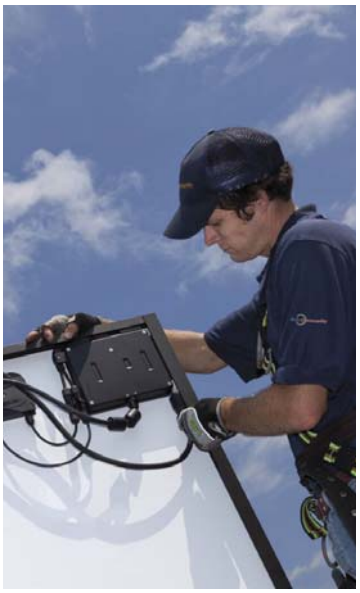
A STRATEGIC PLAN FOR LOCAL SOLAR IN AUSTIN

Approved by the Austin Local Solar Advisory Committee

November 1, 2012



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CONTENTS

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A VISION FOR LOCAL SOLAR IN AUSTIN

Solar energy's well-documented attributes include peak coincidence, price stability, hedging against fuel price volatility, and minimal environmental impacts. Deployed locally, solar also reduces line losses and congestion, reduces transmission costs, spurs local economic development, provides high-skilled jobs, promotes innovation clustering and leadership, strengthens local capital investment and supports local institutions through the tax base. Today local solar costs more than utility-scale solar, but provides additional local benefits that may make up for much of, or more than, the difference in cost, while providing intangible values such as industry and utility experience, knowledge leadership, and national and international recognition.

A key challenge is to cost-effectively optimize solar's benefit to the community while reducing or mitigating conflicts between, or ideally, aligning, the interests of our community-owned utility and its customers.

Local solar provides local benefits regardless of whether it is directly controlled by utility customers or the utility itself; however, solar development models vary in their impact on the long-term financial sustainability of the utility. As solar approaches retail grid parity here in Austin, a key challenge is to cost-effectively optimize the benefit of solar to the community while reducing or mitigating conflicts between, or ideally, aligning, the interests of our community-owned utility and its customers.

To that end, two fundamental questions drive development of the strategy and recommendations provided here:

- What would an optimal environment for growing solar energy in Austin look like?
- How can we create that optimal environment?

Austin is well-known as a national and international leader in clean energy, with a strong history of City leadership converting citizens' vision into innovative and cost effective clean energy initiatives. From Austin Energy's "conservation power plant" in the mid-1990s, to the City's 35% renewable energy goal, to its renowned GreenChoice program, the City and its customer-owned utility have been "walking the talk" far longer than it has been fashionable to do so elsewhere. Since 2004, Austin Energy's incentive programs have supported customer-owned solar, and its 30 MW Webberville Solar Project, completed in 2011, is the largest operating solar power plant in Texas. Both represent commitments not only to renewable energy, but to energy derived locally.

To its credit, Austin is already further down the path of contemplating and wisely acting on these fundamental questions than many other cities. That position derives largely from the efforts of strong local leadership and policy innovation, past and present. But as solar costs decline and the global solar market changes rapidly, mere continuation of Austin's existing policy and programmatic approaches to solar, and especially to local solar, is likely to be insufficient. In order to optimize local development of solar, the City must be proactive in reassessing and adapting its solar goals, programs and policies along with these changes. The Austin Local Solar Advisory Committee intends this Strategic Plan to provide a solid direction and framework for updating the City's goals, programs and policies toward creating an optimal environment for solar development in Austin through 2020.

FINDINGS

Our plan is fiscally sound and affordable, supportive of our municipally-owned utility, and results in net economic and environmental benefits for the community.

The members of the Austin Local Solar Advisory Committee, representing a broad cross-section of the community and a variety of interests, respectfully submit this Strategic Plan to the Austin City Council. Through numerous meetings over 5 months, we have worked diligently to present achievable goals and thoughtful recommendations for optimizing utilization of Austin's abundant local solar resource. Our plan is fiscally sound and affordable, supportive of our municipally-owned utility, and results in net economic and environment benefits for the community. It represents a path forward for Austin to become an optimal environment in which solar can grow, keeping Austin a healthier, economically vibrant, and visionary community for years to come.

BACKGROUND

The Austin City Council created the Austin Local Solar Advisory Committee in April 2012, charging the Committee with developing "a strategic plan with specific recommendations to ensure the optimum utilization of Austin's local solar energy resource base."

The Committee's 20 members represent a broad cross-section of the Austin community, including representatives of the solar industry, Chambers of Commerce, environmental non-profit community, consumer advocate community, and one representative each from both the Electric Utility Commission and the Resource Management Commission. The Committee convened roughly twice each month through October 2012 to produce this Strategic Plan. The Committee considered numerous public comments, hosted several guest speakers, collaborated on fact-finding and data analysis tasks, and completed and considered several working group reports.[i]

While creating this Plan, the Committee considered all aspects of the costs and benefits of local solar development. We examined differences in the solar resource in Austin versus far West Texas, and found significant availability of suitable land and rooftop space for local solar developments. We thoroughly documented the current status of solar technology, business and financial models of solar development, and the likelihood of emerging technologies and models to change conditions for future solar development. We discussed trade-offs associated with large- and small-scale solar development, and with utility-owned generation versus customer-owned generation.

We examined myriad approaches to encourage solar development, proposed novel methods for further consideration, and delineated current legal and regulatory barriers and opportunities. In examining costs and benefits, we reviewed and attempted to quantify direct costs and benefits, those which accrue to the utility and/or the customer making an investment in solar, as well as indirect costs and benefits, those which accrue to the community as a whole, and which are often more difficult to quantify, such as the value of local jobs, economic development impacts associated with industry clustering and leadership, and the health and environmental impacts of power generation. The Committee formally adopted this Plan on November 1, 2012, by a vote of 16 in favor to 0 opposed.

Photo credit: SolarBridge Technologies

PURPOSE AND KEY THEMES OF THIS PLAN

The purpose of this Strategic Plan is to create a set of guideposts that provide adaptable and measurable paths towards optimizing the economic, environmental, grid resiliency and equitability benefits of Austin's solar resources to the Austin community as a whole. This Plan has been developed with the best information available to the Committee, taking into consideration the impact on the affordability goal of maintaining a 2 percent cap on increases in overall rates and keeping rates in the lower 50% of Texas overall, and recognizing Austin Energy's obligation to compare the long-term cost and benefit of any new energy generation resource acquisition greater than 10 MW capacity with other available carbon-free generation resources. It contains detailed goals, findings and recommendations, which may be summarized by the following key themes:

1. Expanding the Breadth of the City's Consideration and Understanding of Solar. Solar energy's value to Austin extends beyond a discussion of utility costs, rates, and affordability goals. This Committee was created, in part, to expand dialogue about solar to the scale of Austin and its citizens, with the understanding that the choices Austin makes regarding solar will contribute to:

- Affordability of energy to all Austin Energy customers;
- Local economic development and jobs;
- The establishment of Austin as a hub of clean tech innovation;
- The resiliency and financial sustainability of Austin's electric utility;
- Local air quality, including the threat of reaching EPA air quality non-attainment; and
- Access to clean energy options across all strata of Austin's community.

2. Adopting Long-Term and Interim Solar Goals that Include Goals for Local Solar. The Committee has examined numerous options for developing local solar, and has studied these options both from their high-level impact on Austin's generation resource mix and from the detailed perspective of program and policy implementation. Articulating a vision, and translating that vision into clear, attainable, reasonable goals for local solar, will provide a shared sense of direction and purpose to our community's efforts toward local solar.

3. Encouraging Local Solar Development that Supports the Utility. Austin's solar development efforts should encourage utility-owned or -contracted developments, with a blend of generation that includes local solar on large rooftops, parking structures, empty lots and City properties within Austin Energy's service area. These local solar facilities benefit all citizens and contribute to Austin Energy's long-term financial sustainability. They not only take advantage of scale in pricing and efficiency, they can be built out in a planned and thoughtful manner to support the utility's infrastructure. In developing these assets, the City should seek to coordinate and cluster buying opportunities to maximize local economic development opportunities, attracting partnering companies to Austin and fostering long-term, stable, well-paying jobs in the region.

4. Growing Customer-Owned Solar While Pivoting from Utility Incentives to Market Drivers. Austin can achieve significant customer-owned or customer-contracted (behind the meter) solar by 2020 while reducing budgets and trimming incentive levels in the existing residential and commercial programs. As customer-sited systems become more affordable, the City should shift its emphasis away from direct incentives like rebates and the PBI and toward mechanisms embedded in the electric rate structure, such as the value of solar rate, time of use rates, capacity credits, and others that credit generation owners for the value of energy provided to the grid while recovering costs associated with provision of electric service. The City may accelerate development of customer-owned solar by supporting organized solar purchases by neighborhoods, through affinity groups, and by customers who rent and lease their properties.

5. Developing and Promoting Solar Financing Options. A number of solar development models seek to mitigate the up-front cost barrier of solar through a variety of financing mechanisms intended to comply with the needs of Austin Energy's regulatory framework, including private or publicly-catalyzed lending, utility-sponsored or third-party solar leasing, and solar green choice approaches. All seek to transform an initial capital investment in solar into a monthly fixed or performance-indexed charge justified by anticipated electric bill savings. Some seek the convenience and security of billing the periodic charge to customers through the electric bill or property tax assessment. Availability of financing through one or more of these models has the potential to greatly expand the market for local solar and associated community benefits. The City should work to develop financing options through strategic financing partnerships and increase consumer awareness of financing options through co-marketing efforts. To this end the City should identify and actively work to mitigate current legal and regulatory barriers to financing.

6. Expanding Access to Solar. Not all Austinites who value solar own a roof or property on which to install it. Renters and business tenants are two important examples. Property owners simply may want the benefits of solar but not the responsibility of on-site ownership. Community solar models (in which customers own all or a fraction of a solar installation located apart from their electric service address and are credited for production on their electric bill) and solar green choice models (in which customers voluntarily purchase solar energy from the utility) may expand the pool of solar customers in Austin. The City should work to identify and reduce barriers to deployment of these models, and seek to implement them as soon as practicable.

7. Considering Additional Approaches to Potentially Supercharge Local Solar in Austin. The City has adopted a goal to require that all new buildings be net zero energy capable by 2015. We believe the City should consider reduced interconnection fees or other policies to encourage new construction to actually achieve net zero energy consumption, via direct solar installation or purchase of solar energy through the utility. We recommend additional education and outreach to builders to encourage this practice, and ask the City to work with banks, Realtor groups, and appraisers to better understand the real estate value of solar. As market prices for solar continue to decline and financing options become more widely available, market demand will propel the vast majority of solar market growth in Austin.

8. Evaluating Progress and Updating this Plan. The Committee understands that the future cannot be seen with precision. With the rapid changes in the solar industry over the past several years, and the continual emergence of new models of solar development throughout the US and around the world, the Committee recommends that the City formally evaluate its solar programs, rates, and actions taken toward fulfillment of this Plan, and reevaluate and update its solar goals in conjunction with the Generation Plan, every two years.

SOLAR DEVELOPMENT SCENARIOS EXAMINED BY THE COMMITTEE

The LSAC established a working group to develop and describe possible scenarios for local solar development. The group presented three scenarios:

1. A business-as-usual approach, based on the current 200 MW solar goal and without significant changes in current programs or policies. Under this scenario, by 2020 solar would contribute approximately 2.8-3.3%[ii] of Austin's projected annual energy requirement.

2. An approach aimed at equaling projected growth in peak demand (estimated at approximately 400 MW by 2020) with new solar resources, including:

- 100 MW of local customer-owned, behind-the-meter solar,
- 100 MW of local utility-owned or -contracted solar, and
- 200 MW of other utility-scale solar.

Under this scenario, by 2020 solar would contribute approximately 5.2-6.0%[ii] of Austin's projected annual energy requirement. This approach would entail significant changes to programs and policies to expand access to solar, facilitate long-term financing, enable utility procurement of large local solar, and other measures such as reduced hook-up fees for new solar homes.

3. A more aggressive approach aimed at replacing generation from the Decker or Fayette power plant with a combination of resources including solar (estimated at approximately 600 MW of solar). This approach would include:

- 100 MW of local customer-owned, behind-the-meter solar,
- 200 MW of local utility-owned or -contracted solar, and
- 300 MW of other utility-scale solar.

Under this scenario, by 2020 solar would contribute approximately 8.0-9.2%[ii] of Austin's projected annual energy requirement. In addition to the policy and programmatic changes described above, this approach assumes that solar costs decline more aggressively or that environmental requirements increase the value of this decision.

RECOMMENDED GOAL FOR LOCAL SOLAR DEVELOPMENT

Based on the Committee's review of these scenarios:

Our review supports a 2020 solar goal of at least 400 MW, including 200 MW of local solar, as technically and economically acheivable.

- The Committee recommends that the City Council adopt a long-term (2020) goal to, at a minimum, meet projected demand growth with solar energy, expand programs and policies to enable fulfillment of this goal, while meeting current affordability goals for its customers. Our review of costs, policies, programs and options support a 2020 solar goal of at least 400 MW, including 200 MW of local solar, as technically and economically achievable.
- We recommend that the City Council direct Austin Energy to develop and present a detailed plan and planning assumptions required for meeting the 400 MW solar goal and an interim (2016) goal of 135-200 MW, including 85-120 MW of local solar as recommended herein, as part of the Generation Plan.[iii]
- We further recommend that the City Council consider increasing local solar goals as market conditions and environmental requirements change, in order to maximize the benefits of local solar while supporting the stability of our utility and the sustainability of our community.
- Finally, we recommend that City Council direct Austin Energy to incorporate evaluation criteria for the utility's investment in local solar into the Generation Plan. These criteria would consider and quantify the impacts of local solar on transmission and distribution costs, line losses, local jobs and economic development, and the environment.

STRATEGIES FOR ACHIEVING THE GOAL

The Committee's recommendation to adopt a goal of at least 400 MW of solar by 2020, including at least 200 MW of local solar, would double the City's current goal of 200 MW of solar. The Committee's recommended goal is based on a buildout scenario that includes the following concentrations of local and non-local solar today, in 2016, and in 2020.

Local Solar	Today	2016	2020
Residential	6.4	20	45
Commercial	1.4	20	55
Large Local	31.0	45-80*	100
Other Solar	0.0	50-80*	200
Total Recommended Solar Goal	38.8	135-200*	400

**Costs and economic benefits were calculated based on the minimum of this range.*

The Committee has conducted high level economic analyses of a buildout scenario consistent with the 2016 and 2020 goals presented above,[iv] in support of the costs, financial impacts, and benefits associated with the recommendation. The results of these Committee analyses are presented below and in the end notes. The Committee was unable to access certain data and planning assumptions and models held internally by Austin Energy, and Austin Energy could not complete internal studies to refine the Committee's findings in the time required to complete this report. We recognize that further work will be required to refine the Committee's analyses, and recommend that this work be completed as part of the utility's generation planning process.

As a result of our analysis, we recommend the following program, rate, and policy measures be considered to meet the local solar goal recommended above:

RESIDENTIAL SOLAR

current: 6.4 MW *goal 2016: 20 MW* *goal 2020: 45 MW*

A goal of consistently increasing annual installed capacity best prepares the residential market for continued growth after 2020.

- Rebate Program: Gradually reduce residential rebate budgets and incentive levels while maintaining/increasing the capacity of new installations. The Committee believes Austin Energy can achieve 40-50 MW of residential solar by 2020 through the rebate program while conforming to these criteria,[v] and that a goal of consistently increasing annual installed capacity best prepares the market for continued growth after 2020.
- Financing: Rebate-driven results can be accelerated or magnified with the introduction of solar-friendly financing options. Recommendations regarding financing are provided below.
- Access: Expanding access to residential solar can accelerate achievement of residential solar goals. The City should actively foster development of community solar or other forms of shared ownership and/or solar green choice options, particularly as a vehicle for enabling access to solar by all Austinites, while pursuing careful legal and regulatory review of tariff structures associated with these models.

- Transparency:
  - Request Austin Energy to produce and annually update a 5-year projection of residential solar program goals (MW installed), and anticipated average installed costs, rebate levels, rebate program budgets, and anticipated value of solar rates. Such projections would be non-binding, but would provide a signal to program customers and the solar installer community of anticipated program direction.
  - Establish targets and metrics for tracking local economic development arising from the residential solar program, and evaluate and publish progress toward achievement of targets annually.
  - Continue involvement of the EUC and RMC in the annual evaluation of the value of solar rate and methodology to ensure clarity and transparency.
- Residential Rates:
  - Provide greater financial certainty for residential solar investments by establishing a floor value for the value of solar rate.
  - Work to clarify the mechanics of how solar customers would interact with time of use rates.

Photo credit: Imagine Solar

- Additional Options:
  - Encourage the rebate program to facilitate privately-organized neighborhood buying opportunities for both existing neighborhoods and new developments.
  - Streamline the process for resolving open permits that currently delay or prevent new solar projects from being contracted or constructed, for example by limiting the scope of open permits to the affected trade or limiting duration of the open permit.
  - Integrate solar inspections with all other electrical inspections.

COMMERCIAL SOLAR

current: 1.4 MW *goal 2016: 20 MW* *goal 2020: 55 MW*

The Committee believes Austin Energy can conservatively achieve 50-60 MW of commercial solar by 2020 through the PBI program.

- PBI Program:
  - Gradually increase forecast annual PBI commitments while phasing the PBI incentives level to zero by the end of 2020. The Committee believes Austin Energy can conservatively achieve 50-60 MW of commercial solar by 2020 through the PBI program while conforming to these criteria,[vi] and that a goal of consistently increasing annual installed capacity best prepares the market for continued growth after 2020.
  - Increase the PBI project eligibility cap to 1MW AC to capture economies of scale and to enable Austin Energy to hasten lower PBI rates toward phase out.
  - Consider offering PBI options targeted to small and large commercial customers, and to non-profit organizations, such as offer a higher-rate, shorter-term (5 year) PBI option to improve financial performance of commercial solar investments, a combination of a small capacity rebate and reduced PBI payments, or allowing PBIs in conjunction with solar leasing.
- Commercial Rates:
  - Recognize that solar reduces aggregate demand during system peaks by offering a credit against the demand/capacity charge for commercial customers with solar generation, calculated as a percentage of installed solar capacity.
  - Increase the net metering rate eligibility cap to match the PBI program eligibility cap.
- Transparency: Request Austin Energy to produce and annually update a 5-year projection of commercial solar program goals (MW installed), and anticipated average installed costs, PBI contract rates and terms, and PBI program budgets. Such projections would be non-binding, but would provide a signal to sector partners and the solar installer community of anticipated program direction.

- Additional Options:
  - Establish community solar or solar green choice options for commercial and industrial customers.
  - Consider allowing large commercial and industrial customers to opt into self-directed solar programs, in which solar-related fees paid into the energy efficiency program may instead be directly and verifiably invested in solar at their own facilities selected through a competitive process.
  - Study the efficacy of applying the value of solar rate to commercial solar installations in lieu of proposed demand credits.
  - Obtain a legal opinion on whether PBI payments made as credits against consumption are taxable transactions that require utility reporting as income.

LOCAL UTILITY-OWNED OR -CONTRACTED SOLAR

current: 31 MW goal 2016: 45-80 MW goal 2020: 100 MW

Investments in local utility-owned or -contracted solar merge cost benefits of larger-scale development with value benefits accruing to the local economy.

Utility-owned or -contracted local solar refers to solar installations from approximately 1-2 MW to as large as 10-20 MW in and around Austin, developed on rooftops, as covered parking facilities, or on empty lots in and around Austin and interconnected to the distribution system for direct sale of energy through power purchase agreements (PPAs) to Austin Energy. Such systems play an important part in both of the larger scenarios studied, and merge cost benefits of larger-scale development with value benefits accruing to the local economy. The Committee estimates that larger utility-scale projects in the local area can be installed at 50-70% of the cost of a residential rooftop system. Energy from these systems may be bundled with all energy and/or sold under voluntary new community solar or solar green choice models.

- The Committee believes a 100 MW goal for local utility-owned or contracted solar is technically and economically achievable.[vii]
- Implement a reverse auction or standard offer mechanism to procure utility-contracted local solar prior to the end of 2016, when the current federal investment tax credit (ITC) is scheduled to decrease from 30 percent to 10 percent, in which multiple project developers may bid and/or sign standard PPAs with the utility.
- Facilitate a competitive rooftop lease bid process, in which local building owners, including commercial and industrial customers, owners of multifamily housing, houses of worship and non-profit organizations bid available rooftop space for use by Austin Energy to host local solar generating systems. This could include a combination of payment/credit in exchange for space.
- When possible, bundle large local procurements together with utility-scale developments and other opportunities to serve the local distributed and customer-owned markets in Austin, leveraging the scale of Austin's solar procurement plans to attract capital investment and sustainable jobs to Austin.

- The City should facilitate coordination with taxing jurisdictions within Austin Energy's service area to encourage an area-wide predictable and consistent approach to potential property tax abatements for large local solar projects.

OTHER UTILITY-SCALE SOLAR

current: 0 MW *goal 2016: 50-80 MW* *goal 2020: 200 MW*

The remaining 200 MW of the recommended 400 MW goal would be met through other, utility-scale solar. Given that the City already has a goal of 200 MW of solar, and that Austin Energy's existing plans anticipate the majority of this goal would be met with utility-scale solar, the Committee's recommendation for other utility scale solar represents a relatively small increase from current plans. The Committee has not provided a specific timetable for acquisition of these utility-scale solar assets, and instead encourages Austin Energy to take a flexible approach that capitalizes on purchasing opportunities through 2020 and, whenever practicable, bundling those opportunities with other measures that may support local solar and economic development goals.[viii]

DEVELOPING OPTIONS FOR SOLAR FINANCING

Financing has been identified as a gateway to scaling local solar, enabling a speedier reduction of rebates and incentives.

Availability of financing options has been identified as a gateway to scaling solar in Austin, enabling a speedier reduction of rebates and incentives. Many approaches to financing of solar generating systems, however, are complicated by tax law and regulatory implications.

- We recommend that Austin Energy actively engage the financial community and other stakeholders to identify and promote appropriate financial products to all solar customers,through collaboration with the solar industry.
- Austin Energy should explore the option, value, and feasibility of on-bill repayment mechanisms, grants or other low interest options to provide access for customers. Additional consideration should be given to enable lease or lease-to-own options that could extend the payments and increase access to customers [ix] who may not have access to traditional financing options.
- The City should work to expand financing options, including leases, through strategic financing partnerships, increase consumer awareness of such options through co-marketing efforts, and identify and actively work to mitigate current legal and regulatory barriers to financing.
- For underserved markets, the City should develop financing models that enable the City or its utility to participate materially and in a financially sustainable manner.
- The City should retain outside counsel to prepare careful legal and regulatory review of proposed tariff structures associated with all proposed financing models.

- The City should explore options to expand availability of financing for solar and energy efficiency improvements, including:
    - Commercial financing and leases such as private lending partners or utility sponsored lease models;
    - Co-development with industry partners of a model third party ownership lease or PPA contract eligible for use in Austin Energy's service area;
    - Municipal mechanisms such as property assessed clean energy (PACE) financing and on-bill repayment; we recommend that the City support the passage of PACE-clarifying legislation in Texas.

EXPANDING SOLAR ACCESSIBILITY

Community solar initiatives may leverage economies of scale and available tax benefits which would enable solar investment by residents and businesses that may be unable or unwilling to install a system on their own property. Austin Energy's existing GreenChoice program offers a proven model that could be extended to solar power to allow all citizens to benefit from the cost savings of larger solar projects. Both have the potential to expand access to solar by deepening the pool of customers able to voluntarily consume solar energy in Austin.

- The City should foster development of community solar and/or solar green choice options, particularly as a vehicle for enabling access to solar by all Austinites, while pursuing careful legal and regulatory review of proposed tariff structures associated with these models.
- The City should work with residential, commercial and industrial developers to identify and facilitate opportunities for solar to be incorporated into infrastructure buildout plans, and financed via mechanisms, such as municipal utility districts, designed for that purpose, especially in conjunction with meeting 2015 net zero capable building codes.

Photo credit: Meridian Solar

- The City should eliminate the currently adopted Uniform Solar Code in favor of nationally accepted practices addressed in the latest fire safety and electrical codes.
- The potential grid-stability impacts of increased PV market penetration need to be analyzed as growth occurs, and this information used to advise potential business model or program alterations for the utility.

IMPACTS SUMMARY

UTILITY COSTS

The Committee modeled costs associated with meeting its recommended goals for local and non-local solar development.

- The Committee estimates the total nominal cost to Austin Energy of meeting its recommended goal to be approximately $36 million from 2013 to 2020, with annual costs peaking at $7.6 million in 2014. These costs include both local and non-local solar goals as recommended.
- In nominal terms, the cost of meeting local solar goals only is estimated to be approximately $60 million from 2013 to 2020; these costs are partially offset by savings achieved from non-local solar.

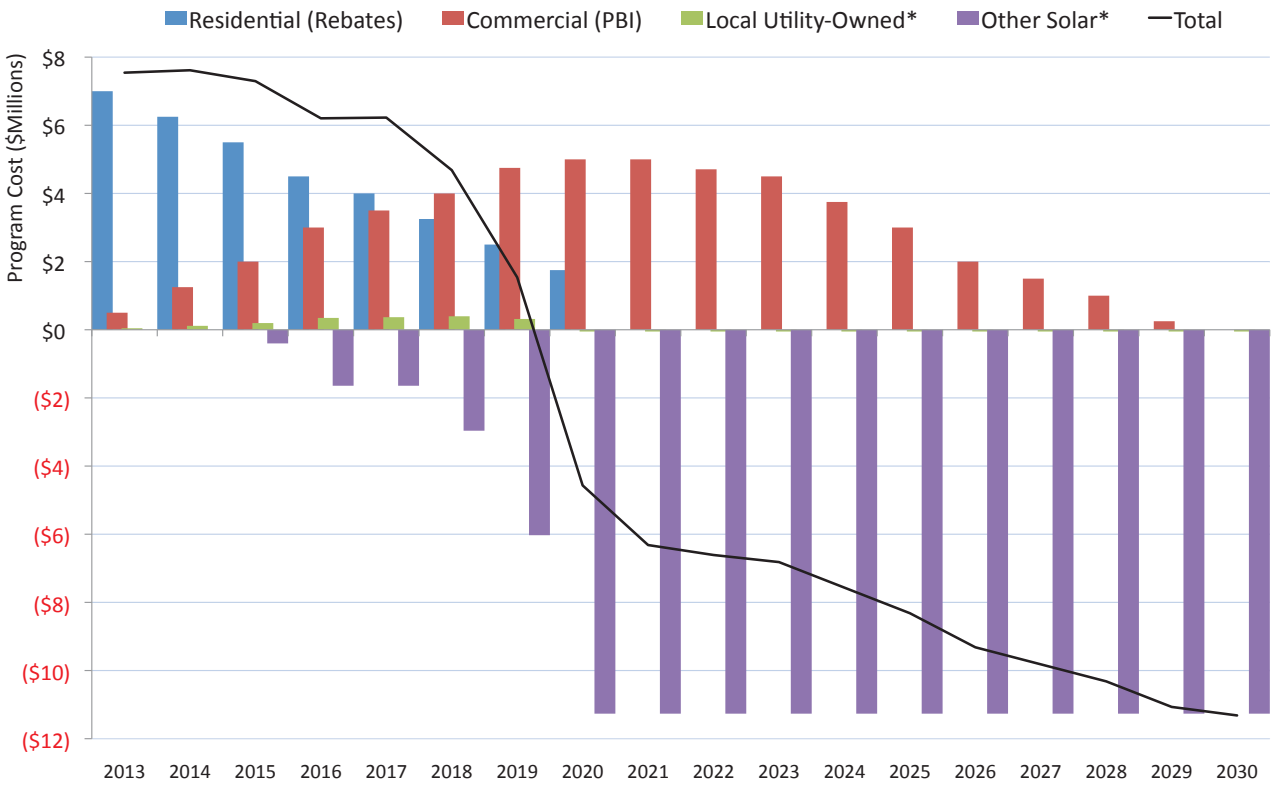
Estimated costs, from 2013 to 2020, and from 2013 to 2030, are summarized in the table below.

Program Costs (millions)

	2013-2020		2013-2030	
Total Costs	Nominal	$NPV_{5\%}$	Nominal	$NPV_{5\%}$
Residential (Rebates)	$34.75	$29.31	$34.75	$29.31
Commercial (PBI)	$24.00	$18.29	$49.71	$33.02
Local Utility Owned*	$1.73	$1.37	$1.21	$1.10
Other Solar*	($23.94)	($17.11)	($136.60)	($75.98)
Total	**$36.54**	**$31.87**	**($50.93)**	**($12.56)**

**Net solar cost versus new natural gas generation.*

The year by year impact of these costs (and savings) is illustrated in the chart below. Further details are provided in the end notes.[x]



** Net solar cost versus new natural gas generation.*

Recommended investments in solar peak at 0.30 percent (less than one half of 1 percent) of anticipated revenue in 2013, and decline to produce savings of 0.64 percent of anticipated revenues in 2020.

- Residential rebates comprise the largest portion of total costs in the earliest years, starting with $7 million in 2013, but diminish by 2020 as the residential rebate program is reduced.
- Commercial PBI payments increase annually through 2020, peaking at $5 million per year in 2020 and diminishing thereafter as PBI contracts expire.
- The net cost of long-term contracts for local utility-owned or -contracted solar ramp from $0 to approximately $0.4 million per year in 2018, and begin to produce annual savings by 2020 due to expected savings from local solar relative to new gas generation.
- The net cost of contracts for other large solar are expected to produce savings relative to new gas generation throughout the study period.
- The costs modeled by the Committee include only solar commitments made through 2020, though the annual obligations resulting from these commitments are modeled through 2030. The City may decide to make additional solar commitments after 2020, but these are not modeled for the purposes of this analysis.

UTILITY COSTS AS A PERCENTAGE OF ANTICIPATED REVENUE

The Committee calculated the costs of its recommendation as a percentage of anticipated utility revenue through 2020. We used a conservative estimate for anticipated revenue, deriving values for each year by starting with 2011 reported annual revenue and increasing that amount by 2 percent annually. This conservative estimate is likely to overestimate the magnitude of the impact of the Committee's recommended goal relative to total revenues. The table below shows that the recommended investments in solar peak at 0.30 percent (less than ½ of 1 percent) of anticipated revenue in 2013, and decline to produce savings of 0.64 percent of anticipated revenues in 2020. Investments in local solar comprise a portion of this total, declining from 0.30 to 0.20 percent of anticipated annual revenue by 2020.

Year	Solar Cost as & of Estimated Total Revenue (Local, Other)	% of Estimated Total Revenue (Local Only)	Aff. Limit
2013	0.30%	0.30%	2.00%
2014	0.30%	0.30%	2.00%
2015	0.27%	0.30%	2.00%
2016	0.18%	0.31%	2.00%
2017	0.18%	0.31%	2.00%
2018	0.05%	0.28%	2.00%
2019	-0.19%	0.27%	2.00%
2020	-0.64%	0.20%	2.00%

These figures indicate that utility investments required to meet the 400 MW goal as recommended by the Committee could be under the current 2 percent annual affordability limit, depending on the cost of new gas generation and solar prices looking forward. Flexibility (timing and capacity) in utility/contractor owned purchases will be crucial to accommodate deviations of new natural gas and solar prices from those assumed in the analysis. Further details and methodology are provided in the end notes.[xi]

LOCAL ECONOMIC DEVELOPMENT BENEFITS

While local solar has greater installed costs, its local benefits greatly exceed those associated wtih development of larger-scale and far-away solar installations on a per-MW basis.

Local economic development impacts associated with the recommended 400 MW goal were estimated using the National Renewable Energy Laboratories' Jobs and Economic Development Impact (JEDI) model. JEDI estimates the number of jobs and economic impacts to a local area that can reasonably be supported by a power plant, fuel production facility, or other project. Jobs, earnings, and output are distributed across three categories: project development and onsite labor impacts, local revenue and supply chain impacts, and induced impacts. More information about the JEDI model is provided in the end notes.[xii]

The following table shows JEDI model outputs which demonstrate that local benefits associated with local solar development greatly exceed the local benefits associated with development of larger-scale and far-away solar

installations, on a per MW basis. While local solar has greater installed costs, the local economic development impact of such projects is substantial. A more detailed version of the same JEDI output table is included in the endnotes.[xiii]

	Residential	Commercial	Large Local	Large Non-Local
Installed Cost* ($/W dc)	$3.90	$3.30	$2.40	$1.80
Local Jobs				
During construction and installation period	341	281	165	--
During operating years	2.60	1.48	1.25	--
Local Wages $000				
During construction and installation period	$15,512	$13,398	$7,508	--
During operating years	$137	$81	$69	--
Local Economic Output $000				
During construction and installation period	$42,575	$35,670	$19,511	--
During operating years	$259	$151	$126	--

**Installed costs are estimated at reported 2012 costs from working group reports and industry information. Local jobs, wages, and economic output are modeled using 2011 wage information in the JEDI model. The committee's modeling of economic impacts using the JEDI model does not consider local tax or manufacturing benefits. The local economic impacts of large non-local solar investments are assumed to be negligible, though these impacts can be improved through purchasing and contracting strategies that consider and reward local economic development.*

Meeting the recommended goal of 200 MW of local solar is estimated to result in the creation of 3,364 local job-years, local wages of $157 million, and total economic output of $360 million by 2020.

Starting from local solar cost assumptions used consistently throughout the analyses in this report, the JEDI model estimates local economic benefits associated with the 200 MW of local solar development recommended in this plan as follows:

- Local Jobs and Wages. The buildout scenario of 200 MW of local solar is estimated to result in the creation of 3,364 local job-years (2,514 of these are direct jobs, 850 are induced), with an average of 420 local direct and induced jobs each year from 2013 to 2020. Average wages associated with these local direct and induced jobs are estimated to be approximately $46,000 per year, and local wages through 2020 total $157 million. The net present value (discounted at 5%) of these local wages totals $124 million.

- Local Economic Output. Local economic output resulting from the buildout of 200 MW of local solar as recommended totals $360 million, with a net present value (discounted at 5%) of $285 million.

- Potential Additional Impact of Non-Local Solar. The benefits shown here accrue only from investments in 200 MW of local solar, and may be enhanced by investments in non-local solar using purchasing and contracting strategies that consider and reward local economic development.

A more detailed table of year-by-year results is summarized in the end notes.[xiv]

In nominal terms, subtracting the $36 million in total program costs from the $360 million in total local economic output yields a net benefit to Austin of approximately $324 million. These findings are consistent with the approach taken by Austin Energy in calculating a "value of solar," but include local economic development benefits of solar to the entire community, whereas the current "value of solar" tariff recognizes only those benefits directly realized by the utility.

HEALTH AND ENVIRONMENTAL BENEFITS

Offsetting energy production with solar produces local health benefits, reduces water used in the production of energy, reduces smog, and promotes healthier ecosystems and cleaner rivers, soils and air.

The environmental benefits calculated here represent the offset of real economic costs to the community such as emergency room visits, premature deaths, and missed work days due to health impacts from pollution. Our estimate of these benefits is based on a review of the leading academic literature on the subject of economic impacts of fossil fuel emissions from Harvard, MIT and the National Academies of Science.[xv]

- Based on this review we estimate the economic impact of pollution that could be offset by 200 MW of local solar as recommended herein to be approximately $15 million.

This figure only includes the benefits from 200 MW of locally developed solar, under the assumption that those resources would be used to offset local fossil generation. It is also possible to use non-local solar to offset local fossil generation, which could as much as double these local benefits. Finally, we note that these health impacts may not entirely accrue with Austin Energy's service area due to the geographic dispersion of Austin Energy's generation portfolio.

Of course, the calculation of the economic value of health benefits derives from assumptions about solar offsetting energy production from fossil fuels, and reducing associated emissions of NO_x, SO_x, CO_2, mercury, and particulate matter. Offsetting fossil-based energy production also reduces water used in the production of energy, and provides other local environmental benefits which are not quantified here, such as reduced smog, healthier ecosystems, and cleaner rivers, soils, and air.

ADDITIONAL BENEFITS

Additional benefits of increased development of local solar include:

- Reduced water consumption compared with traditional energy generation;
- Reduced fuel costs and operating and maintenance costs;
- Stability of energy costs and a hedge against fuel price volatility;
- With the current and conservative cost estimates, this can be done without significant increase in rates to consumers;
- Increased opportunities for local jobs, potential attraction of manufacturing or assembly industries, development of a regional innovation cluster;
- Supports the utility business plan into the future; and
- Maintains the City's position as a leader in clean energy.

Photo credit: SolarBridge Technologies

After accounting for the costs of rebates, PBI payments and the differential costs of local solar compared to other options for new generation, the Committee's recommended goal appears to yield significant net economic and environmental benefits, neither of which are fully accounted for in the cost benefit analysis of current fuel and energy purchases by Austin Energy.

OPEN QUESTIONS

The Committee acknowledges that significant planning by the City and Austin Energy will be required to account for additional program management and administrative support as well as address and implement upgrades in transmission and distribution infrastructure including energy control management systems in order to accommodate and optimize the solar distributed generation prescribed in this plan.

Further study in the intersection on how demand charges interact with solar energy for commercial customers is warranted. There is a consensus that demand charges complicate solar investment decisions, but a fuller understanding of the context is needed. Of particular value is the utility perspective: the value of these charges, whether or not commercial customers with on-site solar generation fit with the monthly peak demand profile used to determine demand charges, and if not, how this model can be altered to maximize value for the utility and the customer.

CONCLUSION

The members of the Austin Local Solar Advisory Committee, representing a broad cross-section of the community and a variety of interests, respectfully submit this Strategic Plan to the Austin City Council. Through numerous meetings over 5 months, we have worked diligently to present achievable goals and thoughtful recommendations for optimizing utilization of Austin's abundant local solar resource. Our plan is fiscally sound and affordable, supportive of our municipally-owned utility, and results in net economic and environment benefits for the community. It represents a path forward for Austin to become an optimal environment in which solar can grow, keeping Austin a healthier, economically vibrant, and visionary community for years to come.

END NOTES

[i] Committee Working Group Reports and Supplementary Work Products. Working Group reports provided valuable background information to the full Committee, and most addressed topics specifically referenced in the Council resolution which created the Committee. However, Working Group final reports were not formally adopted by the full Committee; therefore findings and recommendations proposed in Working Group reports may or may not reflect findings and recommendations adopted by the full Committee in this Strategic Plan.

- Mission and Values Working Group Final Report
- Technical Working Group Final Report
- Program Evaluation Working Group Final Report
- Legal and Regulatory Review Working Group Final Report
- Economic Development, Environment, and Community Working Group Final Report
- Scenarios Development Working Group Final Report

Supplementary work products received by the Committee include:

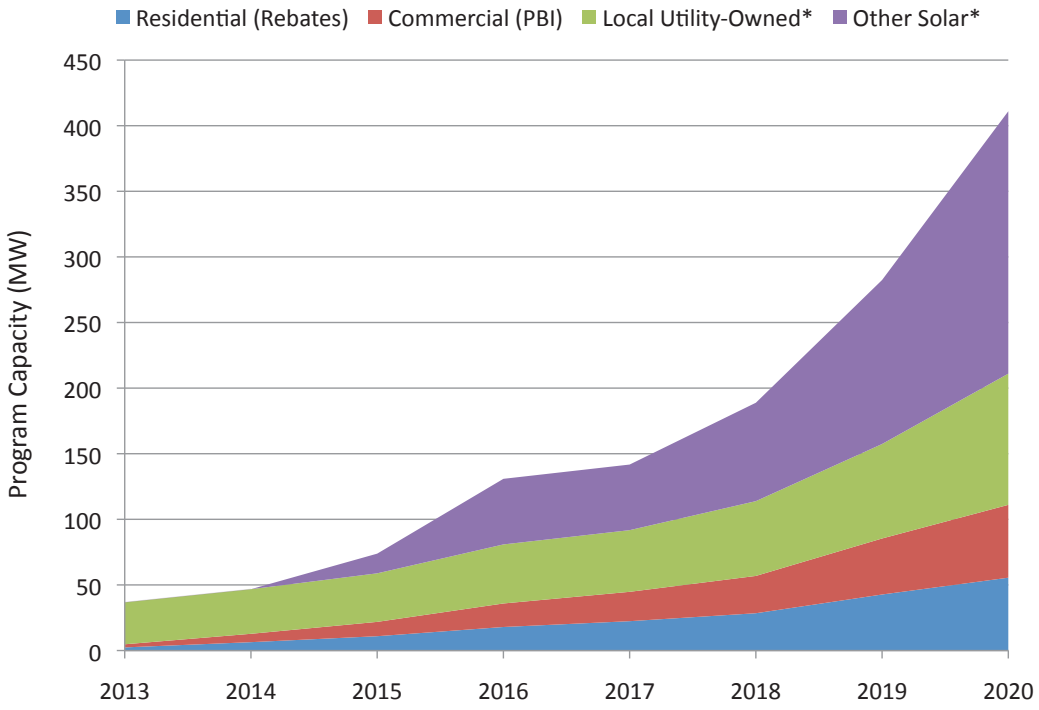
- Local Solar GIS Map (prepared by Austin Energy)
- Best Practices Summary (prepared by Pecan Street Inc.)
- Data Analysis (prepared by Pecan Street Inc.). Includes data on installation costs for residential PV systems; gross power generation, net energy consumption, and impact on the grid of PV systems on a monthly basis; generation, consumption, and grid impact throughout time of day, differentiated for south- vs. west-facing solar arrays; and Impacts on customer's utility bill for both old and new (approved in 2012) rate structures.

This Strategic Plan and many of these supplementary reports and work products are available on the City of Austin's website at http://www.austintexas.gov/department/austin-local-solar-advisory-committee or at a subsequent archived address.

[ii] Calculations assume 2011 total sales of 12.7 million kWh per Austin Energy's 2011 Annual Report, and an annual growth rate of 1.6% or 2.5%, with the low representing forecasted growth after accounting for projected demand savings, and the high representing an average of the 5 years of growth rates reported in the 2011 Annual Report. Solar energy contributions are based on production factors for typical residential, commercial, large local, and other large utility-scale PV systems using the National Renewable Energy Laboratories' online modeling tool, PVWatts version 1.

[iii] A range is provided for 2016 interim local and other utility-owned or -contracted solar. The low end of the range is based on back-end loaded solar purchases to take advantage of potentially lower solar equipment prices, and possible extension of the federal investment tax credit, which is scheduled to expire in 2016. The higher end of the range allows for the City and Austin Energy to take advantage of current global solar equipment oversupply conditions, and scheduled expiration of the federal investment tax credit in 2016. Our intent in providing a range for the interim goal is to recognize uncertainty and provide Austin Energy with discretion, based on its forecasts for natural gas, transmission, and solar prices.

[iv] The figure below illustrates cumulative capacity additions resulting from the buildout scenario analyzed by the Committee. Figures in the chart sum to slightly more than 400 MW due to slight planned overages in the residential rebate and commercial PBI programs. In presenting these buildout scenarios for analysis, it is not the Committee's intent to prescribe particular annual targets toward achievement of the larger goals recommended by the Committee, but rather to provide a benchmark for the Committee's economic modeling and to demonstrate that such a goal is achievable while allowing Austin Energy flexibility in its approach toward meeting the goal.



[v] Residential Solar. The Committee's analyzed approach to the Residential Solar appears below. In presenting the table, it is not the Committee's intent to prescribe particular annual targets toward achievement of the larger goals recommended by the Committee, but rather to provide a benchmark for the Committee's economic modeling and to demonstrate that such a goal is achievable while allowing Austin Energy flexibility in its approach toward meeting the goal.

Residential Rebate Program

	pre-2013	2013	2014	2015	2016*	2017	2018	2019	2020
MWac (annual)		4.0	4.2	4.4	4.5	5.3	5.9	6.3	7.0
MWac (cumulative)	6.4	10.4	14.6	19.0	23.5	28.8	34.7	41.0	48.0
Installed costs ($/Wdc)	$3.90	$3.65	$3.41	$3.19	$2.98	$2.79	$2.61	$2.44	$2.28
Rebate Level ($/Wac)	$2.00	$1.75	$1.50	$1.25	$1.00	$0.75	$0.55	$0.40	$0.25
Rebate Budget ($M)	$4.00	$7.00	$6.25	$5.50	$4.50	$4.00	$3.25	$2.50	$1.75

Production factor is assumed to be 1,300 kWh/kWac, with a DC-AC derating factor of 0.95.

Total Incentives (2013-2020): $34.75M After 2020: $0

$NPV_{5\%}$ of Incentives (2013-2020): $29.31M After 2020: $0

** The current federal investment tax credit (ITC) is scheduled to decrease from 30 percent to 10 percent in 2016. Modeling does not assume the effect of this expiration on nominal and after-tax costs.*

[vi] Commercial Solar. By presenting the table below, it is not the Committee's intent to prescribe particular annual targets toward achievement of the larger goals recommended by the Committee, but rather to provide a benchmark for the Committee's economic modeling and to demonstrate that such a goal is achievable while allowing Austin Energy flexibility in its approach toward meeting the goal.

Commercial PBI Program

	2012	2013	2014	2015	2016*	2017	2018	2019	2020
MWac (annual)		1.0	4.0	4.5	7.0	4.4	6.1	14.3	12.8
MWac (cumulative)	1.4	2.4	6.4	10.9	17.9	22.4	28.4	42.7	55.5
Installed costs ($/Wdc)	$3.30	$3.05	$2.80	$2.60	$2.40	$2.20	$2.00	$1.85	$1.60
Annual PBI Budget ($M)	$0.14	$0.14	$0.125	$0.110	$0.095	$0.075	$0.055	$0.035	$0.013
Amt.: new projects ($M)		$0.21	$0.75	$0.75	$1.00	$0.50	$0.50	$0.75	$0.25

Assumes 10 year PBI contracts.

Production factor is assumed to be 1,276 kWh/kWdc, per PVWatts v.1 modeled at 5% tilt, due south orientation in Austin. Conversion from kWh/kWdc to kWh/kWac assumes a DC-AC conversion factor of 0.85.

Annual PBI commitment costs peak at $5M/yr in 2020 and 2021 and taper to $0/yr in 2030.

Total Incentives (2013-2020): $24.00M After 2020: $25.71

Total (through 2030): $49.71

NPV5% of Incentives (2013-2020): $18.29M NPV5% of Incentives (through 2030): $33.02M

** The current federal investment tax credit (ITC) is scheduled to decrease from 30 percent to 10 percent in 2016. Modeling does not assume the effect of this expiration on nominal and after-tax costs.*

[vii] Local Utility-Owned or -Contracted Solar. By presenting the table below, it is not the Committee's intent to prescribe particular annual targets toward achievement of the larger goals recommended by the Committee, but rather to provide a benchmark for the Committee's economic modeling and to demonstrate that such a goal is achievable while allowing Austin Energy flexibility in its approach toward meeting the goal.

Local Utility-Owned Or -Contracted Solar

	2012	2013	2014	2015	2016*	2017	2018	2019	2020
MWac (annual)		1.0	2.0	3.0	8.0	2.0	10.0	15.0	28.0
MWac (cumulative)	31.0	32.0	34.0	37.0	45.0	47.0	57.0	72.0	100.0
MW AC (cumulative, excl. WSP)	-	1.0	3.0	6.0	14.0	16.0	26.0	41.0	69.0
Solar Contract Cost ($/kWh)	$0.110	$0.107	$0.103	$0.100	$0.097	$0.094	$0.092	$0.089	$0.086
New Gas Cost ($/kWh)	$0.080	$0.082	$0.083	$0.085	$0.087	$0.088	$0.090	$0.092	$0.094
Net Solar Cost ($/kWh)	$0.030	$0.025	$0.020	$0.015	$0.011	$0.006	$0.002	-$0.003	-$0.008
Production Factor (kWh/kWac)	1,750	1,750	1,750	1,750	1,750	1,750	1,750	1,750	1,750
Net Solar Cost ($M)		$0.04	$0.11	$0.20	$0.35	$0.37	$0.40	$0.32	-$0.05

Net solar cost is the difference between estimated contracts for new solar and new gas generation. Net solar cost excludes the cost of the already-contracted Webberville Solar Project (WSP), though this project is counted toward meeting the recommended goal.

Levelized cost of solar in 2012 assumes $2.50/watt for ground-mounted single-axis tracking per Lazard's Levelized Cost of Energy Analysis – Version 5.0, 2011, blended with smaller rooftop and ground-mounted installations in the range of $136-$192/MWh. This estimate of solar costs is high relative to current committee estimates, which show large local solar costs at $2.40/watt. Solar costs are assumed to decrease at 3% per year.

Levelized costs of new gas generation are estimated by Lazard's Levelized Cost of Energy Analysis – Version 5.0, 2011 in the range of $69-$97/MWh; modeling assumes $80/MWh. New gas costs are assumed to increase at 2% per year. These values are conservative compared to findings presented in the Committee's working group reports.

Net solar cost (2013-2020): $1.73M (continues at -$0.05/yr after 2020, assuming no new acquisition).

$NPV_{5\%}$ of net solar costs (2013-2020): $1.37M.

Total (through 2030): $1.21M. $NPV_{5\%}$ (through 2030): $1.10M.

Both total values assume no new acquisition after 2020, and all contract lengths through 2030.

** The current federal investment tax credit (ITC) is scheduled to decrease from 30 percent to 10 percent in 2016. Modeling does not assume the effect of this expiration on nominal and after-tax costs.*

[viii] Other Utility-Scale Solar. The Committee's cost modeling for Other Utility-Scale Solar is presented below. By presenting the table below, it is not the Committee's intent to prescribe particular annual targets toward achievement of the larger goals recommended by the Committee, but rather to provide a benchmark for the Committee's economic modeling and to demonstrate that such a goal is achievable while allowing Austin Energy flexibility in its approach toward meeting the goal.

Other Utility-Scale Solar

	2012	2013	2014	2015	2016*	2017	2018	2019	2020
MWac (annual)	-	-	-	15.0	35.0	-	25.0	50.0	75.0
MWac (cumulative)	-	-	-	15.0	50.0	50.0	75.0	125.0	200.0
Solar Contract Cost ($kWh)	$0.080	$0.078	$0.075	$0.073	$0.071	$0.069	$0.067	$0.065	$0.063
New Gas Cost ($/kWh)	$0.080	$0.082	$0.083	$0.085	$0.087	$0.088	$0.090	$0.092	$0.094
Net Solar Cost ($/kWh)	$0.000	-$0.004	-$0.008	-$0.012	-$0.016	-$0.020	-$0.023	-$0.027	-$0.031
Production Factor (kWh/kWac)	2,250	2,250	2,250	2,250	2,250	2,250	2,250	2,250	2,250
Net Solar Cost ($M)		$0.00	$0.00	-$0.40	-$1.64	-$1.64	-$2.96	-$6.03	-$11.27

Net solar cost is the difference between estimated contracts for new solar and new gas generation.

Production factor is assumed to be 2,036 kWh/kWdc, per PVWatts v.1 modeled at latitude tilt, due south orientation, single axis tracker in Midland. Conversion from kWh/kWdc to kWh/kWac assumes a DC-AC conversion factor of 0.90.

Levelized cost of solar in 2012 assumes $2.50/watt for ground-mounted single-axis tracking per Lazard's Levelized Cost of Energy Analysis – Version 5.0, 2011. This estimate of solar costs is high relative to current committee estimates, which show large solar costs as low as $1.80/watt. Solar costs are assumed to decrease at 3% per year.

Levelized costs of new gas generation are estimated by Lazard in the range of $69-$97/MWh; modeling assumes $80/MWh. New gas costs are assumed to increase at 2% per year. These values are conservative compared to findings presented in the Committee's working group reports.

Total Cost (2013-2020): -$23.94M. $NPV_{5\%}$ of Costs (through 2020): -$17.11M.

Total (through 2030): -$136.60M. $NPV_{5\%}$ (through 2030): -$75.98M.

Both total values assume no new acquisition after 2020, and all contract lengths through 2030.

* The current federal investment tax credit (ITC) is scheduled to decrease from 30 percent to 10 percent in 2016. Modeling does not assume the effect of this expiration on nominal and after-tax costs.

[ix] Existing options relevant to the residential sector include: unsecured loans, lines of credit, and credit cards; home equity loans or lines of credit; FHA or VA energy efficiency mortgages; and FHA and conventional renovation loans.

[x] The cost chart is built from the solar cost estimates provided previously for each market segment, but carried forward through 2030. Summary tables through 2030 are provided below.

Annual Costs ($M)	2013	2014	2015	2016	2017	2018	2019	2020	2021
Residential (Rebates)	$7.00	$6.25	$5.50	$4.50	$4.00	$3.25	$2.50	$1.75	$0.00
Commercial (PBI)	$0.50	$1.25	$2.00	$3.00	$3.50	$4.00	$4.75	$5.00	$5.00
Local Utility-Owned*	$0.04	$0.11	$0.20	$0.35	$0.37	$0.40	$0.32	($0.05)	($0.05)
Other Solar*	$0.00	$0.00	($0.40)	($1.64)	($1.64)	($2.96)	($6.03)	($11.27)	($11.27)
Total	$7.54	$7.61	$7.30	$6.20	$6.23	$4.68	$1.54	($4.57)	($6.32)

Annual Costs ($M)	2022	2023	2024	2025	2026	2027	2028	2029	2030
Residential (Rebates)	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Commercial (PBI)	$4.71	$4.50	$3.75	$3.00	$2.00	$1.50	$1.00	$0.25	$0.00
Local Utility-Owned*	($0.05)	($0.05)	($0.05)	($0.05)	($0.05)	($0.05)	($0.05)	($0.05)	($0.05)
Other Solar*	($11.27)	($11.27)	($11.27)	($11.27)	($11.27)	($11.27)	($11.27)	($11.27)	($11.27)
Total	($6.61)	($6.82)	($7.57)	($8.32)	($9.32)	($9.82)	($10.32)	($11.07)	($11.32)

[xi] 2011 annual revenues were derived from Austin Energy's 2011 Annual Report, Table 31, and grown at 2 percent annually through 2020. Annual program cost data are equivalent as described above, less $4M per year to account for 2012 baseline spending, which is not applied against the 2% affordability limit per AE staff.

		Cost of Recommended Goals ($M)							
Year	Est. Total Revenue ($M)	Residential	Commercial	Large Local	Large Other	Less 2012 Baseline	Total Applied Against Aff. Limit	Solar Cost as % of Est. Total Revenue	Solar Cost as % of Est. Total Revenue (Local Only)
2013	$1,167	$7.00	$0.50	$0.04	$0.00	($4.00)	$3.54	0.30%	0.30%
2014	$1,191	$6.25	$1.25	$0.11	$0.00	($4.00)	$3.61	0.30%	0.30%
2015	$1,215	$5.50	$2.00	$0.20	($0.40)	($4.00)	$3.30	0.27%	0.30%
2016	$1,239	$4.50	$3.00	$0.35	($1.64)	($4.00)	$2.20	0.18%	0.31%
2017	$1,264	$4.00	$3.50	$0.37	($16.64)	($4.00)	$2.23	0.18%	0.31%
2018	$1,289	$3.25	$4.00	$0.40	($2.96)	($4.00)	$0.68	0.05%	0.28%
2019	$1,315	$2.50	$4.75	$0.32	($6.03)	($4.00)	($2.46)	-0.02%	0.27%
2020	$1,341	$1.75	$5.00	($0.05)	($11.27)	($4.00)	($8.57)	-0.64%	0.20%

[xii] Developed by the National Renewable Energy Laboratory (NREL), JEDI estimates the number of jobs and economic impacts to a local area that can reasonably be supported by a power plant, fuel production facility, or other project. JEDI model defaults are based on interviews with industry experts and project developers, but default input values can be overridden by users to account for particular economic characteristics. Economic multipliers contained within the model are derived from Minnesota IMPLAN Group's IMPLAN accounting software and state data files. JEDI models are used by county and state decision-makers, public utility commissions, potential project owners, developers, and others interested in analyzing the economic impacts associated with new or existing power plants, fuel production facilities, or other projects.

Users download the appropriate Excel-based JEDI model and enter basic information about a project, including the state, location, year of construction, and facility size. The model then estimates the project costs (i.e., specific expenditures), and the economic impacts in terms of jobs, earnings (i.e., wages and salary), and output (i.e., value of production) resulting from the project. To the extent a user has and can incorporate project-specific data as well as the share of spending expected to occur locally, the results are more likely to better reflect the actual impacts from the specific project.

To conduct a more specific analysis, users may incorporate project-specific values in place of the default values. No project will follow the exact default pattern for expenditures. Project size, location, financing arrangements, and numerous site-specific factors influence the construction and operating costs. Similarly, the availability of local resources, including labor and materials, and locally manufactured power plant components can have a significant effect on the costs and the economic impacts that accrue to the state or local region.

[xiii] The table below is derived from JEDI modeling and presents additional context to the summary data on local jobs, earnings and economic outputs presented in the body of the report.

All dollar figures in thousands.

	Residential New			Commercial			Large Local		
During construction and installation period	Jobs	Earnings	Output	Jobs	Earnings	Output	Jobs	Earnings	Output
Project Development and Onsite Labor Impacts		$000 (2011)	$000 (2011)		$000 (2011)	$000 (2011)		$000 (2011)	$000 (2011)
Construction and Installation Labor	52	$3,127	-	41	$2,640	-	29	$1,883	-
Construction and Installation Related Services	75	$3,271	-	62	$2,989	-	36	$1,537	-
Subtotal	126	$6,398	$11,284	102	$5,630	$9,926	65	$3,420	$5,742
Module and Supply Chain Impacts									
Manufacturing Impacts									
Trade (Wholesale and Retail)	28	$1,713	$5,190	22	$1,332	$4,035	7	$386	$1,164
Finance, Insurance and Real Estate									
Professional Services	19	$811	$2,986	18	$754	$2,745	9	$379	$1,400
Other Services	30	$2,114	$7,806	19	$1,314	$4,850	16	$1,085	$4,006
Other Sectors	54	$1,362	$3,463	47	$1,624	$3,677	28	$750	$1,541
Subtotal	131	$6,000	$19,444	105	$5,024	$15,307	60	$2,600	$8,111
Induced Impacts	84	$3,115		74	$2,744	$10,438	40	$1,487	$5,658
Total Impacts	**341**	**$15,512**		**281**	**$13,398**	**$35,670**	**165**	**$7,508**	**$19,511**
During Operating Years									
Onsite Labor Impacts									
PV Project Labor Only	2	$90		1	$54	$54	1	$47	$47
Local Revenue and Supply Chain Impacts	1	$31		0	$17	$17	0	$14	$48
Induced Impacts	0	$17		0	$10	$10	0	$8	$30
Total Impacts	**3**	**$137**		**1**	**$81**	**$151**	**1**	**$69**	**$126**

[xiv] The table below presents year by year outputs of JEDI modeling through 2020. Inputs to the model included local solar installation costs and a buildout schedule consistent with those used elsewhere in the analyses presented here.

All dollar figures in thousands.

	2013	2014	2015	2016	2017	2018	2019	2020	Total	$NPV_{5\%}$
Local Jobs	283	225	416	439	564	398	640	398	3,364	NA
Local Wages	$13,074	$10,425	$19,460	$20,549	$26,470	$18,645	$30,030	$18,622	$157,276	$124,223
Economic Output	$32,373	$25,547	$44,253	$46,473	$58,753	$42,787	$66,960	$43,420	$360,566	$285,403

[xv] National Academies of Sciences: "Hidden Costs of Energy: Unpriced Consequences of Energy Production and Use" found these costs to range from 3.2¢/kWh for non-climate damages to 13.2¢/kWh when including climate damages from coal generation. The same study found that climate and non-climate damages from natural gas totaled 5¢/kWh (http://www8.nationalacademies.org/onpinews/newsitem.aspx?RecordID=12794). MIT's "Paying Too Much for Energy? The True Costs of Our Energy Choices" found the combined damages from coal to be 5.6¢/kWh and from gas to be 1.2¢/kWh. This analysis used a mid-range external impact estimate of 5¢/kWh for energy offset by solar power, assumed to be a mix of coal and natural gas generation as has been the case with the fuel mix offset by wind energy.