree for reliability.*

Method of Finance: *City of Houston Generator Permitting Fees or General Funds*

TF Recommendation #10: *The Task Force recommends that the City of Houston establish a local Solar Rebate Program consistent with other major American cities who have created such a DG incentive.*

Method of Finance: *Depends on scale of the program*

TF Recommendation #11: *The Task Force recommends that the City of Houston consider the options listed above to make personal DG investment an affordable, regulatory-straightforward civic priority.*

TF Recommendation #12: *The Task Force recommends that the Texas State Legislature establish a clarified Net Metering policy that is accessible to citizens in the Houston area.*

Method of Finance: *Not meaningful unless the City of Houston decides to act as purchasing counterparty.*

TF Recommendation #13: *The Task Force recommends that CenterPoint Energy and ERCOT consider whether current shedable load programs might practically be extended to consumers as smart meters are installed across the system.*

Method of Finance: *No Meaningful Incremental Cost*

SUMMARIZED RECOMMENDATIONS OF THE TASK FORCE:

TF Recommendation #1: *Selective undergrounding should only be considered where there is a proneness to failure or a cluster of critical users, and pre-emptive FEMA grant dollars (or other external capital sources) are available. Selective undergrounding provides a benefit to a targeted group of users, and therefore is poorly suited for a broad-based funding source such as the rate base generally. The Task Force does recommend, however, that whenever any agency or private entity opens the street beneath aerial lines – for example the COH as part of a capital improvement project ("CIP"), or Metro or a Tax Increment Refinancing Zone ("TIRZ") or a local Management District – that the applicant for a permit show why they should not be required to bury power distribution. In other words, put the presumption in favor of undergrounding and let the applicant rebut it as inefficient in their particular circumstance. Even when immediate undergrounding is not adviseable, approved changes to underground installations should require identification of a proposed linear route of sufficient width for future underground electric duct banks.*

Methods of Finance:

- *New possible sources for funding; FEMA?*
- *Federal Infrastructure Stimulus package?*
- *Tax Increment Refinancing Zones ("TIRZ")*
- *Include in city capital project budget*

TF Recommendation #2: *That CenterPoint Energy should modify the "Right Tree Right Place" policy to allow for structural hardiness of species – rather than strictly height. The Task Force notes that all available evidence indicates that Live Oaks and Magnolias failed in much lesser percentages than did pine or softer oak species. Ash, Hackberry and Maples also seemed much more vulnerable to toppling. Local media outlets should act as full partners in this promoting the modified policy. More regular and aggressive publicity concerning that revised policy is imperative.*

Method of Finance: *No Meaningful Incremental Cost*

TF Recommendation #3: *That CenterPoint Energy re-examine its Distribution Line policy to prefer structural pruning and double trunk mitigation pruning techniques over directional pruning for existing trees that extend above the height of Distribution Lines.*

Method of Finance: *No Meaningful Incremental Cost*

TF Recommendation #4: *The Task Force recommends that CenterPoint Energy begin deploying mid-grid technology as quickly as possible, and accelerate the planned full deployment across the Houston region. Depending on actual equipment, enhancements and needed redundancies, the total cost of the project should range from $200 to $400 million. Even 12-13 strategically placed RTU's in Houston, would improve reliability for up to 80% of the Inner Loop and Galleria, and could possibly be accomplished before the next hurricane.*

With stimulus funding, this program could begin in calendar year 2009, with partial mid-grid improvements being realized in 2010. Without stimulus funding the total net cost for the mid-grid (and its effect on rates) will only be known after the operational savings associated with the mid-grid and other factors (like the cost of debt capital) is determined by CenterPoint Energy and the PUCT.

Method of Finance: *The rate base is already absorbing the cost of smart meters and their attendant equipment, so there is limited capacity to impose an additional current cost on ratepayers. However, there should be some operational savings for CenterPoint Energy that mid-grid devices will make possible, and those savings can help finance some of this cost. For any number of reasons, federal stimulus dollars seem perfectly suited to help defray the capital cost of this project.*

TF Recommendation #5: *The Task Force recommends that CenterPoint Energy create and maintain a web-based system to make detailed information available to the public as data is received from smart meters and intelligent grid elements. This would obviously include real time information about where outages are occurring – and any forecast that can be made with respect to expected restoration intervals. That site should also include the capability of citizens to upload properly identified photographs to assist the grid operator in diagnosing outage causes or hazardous situations.*
Method of Finance: *Pre-emptive FEMA grant?*

TF Recommendation #6: *That CenterPoint Energy explore the use of a proactive, outbound calling interface utilizing the existing Greater Harris County 911 Network database for use in distributing localized information about an outage and the expected restoration interval.*
Method of Finance: *TBD*

TF Recommendation #7: *The Task Force recommends that CenterPoint Energy – in consultation with city officials – develop, host and maintain a master critical facilities database that identifies clearly the types of facilities that are meant to be included, along with a straightforward self-enrollment option that grants automatic list status to healthcare facilities licensed by the State of Texas, incarceration facilities licensed or operated by Texas Department of Criminal Justice, Harris County or other legitimate authority. Non licensed facilities would petition for enrollment based on published criteria. It is important to note that mere identification of critical facilities does not guarantee that grid power would be restored any sooner, but perhaps a generator-distribution priority could be established. Inclusion on the list would be conditioned on the pre-wiring of the facilities' electrical panel to be able to accept generator power.*
Method of Finance: *No meaningful incremental cost*

TF Recommendation #8: *The Task Force recommends that the COH indentify its most critical municipal locations (law enforcement , communications, municipal water, sewer and others), and to the extent that those locations do not already have back up generation or other DG, install that capacity.*
Method of Finance: *Municipal water and sewer fees and general revenue.*

TF Recommendation #9: *The Task Force recommends that the City of Houston establish a citizen-friendly interface where all of the financial and environmental benefits of various conceivable DG investments are expressed. This should include Federal Tax Credits, any local incentives, available net metering benefits, any available shedable load payments, any avoided carbon emissions and other value propositions beyond electric reliability. We would also challenge the local schools to develop a middle school module that students could take home so that the entire family can participate in an "Electricity Fitness" assessment using this online decision tree for reliability.*
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TF Recommendation #10: *The Task Force recommends that the City of Houston establish a local Solar Rebate Program consistent with other major American cities who have created such a DG incentive.*
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MAYOR'S TASK FORCE REPORT:

Electric Service Reliability in the Houston Region

APPENDIX

This Appendix is provided to document the research the Task Force conducted in reaching the conclusions and recommendations in Section Three of this report.

Table of Contents for Appendix

APPENDIX : Distributed Generation – A Deeper Dive

This Appendix is provided to document the research the Task Force conducted in reaching the conclusions and recommendations in Section Three of this report.

Introduction

Distributed generation (DG) is broadly defined as power generation located close to energy loads.[1] There are other, more narrow definitions of DG that say it is only small generators, or define it as renewable power generation, or as power generation that is connected to the low voltage portion of the grid (the "mid-grid"). For the purposes of this report, we adopt the relatively broad definition of DG as electric power sources that are connected directly to the mid-grid or at the customer side of the meter. In that definition, we include both combustion-based and renewables-based generation sources.

The concept of DG has many potential benefits for transmission and distribution companies like CenterPoint Energy, residential consumers, and commercial and industrial facilities. For CenterPoint Energy, DG could represent added capacity in cases where new transmission or distribution development is constrained or by providing peak load shedding. For the homeowner, DG can provide security of electric supply given the current state of the technology and one day will offer an economic alternative to buying power from the grid. For commercial and industrial consumers, CHP forms of DG are already providing both security and economy in electric supply through reduced fuel costs for steam and hot water loads, increased power reliability, decreased exposure to energy price volatility, and, in a few cases, revenues from electricity sales to the

[1] *Maribu, K.M., 2006, Modeling the Economics and Adoption of Distributed Power Generation. Doctoral Thesis, Norwegian University of Science and Technology. Retrieved March 17, 2009 from http://www.diva-portal.org/diva/getDocument?urn_nbn_no_ntnu_diva-755-1fulltext.pdf.*

grid. Some forms of DG also hold the promise of lowering the carbon footprint of the DG owner by incorporating technologies such as solar PV and micro-wind generators, and by utilizing wasted heat in CHP applications.

Notwithstanding the potential benefits of DG, the current state of technology and the state of regulations present some significant challenges. First, except in the case of the larger commercial and industrial CHP applications, DG is more costly than power purchased from the grid Second, for transmission and distribution companies like CenterPoint Energy who are compensated based on power that flows through the meters, DG represents lost revenue unless rate structures are adjusted to compensate. This is a problem because CenterPoint Energy's grid serves as a necessary backup supply for DG installations and therefore must be funded, however the cost of this stand-by service negatively affects the payout of DG investments. Stand-by service is especially needed for renewable DG which by its nature is intermittent and therefore will need to lean on the grid until energy storage technology makes significant advances. A fourth disadvantage is that we have traditionally not wired our homes and businesses with on-site generation in mind. This has led to complicated but important rules that govern interconnection of DG to protect the safety of our buildings as well as CenterPoint Energy's grid and workers. Fifth, in the deregulated Texas electric market there are no rules mandating that someone buy the excess power generated by DG leaving DG owners with no market for the excess power. And finally, combustion DG technologies – ones that burn fossil fuels – shift the emission of ozone creating air pollutants from rural power generation plants to populated urban areas.

In this appendix we discuss the types of DG available and recommend actions that will promote the creation of redundancy in power delivery choices, and therefore resilience to power failure, in the electrical grid in the Houston-Galveston area. Such widely dispersed redundancy can provide islands of power in the aftermath of a major catastrophe where our current centralized power delivery system is vulnerable to failure.

Review of DG Technologies and Applications

There are many types of DG currently deployed in the Houston area for various reasons. In order to understand the differences, we will briefly segment those resources by technology type and application here.

DG technology types can be broadly divided into two categories: combustion DG technologies and renewable DG technologies. Combustion DG technologies use fuel combustion to drive mechanical processes that generate electrical power such as reciprocating engines, gas turbines, and microturbines. Fuel cells, although not a combustion driven technology, are often grouped along with combustion DG technologies because their energy source is generally natural gas. There is a sub category of combustion DG we have previously mentioned called CHP that captures the waste heat byproduct of combustion in an engine or turbine, which can then be used for heating needs. An important characteristic of combustion DG technologies is that they are "dispatchable" which means they can be operated anytime there is a demand for electricity and can be ramped up and down to match electric load.

Renewable DG technologies are driven by energy sources other than fossil fuels and include technologies such as solar-thermal, solar photovoltaic (PV), wind, and hydropower. In the Houston region it is widely accepted that PV and micro-wind are the technologies most appropriate for our climate and topography Renewable DG technologies are generally not considered dispatchable in that they make power when the sun shines or the wind blows which may or may not coincide with when people use power. Given their current high installation cost and their intermittent nature,

most renewable DG technologies are used to supplement grid-supplied baseload power. As better energy storage technologies emerge, renewable energy will move more into the dispatchable category.

The economic trade-off between the two technologies are that renewable DG has the advantage of low (zero in most cases) fuel costs over the operating lifetime, but currently has high up-front costs and long pay-out times. Combustion DG conversely has a relatively low upfront cost, but fuel and emissions costs are subject to wide variations and can be very high at times. The CHP technologies (described more fully below) although usually based on combustion technology, go a long way toward bridging the gap between renewable and combustion DG.

Another way to analyze the DG market is by where the technology is applied:

- **Industrial Primary Service** – There are a number of industrial facilities in the Houston region that have deployed the CHP form of DG as primary or "baseload" power (sometimes referred to as "cogen"). Greater Houston has approximately 11,000 megawatts of installed CHP DG, more than any other metro area in the country, owing to the large industrial capacity in the region and the corresponding appetite for the dual products of power and heat (steam) produced by CHP applications. These DG facilities run round the clock and "earn their keep" economically because on the whole they make power and steam for less than it would cost to buy power from the grid and fire a boiler to make steam. These facilities represent significant electrical generation resources that for the most part do not contribute to grid reliability because they are typically sized smaller than the owner's load. Only a handful of the largest of these installations export power to the grid and those are located in the same general vicinity as central power stations.

- **Residential / Commercial / Municipal Supplemental Service** – Most of the DG installations in the Houston area (in terms of number of installations) have an electrical generating capacity that is smaller than the electric load at the facility or house where it is connected. These types of installations provide supplemental service off-setting a portion of the host's purchases from the grid. When the power grid is unavailable and the proper switching equipment installed, DG installations can meet important needs such as residential refrigeration, battery charging, or life safety systems, but are typically not large enough to provide for continuous duty or full facility operation.

- **Residential and Commercial Backup Service** - During the outages following Hurricane Rita in 2005 and Ike, many homeowners purchased small generators for personal use. Residential backup DG technologies are most commonly combustion, using gasoline, natural gas, or diesel fuel and configured to supply power to specified household loads, such as air conditioning, refrigeration, and lighting. Backup DG for commercial facilities is typically designed to support critical functions (medical, telecommunications, public water systems, etc.) in commercial and municipal facilities. Significant planning and design is needed to configure commercial electric systems to run critical building functions only when the DG is operating. Both commercial and residential backup DG have limitations during extended outages such as that experienced after Hurricane Ike due to limited fuel storage and the ability to replenish fuel supplies during emergency conditions. A 2003 estimate of existing commercial back-up generation in our area is 24,000 units and 7,000 megawatts of generating capacity, but is almost certain to have increased after Hurricanes Rita and Ike.

The table below summarizes the main technologies used for DG service. Each technology has unique attributes that may lend it to better serving specific types of loads, customer needs, or site requirements.

Table 1. Primary Distributed Generation Technologies

Technology	Purpose	Energy source(s)	Primary location(s)	Size Range
Internal Combustion engine	Primary	Natural gas	Residential	1 kW – 10 kW
Fuel cell	Primary	Natural gas	Commercial	200 kW – 2000 kW
IC engine and gas micro-turbine	Primary	Natural gas	Commercial & Light Industrial	200 kW – 10 MW
Gas turbine	Primary	Natural gas	Heavy Industrial & Process Plants	10 MW – 500 MW
IC engine	Supplemental	Gasoline	Residential	1 kW – 2 kW
IC engine	Supplemental	Natural gas	Residential	5 kW – 10 kW
Hybrid Electric Vehicle	Supplemental	Gas / Electric	Residential	5 kW – 10 kW
Solar Thermal/Steam Turbine	Supplemental	Solar radiation	Residential	5 kW - 50 kW
Solar Photovoltaic cells	Supplemental	Solar radiation	Residential and commercial	1 kW – 100 kW
Fuel cell	Supplemental	Natural gas	Residential	1 kW – 10 kW
IC engine	Back up	Diesel	Commercial and Municipal	100 kW – 2000 kW

Economics and Technical Readiness of DG technologies

When developing policy guidance on accelerating DG, it is important to note that all DG is not equal in terms of cost and technical readiness. Of the combustion technologies, reciprocating engines and gas turbines are the well established, highly reliable, incumbents for continuous and peak-shaving applications and for operating in CHP mode in industrial and commercial building settings. Microturbines are a less-mature technology, with higher turnkey installation costs at greater than $1000/kW, and are currently less competitive on pure economics Natural gas-fueled microturbines have the advantage, however, of being cleaner than competing combustion technologies, with significantly lower nitrogen oxide emissions than reciprocating engines and gas turbines, and they are comparatively quiet and reliable For these attributes, microturbines will increasingly be deployed for CHP in commercial buildings and light industrial applications. Fuel cell is a technology with a bright future but a very small installed base due to high turnkey installation costs. Summit Blue (2008) provides capital cost ranges as follows: For industrial gas turbines (e.g. approaching 50 MW), capital costs are about $1,000/kW; costs are higher for small-scale gas turbines (e.g., <1 MW), at up to $5,000/kW. Reciprocating engines of all sizes cost generally about $1,000/kW, while microturbines cost about $2,000 - $3,000/kW. Fuel cells are most expensive, with a capital cost of greater than $5,000/kW.

Renewable DG

Of the renewable DG technologies, solar PV and micro-wind are considered as most applicable in the Houston area The cost of installing solar PV systems has declined in the past decade, but remains comparatively high. Installed costs have dropped from about $10,500/kW in 1998 to about $7,600/kW in 2007, a trend related primarily to "balance of systems" reductions as market incentives have created economies of scale. Nonetheless, the high cost of solar PV relative to competing grid power or combustion DG systems that employ CHP, will remain a powerful disincentive for its widespread adoption A discounted net present value analysis conducted at the University of California Energy Institute, looking at over 25,000 solar PV installations, concluded that solar PV installation costs are three to four times the value of electricity that the installations will produce in their lifetimes. The economics remained negative, although much less so, when factoring in likely costs for greenhouse gases under a carbon pricing scenario.[2]

There are reasons, however, not to dismiss future penetration of solar PV into the national and regional market. Research & development continues to increase the efficiency with which solar energy is converted to electrical power using photovoltaics; a team at the National Renewable Energy Lab has achieved 40% conversion efficiency, far exceeding the approximate 20% efficiency of commercial systems.[3] New materials are being developed to substitute for silicon-based cells, which opens up the promise of lower efficiency – but lower cost – thin films that can be printed onto a substrate that is not silicon-based 1366 Technologies, a spin-out from Massachusetts Institute of Technology, has innovated new design and fabrication approaches that will use non-exotic materials, and has adopted as its goal the manufacture of a multicrystalline silicon-based solar cell that can be mass-produced for $1/watt by 2013. Such a price would translate to an installed cost of about $2/watt, making solar PV cost competitive with coal-fired power generation. Nanosolar, a leader in thin film solar PV, has already developed a printing method that can be mass-produced for under $1/watt. The solar PV industry has grown by 30% annually for the past decade, and seems likely to continue apace at a time when geopolitical and climate concerns favor renewable technologies in US energy policy.

Despite cost disadvantages, renewable DG technologies have a bundle of attributes that will be considered favorably by consumers. They have low operating costs and free fuel. They emit no harmful pollutants or greenhouse gasses during operation. They have a strong association among consumers with a cleaner environment and a lessened dependence on foreign fuel sources. Assuming technology advances and the "learning curve" cost reductions that come with scale, it is the consideration of this Task Force that renewable DG - solar PV in particular – may well be economically viable for distributed deployment in the Houston area during the time-frame envisioned for other initiatives described in this report are deployed, namely CenterPoint Energy's intelligent grid. It is therefore the recommendation that Houston area planners not discount renewable DG as a statistically insignificant factor for increasing grid reliability, but rather as an emerging technology with significant future potential to increase the resilience of the grid following catastrophic weather events.

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[2]University of California, Berkeley (2008, February 22). Cloudy Outlook for Solar Panels. Costs Substantially Eclipse Benefits, Study Shows. ScienceDaily Retrieved March 17, 2009, from http://www.sciencedily.com/releases/2008/02/080220224901.htm

[3]American Chemical Society (2008, November 9). Record High Performance With New Solar Cells ScienceDaily Retrieved March 18, 2009, from http://www.sciencedaily.com-/releases/2008/11/081103124224.htm

Also, governmental entities have sought to redress this cost situation by creating financial incentives that will level the playing field in favor of low carbon energy generation technologies. These financial tools include rebate programs, municipal financing, net metering, and sales of excess energy to REPs (see Section Three of this report for more information on these) as well as Tax credits and Feed-in tariffs:

- **Tax credits.** The US Congress recently renewed a tax credit equal to 30% of the cost on residential solar PV installations. This tax credit will be in force until 2016 and may be renewed

- **Feed-in tariffs.** Feed-in tariffs are essentially mandates that require utilities to purchase renewable DG power for above market rates, and to guarantee these payments for long periods, often 15 to 25 years. Feed-in tariffs are credited with accelerating solar PV penetration in Germany, which pays up to four times the cost of coal-fired power generation for rooftop PV and has five times the number of installed panels as the US. In the US, Gainesville, FL has become the first US city to institute a feed-in tariff, promising to pay twice the standard utility rate guaranteed for 20 years. Hawaii, California, Oregon and Washington, as well as the City of Los Angeles, are thought to be considering similar feed-in tariff programs. The challenge for introducing such a program in Houston will be in aligning interests of separate legal entities Gainesville and Austin are cities in which the utility is city-owned, allowing seamless implementation of public policy. In the Houston area, the local governments, CenterPoint Energy and the REPs are all separate legal entities Any similar program here would need to be coordinated at the state legislative and/or the PUCT level, and would require adjustment of rate structures to ensure an equitable allocation of the cost to subsidize renewable DG.[4]

Finally, after Ike, many Houston-area consumers demonstrated that economics are not the most important factor in their purchasing decisions regarding DG. They purchased backup generators without regard for competitive cost per kWh metrics (a generator that is operated for one week every ten years by definition has poor operating economics) but rather for the more intangible sense of personal security and avoided hardship in the event of a grid-down event. Consider the expense of a residential DG system to be a "backup premium" that a consumer is willing to pay, and it becomes apparent that Houston's susceptibility to hurricanes will be an additional driver to DG adoption. To the extent that renewable DG becomes more cost-competitive and can be configured to create safe islands of power in grid-down or generation-down events, these technologies may exhibit similar market penetration as have backyard combustion generators in response to hurricane threat.

Plug-In Hybrid Electric Vehicles (PHEVs) Grid-Connected Opportunities

A Plug-In Hybrid Electric Vehicle (PHEV) is a hybrid vehicle with batteries that can be recharged by connecting a plug to an electrical power source. With an internal combustion engine (ICE) and batteries for power, they share the characteristics of conventional hybrid electric vehicles and battery electric vehicles. A large number of auto manufactures will be mass producing PHEVs in year 2011 which will introduce mobile energy loads as well as

[4] *New York Times, March 12, 2009, Europe's Way of Encouraging Solar Power Arrives in the U.S., Retrieved April 4, 2009 from http://www.nytimes.com/2009/03/13/business/energy-environment/13solar.html?_r=1&scp=2&sq=feed-in%20tariffs&st=cse.*

increase energy storage capabilities. A PHEV will charge at 120 volt for 8-10 hours or 240 volt "fast charge" for 1-3 hours, however, the vehicle owner will have the flexibility to choose the charge voltage since the auto maker will configure their vehicle to handle both charging requirements. The potential for PHEVs to be used as a back-up power source and demand response appliance is high; however, the PHEV's battery pack capacity constraints will limit those opportunities.

A typical PHEV will have 10-15 kWh Lithium-Ion battery and storage capacity on-board the vehicle which could provide the following household appliance back up capacity and run time under emergency conditions:

Type	Size	Run Time
Portable Floor Fan	20 in. Box Type	64 hours
Refrigerator	25.4 cubic in	60 hours
TV	37 in LCD	55 hours
Air Conditioner	3 ton	2.7 hrs

After a PHEV has fully depleted its battery charge from operational use or stand-by power use, the vehicle can recharge the battery pack from standard ICE operation through regenerative braking system (energy created from the motion of the vehicle is put back into the battery pack from the vehicle braking system); however, the vehicle will only be able to recharge to a limited capacity (approximately 20-30%) due to vehicle operational requirements.

In order for a PHEV to be able to provide reverse power flow from the battery to a household or the power grid, the vehicle must have an integrated inverter and battery charger used to transfer power in either direction. These devises will be installed on the majority of the PHEVs offered in year 2011 but some auto makers will offer this as an upgradable option. In addition, similar to emergency generators that are installed today, the PHEV battery back-up system will have to be decoupled from the electrical grid during operation in order to prevent system back feed and safety concerns for the system operator. This is typically accomplished by installing a fused breaker or manual cross tie switch for system isolation.

Fuel Cells

Fuel cells, although in use for many years in highly specialized applications, are an emerging technology for residential and commercial use. Companies who manufacture or sell this technology have focused their marketing efforts on northern climates due to the large amount of heat that is produced as a by-product of the process. Fuel cells work the same way batteries work in that a chemical reaction, rather than combustion, is the energy source. Fuel cells that use pure hydrogen technically only emit water, however, pure hydrogen supplies generally come from processes based on fossil fuels which emit CO_2. Residential models currently available are fueled by natural gas and are about

40% efficient in converting fuel into electricity. Vendor literature on the residential and small commercial units claims installed costs ranging from $1,500 per kW to $6,000 per kW. In the limited amount of research the Task Force conducted, it appeared most installations are expected to cost around $4,500 per kW which would be about $22,000 for a typical 5 kW residential sized unit.

Industrial CHP

Large-scale combustion DG technologies configured for CHP and deployed in industrial settings, have the lowest barriers to market penetration in our area. Texas leads the nation in CHP applications, with over 17,300 MW of installed capacity, of which over 90% is in Industrial facilities, with over half of Texas' installed capacity having a rating of 25 MW or greater (Summit Blue 2008). These medium and large CHP facilities are primarily deployed in the petrochemical and refining complexes along the Texas Gulf Coast.

This Industrial CHP phenomenon is driven by the bundle of attributes that DG/CHP can deliver to industrial facilities: overall systems efficiency; control over power quality; flexibility in fuel use and pricing; heat that can be applied to thermal loads that are core to the operation. Large industrial plants are managed by professionals who have the tools to analyze cost and benefit as well as the skills and expertise to operate large machinery. One intriguing possibility is that large CHP installations could be configured to share power in local "micro-grids" with other critical facilities or local neighborhoods. In the days before and after a hurricane landfall, large petrochemical and refining complexes may be shut down and employees sent home for safety reasons. Yet the plant might still have the potential to generate electrical power from natural gas fired CHP systems. The concept that an industrial-scale CHP micro-grid might voluntarily agree to export power outside its fence in emergency situations is compelling due to the large installed base of CHP generating capacity in the Houston area. However, there are significant obstacles involving liability, the existing regulatory framework, and pricing, that would need to be worked out to make this proposition attractive to private sector CHP managers. Also, the industrial facilities tend to be located adjacent to the centralize power generating stations so there may not be any locational benefits to this type of DG even if micro-grids authorized are implemented.

Commercial CHP

In Texas, 199 MW of CHP capacity is found in commercial scale buildings, which is a relatively small proportion of Texas' total of 17,330 MW total CHP capacity. Of the commercial installed capacity, 82% is at universities, 10% is installed at hospitals or healthcare facilities, and 7% is installed in office buildings. Less than 1% is installed in government buildings, hotels, museums, and zoos (Summit Blue 2008).

For commercial facilities, the barriers to adoption include high up-front costs, an inability to secure long-term financing for the investment, and a lack of information about the benefits of on-site power generation. Yet CHP at these mid-sized facilities represent a potentially important area of growth for DG in our region for a few reasons. First, many of the facilities in the commercial scale designation are institutionally owned, with a single owner that will occupy the facility well into the future. This ownership structure favors long-term investment decisions over properties

that are owned briefly for resale. Second, these facilities often have significant thermal loads – hot water, steam, cooling – that will be well-served by CHP applications. Third, they tend to be located closer to other critical facilities or vulnerable population facilities where the concept of micro-grid can have the greatest impact. Finally, occupants and building managers in this category are likely to place a high value on a secure power supply, whether to provide continuing medical, educational, communications, or public services; or to serve as a shelter or command and control center during disaster recovery.

Despite the relatively small percentage of Texas CHP that is installed at commercial scale – 199 MW out of 17,300 MW total installed capacity – it appears there will continue to be strong economic reasons for this sector to grow in the next decade. Summit Blue (2008) foresees an additional 350 MW of "economic potential" (i.e., technically feasible CHP installations adjusted for economic modeling for factors such as natural gas pricing) in the commercial sector in Texas by 2023. For Houston, this projected growth represents an opportunity to increase power reliability in critical facilities at the same time we position DG resources for micro-grid opportunities down the road. Despite the apparent economic rationale for more commercial scale CHP, it was the consensus of the Task Force that two key initiatives should be undertaken to encourage and facilitate more development, sooner:

- **Education:** Building owners and operators will make rational investment decisions when presented with credible information. Education and outreach programs will be successful in accelerating the adoption of DG/CHP technologies in the Houston area. This statement is supported by stakeholder surveys that indicate a lack of information and technical knowledge in the small CHP Commercial sector (Summit Blue 2008) and modeling exercises[5] that predict accelerated adoption with more aggressive outreach. With respect to outreach, Houston has an opportunity to gain leverage from existing institutions and initiatives. The US DOE has established a CHP program, and has designated the Houston Advanced Research Center (HARC) as a Regional Application Center (RAC) to accelerate information diffusion in the region. HARC's Gulf Coast CHP Application Center (http://www.gulfcoastchp.org) program has a five-year head start on developing stakeholder processes, website development, workshops, seminars, and other educational programs. The CHP Application Center was a catalyst in forming a CHP trade association in Texas. Through these partners, the City of Houston has natural allies in coordinating with US DOE and regional CHP technology providers on education and outreach programs.

- **Coordination:** This outreach opportunity can be accelerated by linking to an initiative previously discussed in this report, the compilation of master lists of Critical Facilities and Vulnerable Population Facilities. Once these master lists are compiled in coordination with the City of Houston, CenterPoint Energy, REPs and other stakeholders, it will be easier for an outreach coordinator to initiate contact with potential CHP customers. The HARC CHP Regional Application Center outreach activities should be coordinated with the proposed Power Portal public outreach proposed elsewhere in this report. One of the possible components of the Power Portal could be a "decision tree" interface, in which building owners can follow cues starting with "How do I make my building's power resilient to power failure?" The questionnaire can be modeled after the US DOE information website for CHP (fund on the Web at www.epa.gov/CHP/project-development/qualifier_form.html. Customized

[5] *Maribu, K.M., 2006, Modeling the Economics and Adoption of Distributed Power Generation. Doctoral Thesis, Norwegian University of Science and Technology. Retrieved March 17, 2009 from http://www.diva-portal.org/diva/getDocument?urn_nbn_no_ntnu_diva-755-1__fulltext.pdf.*

for a Houston audience, the focus could be on reliability generally, guiding the user through highest-level qualifiers (Have you managed vegetation in proximity to power lines? Do you have a bi-lateral feed from the grid? Are you proximate to a natural gas supply?) to more technology-specific questions (What is your buildings annual power usage? What are your building's hours of operation? Do you have thermal loads?). This decision tree portal might be structured to move the user from simple actions to improve his or her reliability, such as vegetation control, to specific recommendations regarding appropriate technology sets, such as natural gas CHP or solar PV. The portal could then steer the user to various links for further information or personalize follow up.

Accelerating combustion DG technologies should be considered with a full awareness of potential unintended consequences with regard to air pollutants. Improving air quality in the Houston area has been a decades-long battle. With a sprawling metropolitan area of five million people, a warm climate, and the nations largest refining and petrochemical complex at its doorstep, Houston is a "perfect storm" of ozone formation. With the initiation of the Texas Emissions Reduction Program (TERP), Texas has also become one of the nation's most progressive states with regards to research programs to understand the causes of poor air quality in the Houston area, and incentive programs to reduce mobile source ozone precursors. The City of Houston has been particularly active in recent years identifying point source polluters and seeking emissions reductions from their facilities. In that context, it is important to comment on the air emissions paradox of CHP systems. As often noted, CHP power generation represents about a 75% system efficiency vs. central power plant efficiency of 48% since CHP systems capture wasted heat and put it to use, whereas central plants vent their waste heat.[6] Along with CHP's increased efficiency comes a commensurate decrease in greenhouse gases as well as NOx and other criteria emissions. However, since CHP power is generated "in town" and at ground level, the criteria emissions may be produced in closer proximity to (and therefore have a greater impact on) populated areas. A study conducted at the University of California Energy Institute looked at exposure to inhaled pollutants downwind from 25 central power stations vs. downwind of five types of combustion DG/CHP devices.[7] Despite the overall reduction in emissions in CHP as compared to central power, the inhaled pollutant exposure was several-fold higher downwind from CHP in proximity to dense populations vs. that from central power plants. This unintended consequence of a cleaner power generation paradigm should be considered in the context of the Houston-Galveston non-attainment area. The good news is that there is technology just now being deployed into the commercial scale market that can dramatically reduce the particular component of CHP emissions that leads to ground level ozone: NOx. The technology, known as selective catalytic reduction ("SCR") has been around for years at the industrial scale, but recent initiatives such at the TERP have lead to the development of smaller scale units.

The Summit Blue (2008) report to the PUCT represents a current and thorough analysis of CHP infrastructure and potential in Texas, analysis of barriers to CHP market penetration, and policy options to foster CHP investment. The study is timely in light of this Task Force's effort to review policy options that might accelerate adoption of CHP in the Houston region as a way of hardening our electrical grid against hurricane damage and widespread power failure. Therefore, the Task Force urges the PUCT to consider the recommendations of that report.

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[6] *U S. Environmental Protection Agency. 2008. Catalogue of CHP Technologies. Retrieved April 4, 2009 from http://www.epa.gov/chp/basic/catalog.html*

[7] *Heath, G.A., Granvold, P.W., Hoats, A.S., and Nazaroff, W N., 2005, Quantifying the Air Pollution Exposure Consequences of Distributed Electricity Generation, University of California Energy Institute. Retrieved March 17, 2009 from http://repositories.cdlib.org/ucei/devtech/EDT-005.*

Commercial and Municipal Back-Up DG

Functionally, these installations are already focused on reliability by definition, so the ability to leverage them for additional reliability is a challenge. The Task Force's approach here is therefore to make backup DG more affordable in keeping with the notion that more is better. One way to free up capital that could be utilized to purchase and install back up DG is to publicize and expand the existing "shedable load" programs administered by CenterPoint Energy and by ERCOT. These programs are designed to allow the grid to manage peak demand or brownout scenarios by notifying and bypassing customers who have agreed – in exchange for upfront cash payments – to surrender grid power when asked to do so. While participation in the "shedable load" programs might seem inconsistent with the basic notion of reliability, as a practical matter in a grid-down scenario, power would be lost whether or not a given customer has agreed to serve as shedable load. As with the other incentives to invest in DG, these programs are not well publicized or understood. A coordinated public message through a single web site that detailed these programs and created a single point of information and application would increase participation.

An important example of where shedable load payments could incent the investment in generators, and therefore increase reliability in a critical municipal use, is the water pumping station in East Harris County where primary power has failed in both of the most recent storms.[8] Shedable load payments may provide the financial resources the City requires for the installation of generators at that site and others.

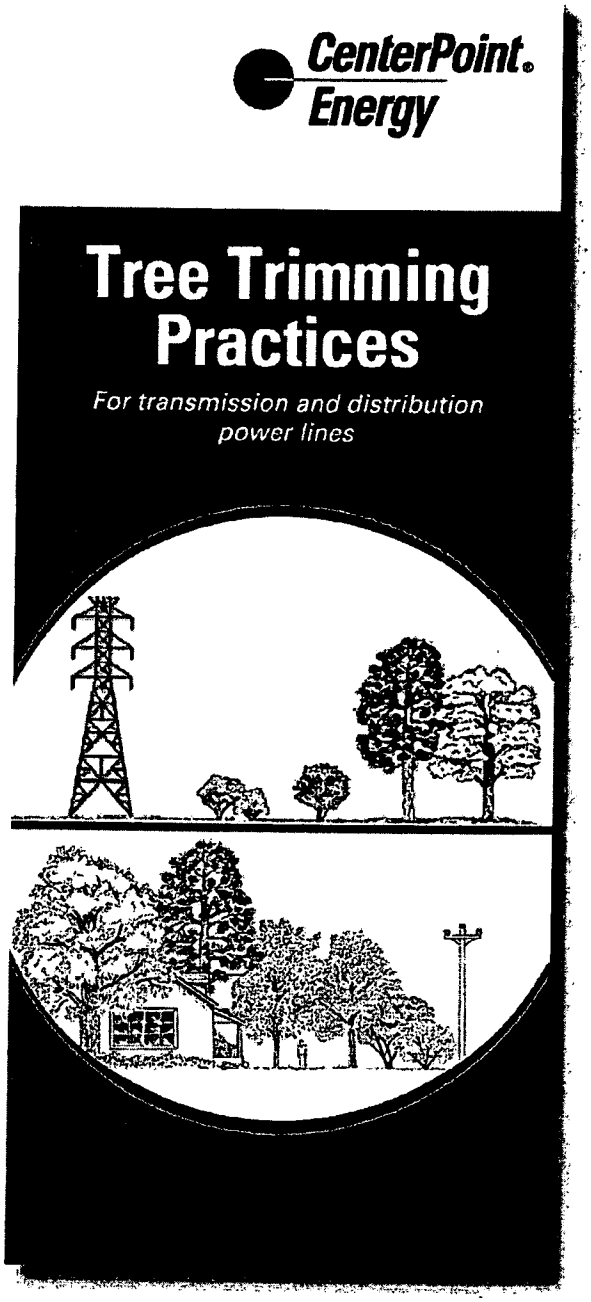
From an environmental viewpoint, it is a worthy goal to encourage lower emission forms of back up DG than the standard diesel generator genset, but until the most popular alternative generation technologies become more reliable themselves (wind and solar are intermittent resources), it will be hard to incent new behavior here beyond the City perhaps lowering the permit fees for natural gas generators and other non diesel/gasoline back up DG as a token incentive. Since permit fees rarely drive purchasing decisions, however, the response to that gesture will be modest, so the Task Force does not include this suggestion as a formal recommendation. Net Metering (discussed in Section Three of the Task Force Report) will not be effective incentives here due to the relatively high "heat rate" (a standard measure of economic efficiency) of standard generators and the variable nature of maintenance of back up DG installations.

Conclusion

DG is a powerful tactic in the struggle to balance reliability against cost and the environment, but it is dynamic in its technologies and very site-specific in its appropriateness. As a city with a unique base of engineering talent, with an expertise in all the back end systems required for power generation and delivery, Houston should take every opportunity to lead the world in DG research and deployment.

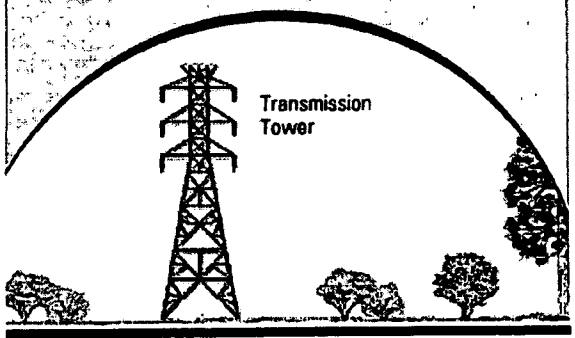
[8] *This facility is located outside the CenterPoint Energy service area.*

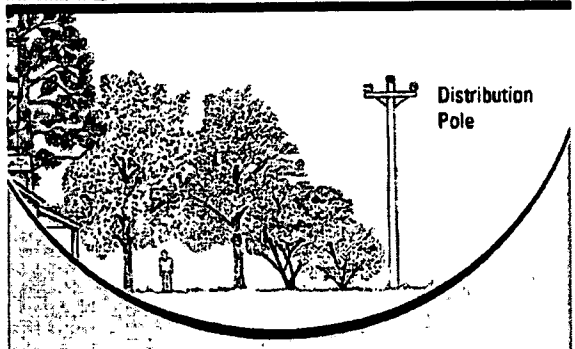
II. CenterPoint Energy Tree Trimming Practices



Transmission vs. Distribution

It's important to distinguish between higher-voltage transmission lines, which are generally located on large steel towers or poles within rights-of-way owned by CenterPoint Energy, and comparatively lower-voltage distribution lines, which are usually on wooden poles along roadways or in easements along property lines. Much greater clearance from trees is needed for high-voltage transmission lines than for distribution lines.





CenterPoint Energy's tree trimming practices:

Preventing power outages

We are dedicated to bringing our customers reliable, safe and efficient electrical service. Our professional tree trimming program is integrated into our daily operations to help make this possible. Trees that grow close to CenterPoint Energy's electrical poles and lines will be trimmed by a professional tree trimming company under contract with CenterPoint Energy. Tall-growing trees will be removed from high-voltage transmission line rights-of-way.

Houston and the surrounding areas are fortunate to have a climate that supports a long growing season and a wide variety of trees, which can provide beauty and shade for a home. Trees also serve as a habitat for wildlife and can help homeowners save on energy through shade. However, trees left to grow unmanaged not only can diminish in beauty but also can cause power outages and electrical safety hazards.

We've designed this brochure to answer questions you might have regarding our tree trimming activities. Please keep this brochure handy as it contains several useful phone numbers and emergency contacts.

II. CenterPoint Energy Tree Trimming Practices *(continued)*

DISTRIBUTION LINES

Why plant trees?

Trees and shrubs can shade homes or offices from both direct and reflected sunlight to help keep them cool and energy-efficient. Also, trees can help reduce the velocity of wind striking the outside walls of your house to help moderate temperature fluctuations.

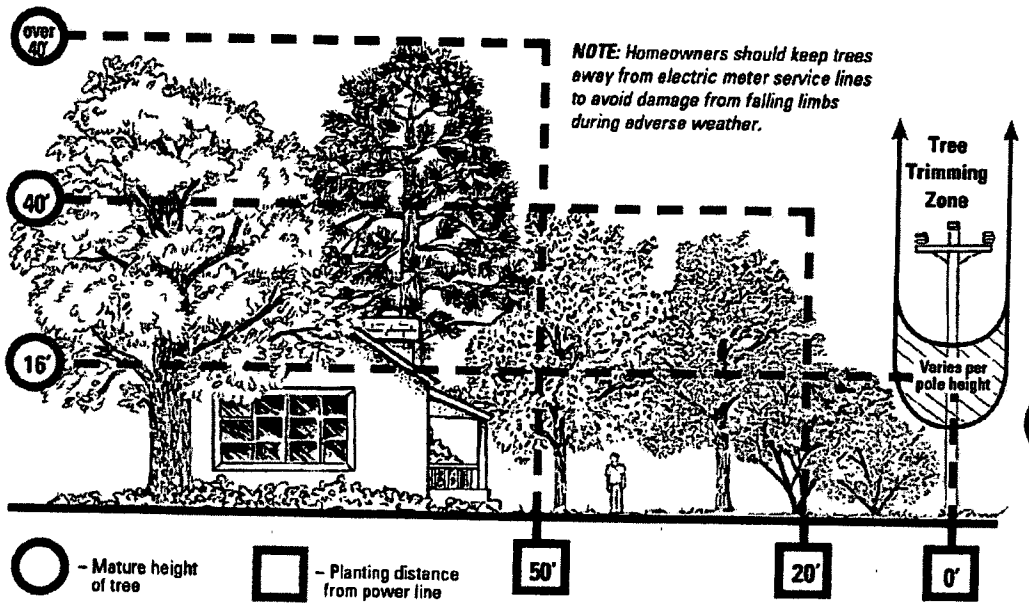
What do I need to do before planting new trees?

Before you plant, be aware of the location of any utility lines, including those underground. To locate underground lines such as electric, cable, telephone and gas lines, "Call Before You Dig" at 811 nationwide. Please call at least two business days before you plan to dig.

Also, know the growth potential of your trees and place them an appropriate distance from residential power distribution lines (see diagram). For an approved list of compatible vegetation, please visit www.CenterPointEnergy.com/trees or call CenterPoint Energy at 713-207-2222 or 1-800-332-7143, and a company forester will be notified to assist you.

Planting the right tree in the right place, away from power lines, will help replenish local urban forests with quality trees and reduce CenterPoint Energy's need to trim or remove trees.

Safe planting distance for trees near distribution lines



DISTRIBUTION LINES

How can I avoid having trees trimmed or removed because of power lines?

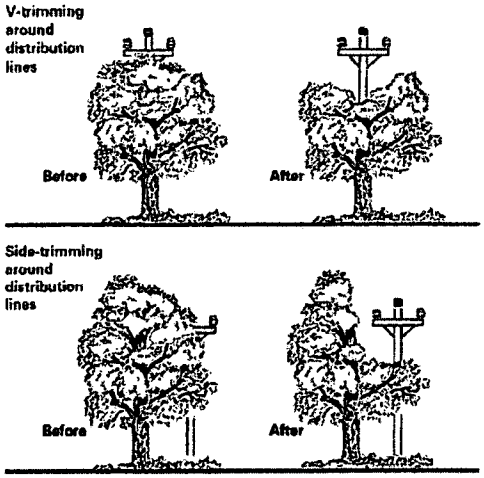
The best way to avoid conflicts is to never plant trees underneath power lines. When high-voltage transmission lines are nearby (see p. 12 -13), never plant a tree within or directly adjacent to the transmission line right-of-way. Instead, choose low-growing ground covers, decorative plants and shrubs to avoid any conflict with the transmission lines as the plants grow to maturity. Any vegetation or trees that interfere with the safe operation, maintenance, or construction of a transmission line are subject to removal under the terms of the land rights granted to the company.

If you choose to plant trees near your home, select trees that have a short height at maturity and a crown spread that will not interfere with nearby power distribution lines. Proper selection and placement of trees can eliminate potential safety hazards, reduce expenses, improve service reliability and enhance the landscape's appearance.

If I plant a tree too close to power lines, will it be removed?

The vast majority of trees that CenterPoint Energy maintains near distribution lines in mostly residential areas are only trimmed. Trees growing under or near distribution lines and electrical equipment are typically trimmed to provide adequate clearance for sustained service reliability. Trees affecting distribution lines may be removed when necessary to eliminate hazards to the lines, address imminent safety concerns or for other issues.

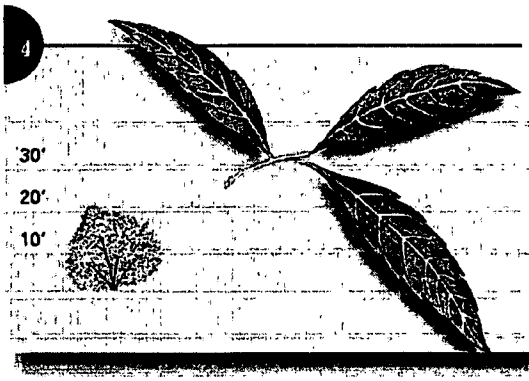
What will my trimmed tree look like?



How are trees trimmed?

Trees are trimmed according to the American National Standards Institute A300 Pruning Standards, which are utility trimming standards accepted by the National Arbor Day Foundation, the International Society of Arboriculture and other tree care organizations.

The standards include use of natural lateral or directional trimming methods that promote growth of the tree away from the electrical facilities. These trimming methods ideally allow a tree to retain as much of its natural form as possible while requiring less trimming in the future.



SOUTHERN WAXMYRTLE
Myrica cerifera

This low-lying tree offers good shading for the energy-conscious. The Southern Waxmyrtle is an evergreen and does well in moderate to wet soils. At full maturity, this tree can grow to a height of 10' to 20'.

II. CenterPoint Energy Tree Trimming Practices *(continued)*

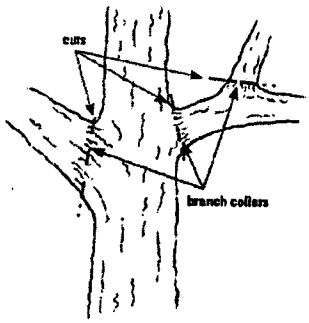
DISTRIBUTION LINES

Will the trees ever regain a natural appearance?

The trees will continue to grow, but they will not look the same as before they were trimmed. Because trees and power lines are not compatible, CenterPoint Energy will continue to trim as necessary in the future to maintain clearance for service reliability. Allowing the trees to grow naturally could create problems with the delivery of electrical service. However, CenterPoint Energy does use natural trimming methods to minimize the impact of the work.

Will the trees die?

Trees are trimmed to cause the least possible stress to the tree. Proper trimming methods are used to minimize the impact on a tree's health, structure, and appearance. For example, when limbs are removed, they are cut at the branch collar, which reduces the likelihood of disease or decay entering the tree and excessive re-sprouting.



If a fruit or pecan tree is currently bearing fruit or nuts, can you wait until the fruit ripens or the nuts drop before trimming the tree?

CenterPoint Energy will, if requested, wait to trim a specific tree until after the nuts drop or the fruit ripens unless the tree poses an immediate service problem. Please contact the contract tree crew or call CenterPoint Energy at 713-207-2222 or 1-800-332-7143.

Can I request trimming if my trees are close to power lines?

Yes, if you feel your trees are too close to any electrical facility, we encourage you to call CenterPoint Energy to request tree trimming. A representative from CenterPoint Energy will inspect the tree to determine if it requires trimming immediately. If the tree does not create an obvious hazard or service reliability problem, CenterPoint Energy may defer maintenance until area-wide trimming is done in the future.

What if I want a tree removed instead of trimmed?

CenterPoint Energy may remove trees that are close to its power lines based on factors such as the types of equipment affected, the type of tree, its growth rate, its appearance after normal line clearance maintenance, size, health, ongoing line

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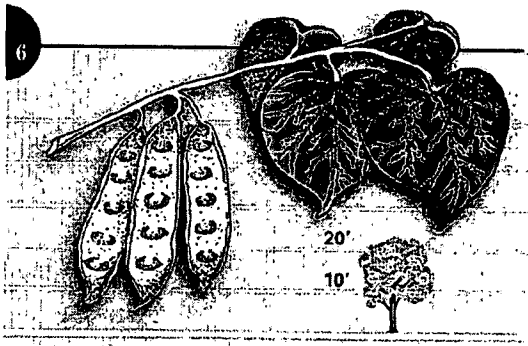

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REDBUD

Cercis canadensis

The two species of Redbud trees recommended for this area are the Eastern and the Texas. The Eastern Redbud does well in average soils while the Texas Redbud thrives in hot, dry locations. Redbuds can grow to 20' at full maturity.

clearance requirements, etc. The tree crew leader, supervisor or a CenterPoint Energy forester will determine whether or not a tree should be removed.

When a hardwood tree is removed, CenterPoint Energy contractors will apply a herbicide to the stump to ensure that the tree's root system will not re-sprout. State and federal regulatory agencies have approved all herbicides utilized by CenterPoint Energy contract crews. All CenterPoint Energy contract crews have been trained to handle and apply herbicides properly. For additional information on herbicide usage on or around CenterPoint Energy facilities, please call CenterPoint Energy at 713-207-2222 or 1-800-332-7143, and a company forester will be notified to assist you.

Will you also remove dead trees?

If a dead tree is posing a threat to CenterPoint Energy's electrical equipment, the company will cut down the tree at no expense to the landowner. However, the property owner is responsible for disposing of the wood left on-site. Remember, never attempt to remove any tree next to a power line yourself – call CenterPoint Energy for assistance at 713-207-2222 or 1-800-332-7143.

How long do I have to wait for the debris to be cleaned up from my property?

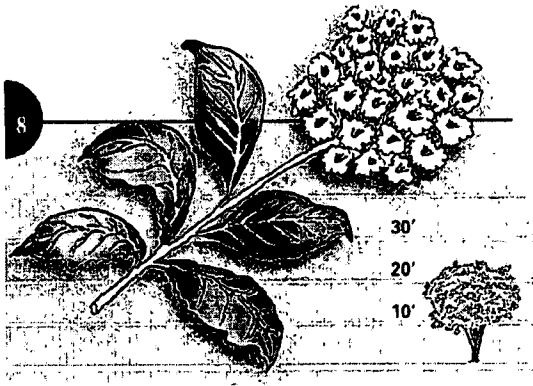
Under normal daily operations, tree trimming debris should be removed from your property on the same day the work is performed. Occasionally it may be left overnight and removed the next morning but only after the contractor has properly notified the property owner and/or received his/her consent.

Please note, however, that property owners, not CenterPoint Energy, are responsible for clearing debris resulting from emergency tree trimming for service restoration caused by fallen/broken trees, following routine inclement weather, or in the immediate aftermath of a major storm or other natural disaster.

How much does tree trimming cost?

CenterPoint Energy does not charge for typical tree trimming service performed on its existing electrical facilities. It provides this service to help ensure reliable delivery of power. If a CenterPoint Energy contractor requests payment for this service, you should notify CenterPoint Energy immediately.

(**Note:** CenterPoint Energy may charge individuals or developers for tree clearing to help facilitate new service construction in certain situations which would be agreed upon prior to construction.)



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CRAPE MYRTLE

Lagerstroemia spp.

The Crape Myrtle family has many varieties and hybrids. Crape Myrtles are heartiest in full sun and come in a range of sizes and colors. Summer flowers and colorful leaves in the fall make this tree a Houston-area favorite. Choose dwarf varieties when planting near power lines.

DISTRIBUTION LINES

Do you trim trees away from phone, TV, or DSL lines?

No. CenterPoint Energy does not trim or remove trees away from telephone, DSL, or cable television wires. We also do not trim or remove trees that interfere with the electric service lines running from CenterPoint Energy's electric distribution lines to customers' meters unless the trees are causing or will soon cause damage to the service lines.

Does CenterPoint Energy trim trees or vegetation away from street lights or security lights to improve visibility?

No. CenterPoint Energy will not trim trees or vegetation from around, above, or below street or security lighting facilities to maintain or improve visibility.

CenterPoint Energy will trim trees or vegetation from around, above, or below street and security lights when the tree or vegetation is causing or will soon cause damage to street or security light assets, including the light fixture, secondary conductors, and/or attached facilities.

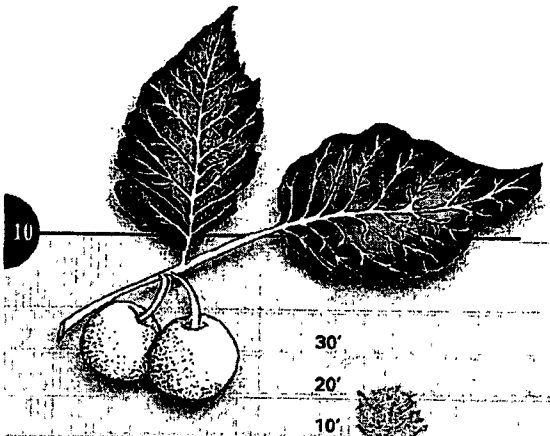
Customers requesting trimming of vegetation from around, above, or below street or security lights must contact the entity with territorial jurisdiction over the lighted area (road right-of-way, park, hike & bike trail etc.), such as the municipality, county, State of Texas, or homeowners or property owners association.

What about vines on utility poles or guy wires?

Vines on poles and guy wires will be cut at or close to ground level and left to deteriorate and fall later. Vines that are cut may be treated with herbicides to prevent re-growth.

Can I trim my trees around the power lines in my yard?

No! Serious injury or death can occur when untrained homeowners or workers attempt to trim trees around energized power lines. By law, unless you coordinate with CenterPoint Energy to do the work safely, only professionals who are authorized by the local electric utility are allowed to trim or remove trees next to energized power lines. These professionals have been properly trained and equipped to work safely around power lines.



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11

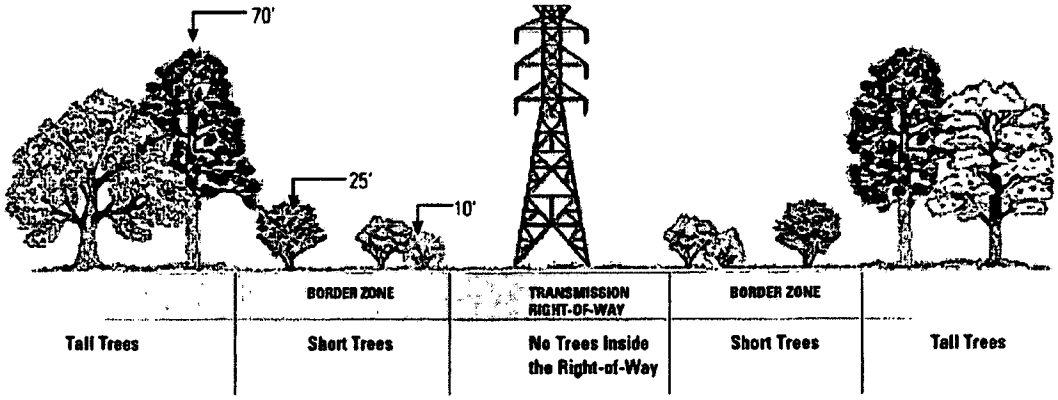
MEXICAN PLUM

Prunus Mexicana

The Mexican Plum is known for its fragrant spring flowers. This hardy tree adapts well to a variety of locations, especially areas with good drainage. The Mexican Plum grows to 20' at full maturity.

TRANSMISSION LINES

Plant trees away from high-voltage transmission lines



Can I plant trees near power transmission lines?

No. It's important to distinguish between higher-voltage transmission lines, which are generally located on large steel towers or poles within rights-of-way owned by CenterPoint Energy, and comparatively lower-voltage distribution lines, which are usually on wooden poles along roadways or in easements along property lines. Much greater clearance from trees is needed for high-voltage transmission lines than for distribution lines.

CenterPoint Energy's large transmission conductors serve numerous industrial, commercial and residential customers. If a tree makes contact with a transmission line, service to thousands of homes and businesses may be interrupted. Hazardous current may travel down the tree, into the ground, and across local underground cables and pipes causing severe damage to public and private property. To prevent this hazardous situation and ensure safety and reliability, tall-growing trees within the transmission right-of-way will be removed.

In short, you should plant trees away from high-voltage transmission lines.

12

CenterPoint Energy owns more than 3,600 miles of overhead transmission lines and over 27,000 miles of overhead distribution lines. We inspect and maintain our transmission rights-of-way and transmission line vegetation growth on a five-year cycle with trees removed or trimmed from 20 percent of transmission lines and circuits annually. CenterPoint Energy trims 700,000 to one million of the 3.5 million trees on our distribution system each year.

13

Can I plant trees in an open area inside a transmission line right-of-way?

No. Transmission line rights-of-way are dynamic: they change over time with the construction of new lines and rebuilding or reconfiguration of existing lines. Thus, trimming requirements may also change over time.

Open space inside a transmission line right-of-way is reserved for future transmission and distribution lines that will require the trees to be removed in any case.

How does CenterPoint Energy determine if trees need to be removed from areas bordering transmission rights-of-way or merely trimmed?

The decision to remove a tree depends on several factors:

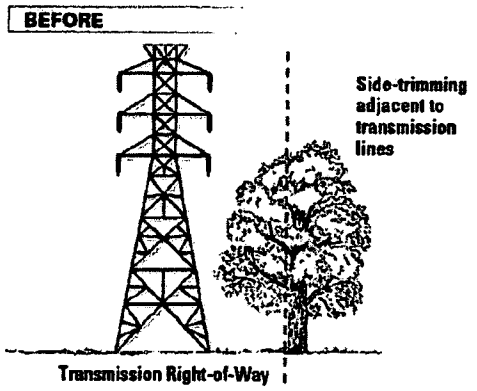
- The voltage of the power lines,
- The proximity of the tree to the wires and
- The health of the tree.

CenterPoint Energy works continuously to remove all trees and vegetation that will at some time interfere with the safe, reliable operation of its transmission lines. Our purpose is to produce a predictable environment of low-growing vegetation within our transmission line corridors according to the utility model recognized by the Federal Energy Regulatory Commission (FERC).

CenterPoint Energy inspects and maintains its transmission rights-of-way and transmission line vegetation growth on a five-year cycle, which means that 20 percent of the circuits/lines have trees removed or trimmed annually. CenterPoint Energy makes an annual aerial inspection of the rights-of-way to identify trees that are dead, dying or compromised in such a way that they may fall onto an adjacent transmission line.

Since such trees are usually located outside the right-of-way, CenterPoint Energy attempts to obtain landowner permission to remove these trees before they fall. Branches that overhang into CenterPoint Energy's right-of-way may be trimmed rather than removing the entire tree.

What does a tree trimmed away from a transmission line look like?



Who can I talk to if I have more questions?

If you have questions or would like information on appropriate trees or shrubs to plant, please call CenterPoint Energy at 713-207-2222 or 1-800-332-7143, and a company forester will be notified to assist you.

II. CenterPoint Energy Tree Trimming Practices *(continued)*

"THE RIGHT TREE IN THE RIGHT PLACE" *is more than a saying to CenterPoint Energy. We have a vested interest in the horticultural makeup of our city. Inside this brochure, you'll find tips to help you recognize tree shapes and sizes as well as some of the benefits of these trees – not only for their beauty but also their practical applications.*

Before planting a tree, call the "Call Before You Dig" nationwide phone line at 811 to safely locate underground utility lines, such as electric, cable, telephone and gas lines. Please call at least two business days before you plan to dig.

16

II. CenterPoint Energy Tree Trimming Practices *(continued)*

Electric Service

What do you do when

- You see a downed power line?
- You need to report a street light outage?
- You have problems with your electric service?

Call CenterPoint Energy at 713-207-2222 or 1-800-332-7143. We own and maintain the power lines and restore your electricity when it goes out. Your retail electric provider contracts with us to deliver electricity to you over our power lines.

What do you do when

- You have a question about your electric bill?
- You want your meter read?

Call your retail electric provider. Their customer service number is on your electric bill. CenterPoint Energy does not sell electricity or send you an electric bill, but your electric provider does contract with us to read your meter for them.

Natural Gas Service

What do you do when

- You need help with your natural gas service?
- You have questions about your natural gas bill?
- You want information on the benefits of dependable, affordable natural gas?

Call CenterPoint Energy at 713-659-2111 or 1-800-752-8036. We sell natural gas, own and maintain the natural gas lines, and handle all natural gas bill inquiries.

What do you do when

- You smell natural gas in your home or business?

Leave your home or business immediately, and then call CenterPoint Energy at 713-659-2111 or 1-888-876-5786.

CenterPoint Energy

Always There.®

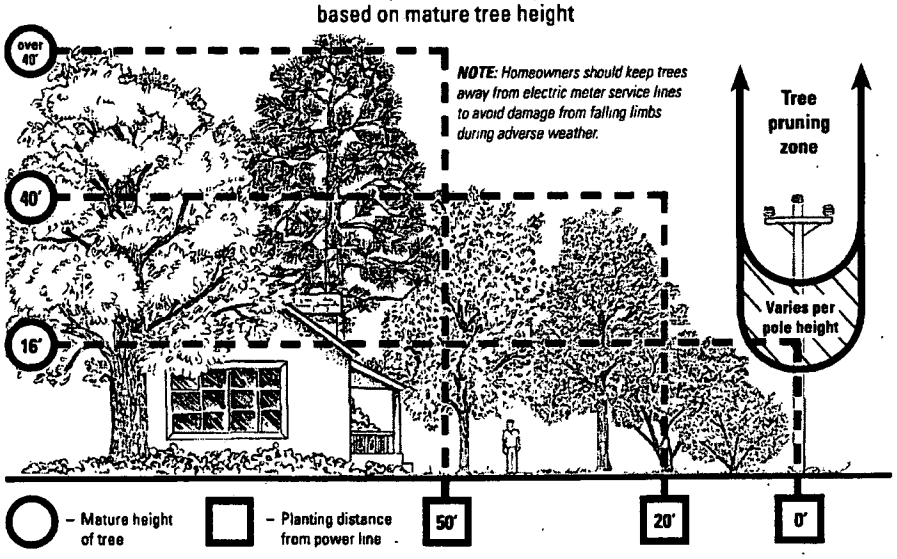
www.CenterPointEnergy.com/trees

CNP826 OCT 2008

III. a. Existing CenterPoint Energy Vegetation Management Recommendations

Plant the Right Tree in the Right Place

Recommended distance to plant trees away from ***distribution lines*** based on mature tree height



When trees grow into power lines, they can cause power outages and create safety hazards for you and your neighbors. Use the guide above to select trees that have a short mature height and spread that will not interfere with nearby power lines.

Before you dig, call 811 to locate underground utilities.
And remember to "look up and live": stay at least 10 feet away from power lines.

CenterPoint. Energy

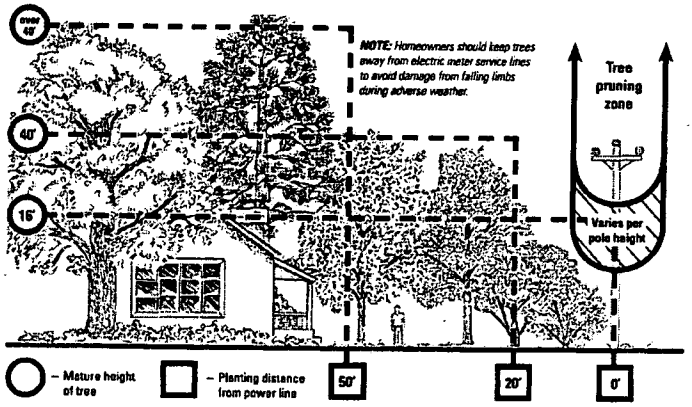
Always There.®

For more information, visit www.CenterPointEnergy.com/trees

III. b. Existing CenterPoint Energy Vegetation Management Recommendations

Recommended list of low-growing trees suitable for planting near power distribution lines

Common Name	Scientific Name	Mature Tree Height
Texas Redbud	*Cercis canadensis var. texensis*	20 ft.
Fringe Tree	*Chionanthus virginicus*	30 ft.
Texas Hawthorn	*Crataegus texana*	20 ft.
Yaupon Holly	*Ilex vomitoria*	15 - 25 ft.
Dwarf Crape Myrtle	*Lagerstroemia spp. (dwarf varieties)*	20 ft.
Southern Waxmyrtle	*Myrica cerifera*	10 - 20 ft.
Texas Pistache	*Pistacia texana*	10 ft.
Mexican Plum	*Prunus mexicana*	20 ft.
Little Gem Magnolia	*Magnolia grandiflora 'Little Gem'*	15 - 20 ft.
Pygmy Date Palm	*Phoenix roebelenii*	8 ft.
Mediterranean Fan Palm	*Chamarops humilis*	15 ft.



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III. c. Existing CenterPoint Energy Vegetation Management Recommendations

Low-Growing Vegetation Suitable for Transmission Corridors

The following is a list of small shrubs acceptable for planting within transmission corridors. Most bedding plants and ground covers are acceptable and not covered within this document. Permission must be obtained from CenterPoint Energy prior to planting anything within a transmission corridor to ensure the type and location of the vegetation does not block access to the corridor or affect the ability to inspect and maintain the transmission lines. For permission, please contact the CenterPoint Energy Surveying & Right of Way Department at 713-207-5769. For questions about approved species, please contact CenterPoint Energy at 713-207-2222 or 1-800-332-7143 and a company forester will be notified to assist you.

AQUIFOLIACEAE

Ilex glabra — Inkberry
Height: 6 - 8 feet
Leaves: lustrous, dark green, some times yellow green (evergreen)
Fruit: black berry, September-May
Landscape Value: excellent for foundation, hedges, masses, or an accent plant

Ilex verticillata — Winterberry
Height: 6 - 10 feet
Leaves: deep rich green (deciduous)
Fruit: bright red, August-September
Landscape Value: excellent for mass effect. Needs male and female for fruit set

CAPRIFOLIACEAE

Viburnum acerifolium — Maple-leaf viburnum
Height: 4 - 6 feet
Leaves: bright green, changing to red or purple in fall (deciduous)
Flower: yellowish white, June
Landscape Value: shade tolerant, fall colors are brilliant (pink, rose, red, to grape juice purple)

CELASTRACEAE

Euonymus americanus — Strawberry bush
Height: 4 - 6 feet
Leaves: dark green changing to yellow green in fall (evergreen)
Flower: 5 petaled greenish purple, July-September
Landscape Value: goes unnoticed until September or October when the warty, scarlet capsules open to display orange seeds. From this character it gets its other common name "hearts-a-burstin"

Revised 2007 — CenterPoint Energy — Page 1 of 5

III. c. Existing CenterPoint Energy Vegetation Management Recommendations *(continued)*

RUBIACEAE

Cephalanthus occidentalis — Button bush
Height: 6 - 10 feet
Leaves: bright green lustrous above, lighter pubescent below (deciduous)
Fruit: red or brown rounded mass of nut-lets
Landscape Value: does well in moist sites, has a rather loose, gangly appearance

ROSACEAE

Spirea x bumalda — Bumald Spirea

Height: 2 - 5 feet, depending on variety
Leaves: variable, depending on variety; bronze, red, pinkish-red-purple when young, finally changing to green or variegations of green, yellow, gold, or burgundy; fall colors vary from greenish purple, orange-red, and chartreuse
Flower: white to deep pink, June – August
Landscape Value: Good filler, can be used as a low massing plant

SAXIFRAGACEAE

Itea virginica — Virginia sweetspire
Height: 3 - 9 feet
Leaves: bright green changing to crimson in fall (deciduous)
Flower: white, upright, fragrant, June-July
Landscape Value: flowers at a time when few plants are in flower. Likes moist to wet sites. Not utilized enough in home landscapes, holds its leaves a long time

STYRACACEAE

Styrax americanus — American snowbell
Height: 6 - 8 feet
Leaves: bright green (deciduous)
Flower: white bell-shaped, hang down instead of facing up, (June- July)
Landscape Value: slender stem rather wispy shrub, likes cool, moist, acidic sites, excellent for southern gardens

Revised 2007 — CenterPoint Energy — Page 2 of 5

III. c. Existing CenterPoint Energy Vegetation Management Recommendations *(continued)*

VERBENACEAE

Callicarpa americana — American beautyberry
Height: 3 - 8 feet
Leaves: medium green, pubescent (deciduous)
Flower: light lavender pink, June-August
Fruit: violet to magenta berry
Landscape Value: good shrub for massing

Definition of Terms:
pubescent .....covered with short, soft hairs
glabrous.....smooth, not pubescent or hairy
lustrous.....slight gloss
deciduous .....falling away, not persistent
persistent .....remaining attached for more than one season, not falling off in autumn
evergreen.....having green foliage throughout the year
semi-evergreen.....green for only a part of the winter, or only part of the foliage fully evergreen

Other Notable Vegetation**

Azaleas	Camellia	Hibiscus
Japanese Boxwood	Hydrangea	Pampas Grass, Maidenhair Grass, etc.
Barberry	Chokeberry	Butterfly Bush (*Buddleia* sp.) – some varieties

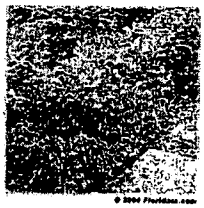
**Many other shrubs and ground covers

For questions about approved species, please contact CenterPoint Energy at 713-207-2222 or 1-800-332-7143 and a company forester will be notified to assist you.

III. c. Existing CenterPoint Energy Vegetation Management Recommendations *(continued)*

Picture Gallery of Approved Vegetation

Inkberry

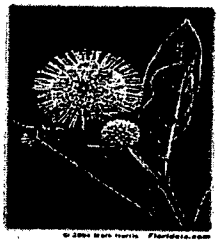



Winterberry


Maple-leaf viburnum


Strawberry bush

Button bush

Virginia sweetspire


Revised 2007

CenterPoint Energy

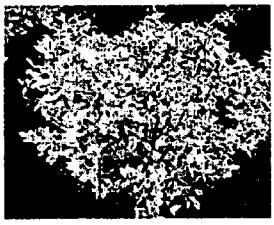
Page 4 of 5

III. c. Existing CenterPoint Energy Vegetation Management Recommendations *(continued)*

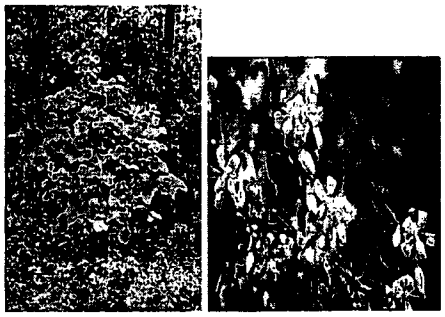
Bumald Spirea 'Gold Flame'

Bumald Spirea 'Anthony Waterer'

Bumald Spirea 'Goldmound'



American snowbell



American beautyberry

Revised 2007

CenterPoint Energy

Page 5 of 5

IV. CenterPoint Energy Smart Grid Deployment Estimate

CenterPoint Energy Smart Grid Deployment Estimate

		Estimated Capital Installation Cost (mm), tax included, 8-10yr Deployment Plan		
Expenditure Area	*Description*	*Basic Distribution only, Circuit Fault Location and Automatic Switching*	*Basic Distribution Circuit Fault Location, Automatic Switching plus Substation level 1 Monitoring*	*Full Smart Grid Functionality*
Project Management & Overall Engineering	Project Management and Overall engineering design and development	10	10	16
Central Control Systems	Distribution management system, asset management system, network management system, systems integration, IT operating hardware & software, major event (hurricane) restoration program development, event management system, cyber security systems, & overall intelligence layers	40	40	74
Substation field Equipment	Transformer monitoring equipment, Load tap changer voltage controls, VAR controls, microprocessor relaying & detail engineering	0	59	122
Distribution Field Equipment	RTU hardware & software, circuit switches, switch controls, communication interfaces & detail engineering	90	90	116
Communication Field Equipment	Fiber Optics, radio controllers, antennas, & detail engineering	55	55	57
	Total	195	254	385

DC
2-Apr-09