PROSPECTUS FOR A SUSTAINABLE FUTURE

Recommendations for Implementing UC's Commitment to Climate Neutrality

Report of the University of California Climate Solutions Steering Group
November 2011

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1. **By 2014:** Reduce greenhouse gas emissions to year 2000 levels, per UC Presidential Policy.
2. **By 2020:** Reduce emissions to 1990 levels, per UC Presidential Policy and in compliance with California AB 32, the California Global Warming Solutions Act.
3. **As soon as feasible:** Achieve climate neutrality, per the American College and University Presidents' Climate Commitment, of which UC is a charter signatory.

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Data files for the graphs and tables presented in this report are available upon request.

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Executive Summary

The University of California has adopted policies to aggressively reduce greenhouse gases generated as a result of University activities. UC has committed to the following climate goals:

1. **By 2014:** Reduce greenhouse gas (GHG) emissions to year 2000 levels, per UC Presidential Policy.

2. **By 2020:** Reduce emissions to 1990 levels, per UC Presidential Policy and in compliance with California AB 32, the California Global Warming Solutions Act.

3. **As soon as feasible:** Achieve climate neutrality, per the American College and University Presidents' Climate Commitment (ACUPCC), of which UC is a charter signatory.

The Climate Solutions Steering Group was appointed to advise the Executive Vice President for Business Operations on strategies for moving these commitments from concept to implementation. Our recommendations focus on the ultimate goal of climate neutrality, for three reasons. First is the conviction that it can and must be done, although the technologies required to do so are yet to be fully developed. Second is the understanding that the large-scale investment in clean energy required to meet the 2020 goal will also put climate neutrality within reach. Third is the recognition that many constituencies have a stake in the University's climate actions and outcomes, and serious reputational consequences will ensue should the University fail to achieve any of its climate commitments.

The Scope of the Challenge: Massive

The UC system currently emits approximately 1.7 million metric tonnes of carbon dioxide equivalent ($MTCO_2e$) per year. With growth, the University could be emitting as much as 2 million $MTCO_2e$ by 2014 and 2.15 million $MTCO_2e$ by 2020—twice the allowable emissions level (Figure A).

If aggressive measures are not undertaken to reverse UC's emissions trajectory, the costs associated with emissions will be substantial. As California's market-based emissions regulations take effect, the direct and indirect costs to emit carbon will increase year by year, and campus-based initiatives will not be sufficient to address the challenge.

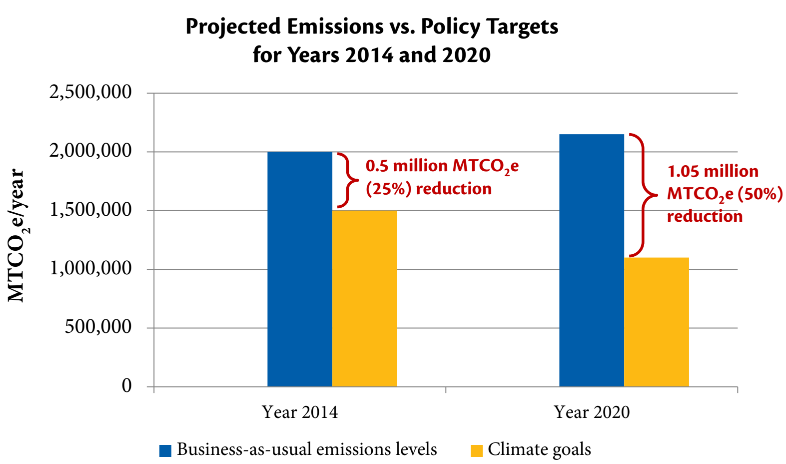


Figure A. Estimated emissions and climate goals in target years, based on current projections.

The University has made remarkable progress in reversing the growth of GHG emissions. Most campuses have launched projects that will attain their 2014 GHG goal, and several campuses have voluntarily adopted more aggressive plans to accelerate their 2020 GHG goal to as early as 2014. However, several campuses will need off-site renewable energy in order to attain the 2014 goal, and essentially all campuses will need large-scale, off-site solutions to achieve the 2020 goal.

Emissions Sources

Emissions are categorized as Scope 1 (direct), Scope 2 (indirect), or Scope 3 (other) based on their source. Each source carries with it specific issues and opportunities.

- **Scope 1 emissions are direct GHG emissions from sources UC campuses control**, primarily from the combustion of natural gas in co-generation (combined heat and power) plants. UC's six co-generation plants account for nearly 40 percent of UC's fixed carbon footprint. This *carbon-efficient* infrastructure can be rendered *climate neutral* by substituting biomethane for natural gas.
- **Scope 2 emissions are indirect GHG emissions generated during production of electricity and steam that UC purchases.** These account for 34 percent of UC's carbon footprint. Utilities will be required to procure a third of their energy from renewable sources by 2020, which will improve UC's carbon footprint, but force utilities to increase their rates.
- **Scope 3 emissions are other indirect emissions from sources not controlled by our institution,** primarily commuting and air travel emissions. These remaining emissions constitute about 25 percent of UC's carbon footprint.

This report focuses on strategies that address the University's Scope 1 and 2 emissions.

Recommended Strategies

The recommended strategies are designed to avert carbon costs and control renewable energy costs while enabling the University to achieve its climate commitments.

1. **Minimize energy consumption through deep energy-efficiency.** Expand the Statewide Energy Partnership (SEP) Program (a comprehensive, multi-year, energy-efficiency retrofit program financed by utility-administered incentives in combination with 15-year, UC-issued revenue bonds) with emphasis on measures that reduce energy consumption by 50 percent or more.

2. **Procure renewable energy at sufficient scale to negate the University's Scope 2 emissions.** Develop a systemwide wholesale power procurement strategy to manage costs and build a carbon-efficient electricity portfolio that is cost-comparable with utility-supplied electricity. This will entail a combination of related strategies:

    a. Comprehensively plan for energy acquisition over a 20-year period to average and stabilize pricing and avoid carbon-driven costs.

    b. Establish the legal and business mechanisms required to import and distribute wholesale power.

    c. Pursue statutory and regulatory changes to enable the wholesale procurement of off-site power.

    d. Seek membership in the Northern California Power Agency (NCPA) to facilitate economies-of-scale and risk-sharing.

3. **Procure biomethane, which is essentially climate neutral, for use in the University's natural gas infrastructure to negate Scope 1 emissions.** Biomethane (harvested from controlled decomposition of organic matter) is essential to neutralize carbon emissions from UC's central plants and to mitigate UC's cap-and-trade compliance costs. Biomethane has been proven at scale in Europe and China, but the U.S. biomethane market is still in its infancy. UC will therefore need to pursue a phased approach to biomethane procurement.

Avoiding the Cost of Carbon

Although there are significant investments associated with the recommended strategies, they will, over time, prove considerably less costly than a passive position of incurring the direct and indirect costs of carbon.

The main drivers of increased costs are the State's greenhouse gas cap-and-trade program and the Renewable Portfolio Standard (RPS). Cap-and-trade regulation will require all major GHG emitters to hold a permit (called an "allowance") for each ton of CO_2e that they emit. The price of an allowance is expected to escalate steeply as the California Air Resources Board scales back the pool of available allowances between 2013 and 2020. The RPS requires the utility companies in California to procure 33 percent of their electricity from renewable sources by 2020. Both the RPS and cap-and-trade will increase costs associated with grid electricity.

Between 2013 and 2020, the University will incur an estimated $126 million to $475 million in added costs. Figure B illustrates a range of possible future costs, with reference to current energy prices. These projected increases are real cost increases in excess of the rate of price inflation, and thus dollar amounts are in 2011 dollars.

Investing in Long-term Energy Strategies to Avoid Carbon Costs

The central challenge in adopting renewable power is the initial added cost when compared to business-as-usual. Although there are significant costs associated with the recommended climate strategies, they will negate carbon costs associated with cap-and-trade regulations, hold down renewable energy costs and, over time, prove considerably less expensive than business-as-usual (Figure C).

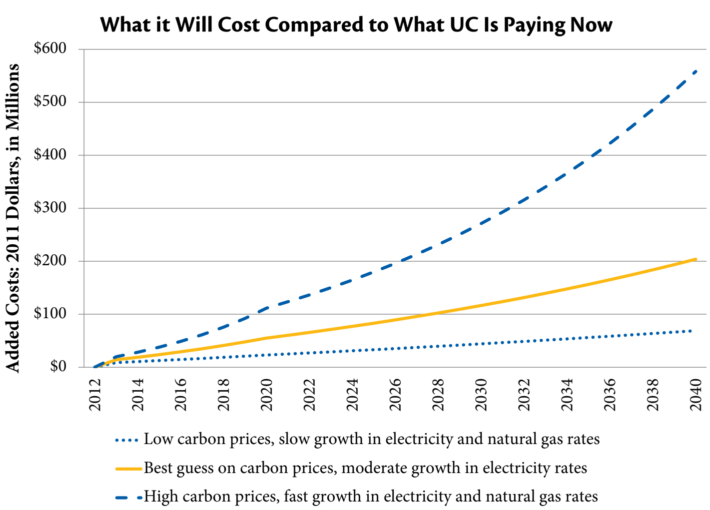


Figure B. Each projection is based on different assumptions regarding carbon prices and the cost escalation rates of electricity and natural gas:

- **Low end: carbon prices stay at the CARB price floor from 2013 to 2020, and escalate by 2.5 percent each year thereafter. Electricity escalates at 1.5 percent, including carbon and RPS costs. Non-carbon-related escalation in natural gas rates is 1 percent.**
- **Mid-range: carbon at $40 in 2020, escalating at 5 percent per year until 2040. Electricity escalates at 3 percent, including carbon and RPS costs. Non-carbon-related escalation in natural gas rates is 1.5 percent.**
- **High-end: carbon hits $90 in 2020 and escalates by 7.5 percent each year thereafter. Electricity escalates at 5 percent, including carbon and RPS costs. Non-carbon-related escalation in natural gas rates is 3 percent.**

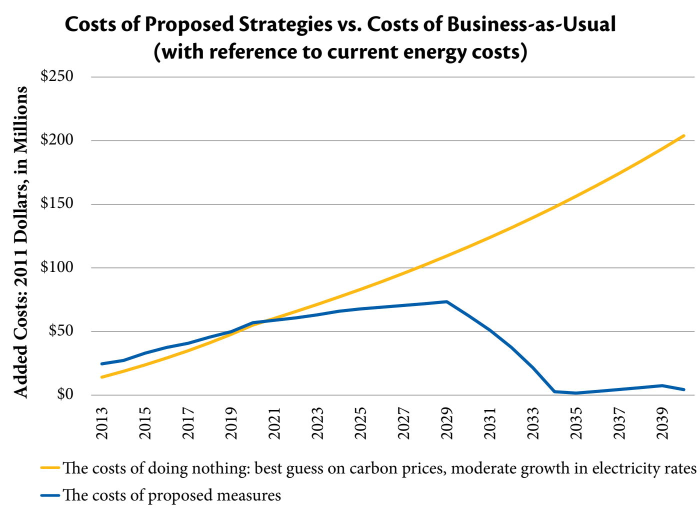


Figure C. The gold line is identical to the mid-range estimate in Figure B. The blue line represents the cost of the proposed recommended strategies. Both projections rely on the same assumptions regarding carbon prices and increases in electricity and natural gas rates. The blue line further assumes that UC steadily increases its supply of biomethane to 30 percent of demand by 2020 (and 95 percent by 2040); UC's wholesale power portfolio meets all RPS requirements; 83 percent of procured electricity is climate neutral by 2020 through procurement of hydroelectricity; and UC's energy-efficiency program more than doubles the annual energy savings of the current program by 2020. Other possible factor-mixes could also meet the 2020 GHG policy goal.

When calculating carbon costs, it should be noted that paying for a cap-and-trade emissions allowance confers the right to emit carbon, but it does not *negate* carbon emissions. Thus, any institution that has signed the ACUPCC to achieve climate neutrality must also factor in the cost of buying carbon attributes, including Renewable Energy Credits (RECs) or carbon offsets, to negate carbon-emitting operations and consumed energy. RECs and offsets essentially pay someone else to abate UC's carbon emissions. They are regarded as last resort strategies in all UC campuses' Climate Action Plans. The Climate Solutions Steering Group has heard no support for a climate solutions strategy that relies on the procurement of carbon attributes.

An Urgent Call To Action

Although UC is making progress through campus-based energy conservation and renewable energy production (primarily solar), and earning awards and high ratings for its sustainability efforts, the University of California is currently not on target to meet its 2020 greenhouse gas emissions goal of attaining 1990 emissions levels.

Moreover, without effective action, UC's facilities and operations will fall seriously out-of-step with the findings that its own faculty are generating. It would be unfortunate if University operations continue to contribute to climate degradation even as our researchers reveal and model its global costs.

It is the position of this report that UC will be better served if it makes proactive investments in carbon abatement measures to lower costs in the long term, instead of passively bearing escalating carbon costs. We advocate a scalable approach that can be ramped up or down, depending on emerging trends of energy and carbon prices. Creative financial strategies are needed that can, in effect, exploit long-term savings to underwrite the initial cost premium of renewables.

Taking Action Now

Four compelling reasons point toward the need to move forward aggressively now:

1. Even modest facilities growth could negate much of the carbon abatement achieved by energy efficiency measures.

2. If no progress is made toward developing or procuring biomethane, UC will have to bear higher costs for natural gas, and incur reputational damage for failing to meet its targets.

3. Renewable energy in the quantities required cannot be developed, or even procured, overnight. The scale of such an endeavor requires aggressive business planning now for the projects that will need to come online during the latter half of this decade.

4. The University's cost of capital is very low at present. This per-year capital expense is comparable to the annual savings increment that will be realized by procuring or investing in renewable power with a lower rate of cost escalation than grid power.

Thus, no financial penalty is incurred for early action to procure renewable power. However, delayed action does incur the penalty of procuring carbon offsets in 2020 if renewable power falls short of what is needed to achieve mandated limits.

Implementing the recommendations of this report will avert carbon costs and create an energy infrastructure that will serve the University with renewable energy through at least mid-century. In addition, establishing the scalable business strategies to accomplish the 2020 emissions goal will equip UC to proceed all the way to its ultimate climate commitment, making it one of the first—and surely the largest—distinguished research university to attain climate neutrality.

The full text of this report can be downloaded at universityofcalifornia.edu/sustainability/climate_action.html

Campuses and medical centers are augmenting energy-efficiency programs with on-site renewable energy. However, the scale of reduction required to meet the 2020 goal and, ultimately, climate neutrality is such that no campus or medical center (with one or two possible exceptions) will be able to meet its energy needs with on-site production.

Understanding the scope of the University's climate reduction challenge is critical to understanding the recommended solutions. The targets for reduction of GHG emissions demand that UC campuses revert to previous decades' emission levels, and they are not growth-adjusted. Based on projected emissions, UC will be 25 percent over its emission target for 2014, and will be emitting at twice the allowable level in 2020, unless aggressive measures are adopted.

PART 1. Background

Recognized for its leadership and level of commitment, UC can be equally recognized for its implementation of strategies to achieve climate neutrality

The Regents of the University of California have adopted policies to aggressively reduce greenhouse gases generated as a result of University of California activities. The University of California Sustainable Practices Policy reflects and supports California environmental policy and law with regard to carbon reduction. UC has also committed to the ultimate goal of climate neutrality, a commitment the University formally embraced along with colleges and universities nationwide, when it became a charter signatory to the American College and University Presidents' Climate Commitment (ACUPCC) in 2007. Climate neutrality means that the UC system will have zero net impact on the earth's climate. This is achieved by minimizing GHG emissions as much as possible, and procuring carbon attributes as necessary to mitigate the remaining emissions.

The Climate Solutions Steering Group was appointed to advise the Executive Vice President for Business Operations on large-scale, systemwide strategies needed to fulfill these commitments. The group was tasked with exploring planning and decision tools, financial and business models, emerging technologies, and large-scale renewable energy projects that have the potential to move the University's carbon reduction commitments from concept to implementation. This implementation focus complements the policy focus of the UC Sustainability Steering Committee.

UC's Climate Goals

The University of California has committed to the following:

1. **By 2014:** Reduce greenhouse gas (GHG) emissions to year 2000 levels, per UC Presidential Policy.
2. **By 2020:** Reduce emissions to year 1990 levels, per UC Presidential Policy and in accordance with California AB 32.
3. **As soon as feasible:** Achieve climate neutrality, per the ACUPCC, of which UC is a charter signatory.

The Climate Solutions Steering Group has focused on the ultimate goal of climate neutrality in developing our recommendations. The rationale for this focus is threefold:

It can and must be done.
First and foremost is the conviction that climate neutrality can and must be achieved, although the technologies required to do so on the scale required are yet to be fully developed. Several signatories to the ACUPCC—all smaller, liberal arts institutions—have already attained climate neutrality or will do so within a few years. Among large research universities, several have committed to attain net-zero emissions several decades earlier than the average UC campus Climate Action Plan.

Achieving the 2020 goal will facilitate climate neutrality soon thereafter.
Second, to achieve the 2020 goal, and to comply with AB 32, UC needs to develop a climate neutral energy supply on a massive scale. The large-scale strategies required to meet the 2020 goals, detailed in this report, will also put climate neutrality within reach.

The University has staked its reputation on it.
Third, we recognize the serious reputational consequences of failing to achieve *any* of the goals set forth in UC's climate commitments, including the ultimate goal of climate neutrality. UC attracted national attention when all 10 campuses became signatories of the ACUPCC. In becoming a signatory to that document, the University

of California made a significant public pledge to go well beyond goals set by law and policy. As with the UC Sustainable Practices Policy, UC's ACUPCC participation has been widely supported by the University community—especially students, who will encounter the direct and indirect effects of climate change, including environmental, economic, health, public policy, political, and social justice factors, throughout their post-collegiate lives. Within California, it has been backed by many supporters and stakeholders, and by the state's scientific and environmental communities. Beyond California, UC's expressed commitment to climate neutrality has strengthened its position as a national and global thought leader and has attracted considerable visibility. This commitment is emblematic of the environmental leadership associated with the University of California.

The Scope of the Challenge: Massive

> ***Based on projected emissions, UC will be 25 percent above its emissions target for 2014 and will be emitting at twice the allowable level in 2020, unless aggressive measures are implemented.***

Understanding the scope of the University's climate reduction challenge is critical to understanding the recommended solutions. The UC system currently emits approximately 1.7 million metric tonnes of carbon dioxide equivalent ($MTCO_2e$) per year (Figure 1). This total is projected to reach 2 million $MTCO_2e$ by 2014 and 2.15 million $MTCO_2e$ by 2020.[1] The targets for reduction of GHG emissions demand that UC campuses revert to previous decades' emission levels, and they are not growth-adjusted (Figure 2). Campuses have expanded, and will likely continue to expand, buildings and square footage, student enrollments, research activities, and clinical operations—all of which increase the carbon footprint, notwithstanding the more stringent building and operational standards for energy efficiency now in effect. Dialing back emissions to year 2000 or year 1990 targets in the face of campus growth amplifies the challenge of UC's climate commitments. Based on projected emissions, UC will be 25 percent above its emission target for 2014, and will be emitting at twice the allowable level in 2020, unless aggressive measures are adopted.

1. Based on data compiled from the 10 UC campuses' Climate Action Plans.

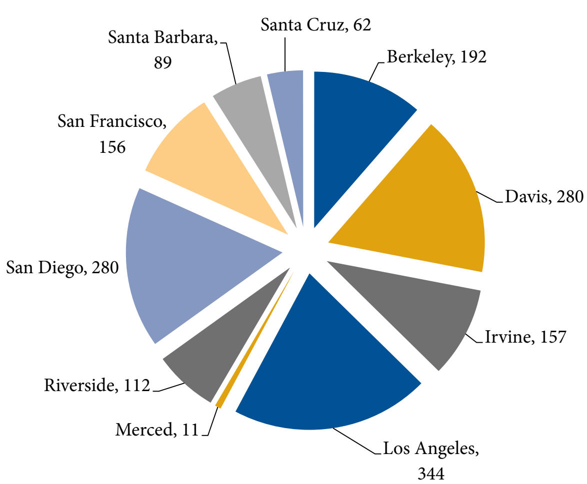


Figure 1. 2010 GHG emissions by campus, including Scope 1 (direct), 2 (indirect), and 3 (other indirect) emissions.

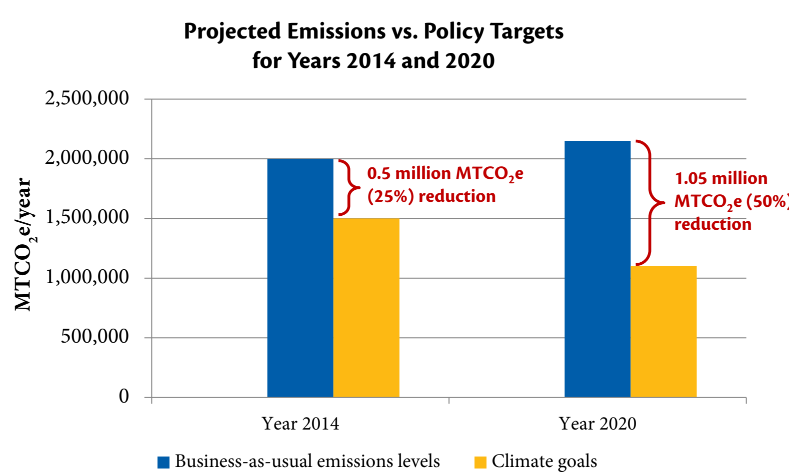


Figure 2. Estimated emissions in target years, based on the most recent projections, compared to emission reduction policy targets for 2014 and 2020.

Emission Sources

Emissions are categorized as Scope 1 (direct), Scope 2 (indirect), or Scope 3 (other) based on their source (Figure 3). Each source carries with it specific issues and opportunities.

Scope 1 emissions are direct GHG emissions from sources controlled by campuses, primarily from combustion of natural gas in co-generation plants. UC has invested hundreds of millions of dollars in a combustion-based energy infrastructure that is not yet fully amortized. Its continued operation will be essential to the University for the foreseeable future, and it is, in fact, a key to one of the recommended climate strategies. UC's six co-generation (combined heat and power) plants are considered "green" because of the efficiency with which they convert natural gas into electricity and heat. These plants are also carbon-efficient, emitting few units of CO_2 per unit of energy produced. Yet they still account for nearly 40 percent of UC's fixed carbon footprint because they burn natural gas, a fossil fuel. This carbon-*efficient* infrastructure can be rendered climate *neutral* by substituting biomethane for natural gas.

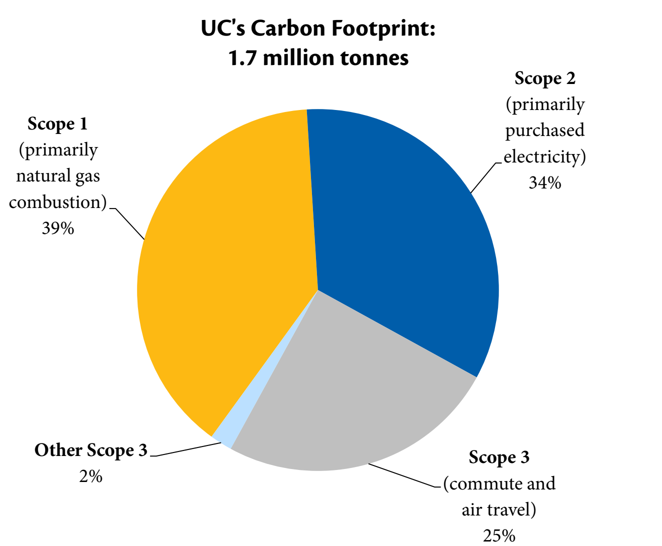


Figure 3. UC's current carbon emissions

Scope 2 emissions are indirect GHG emissions generated during production of electricity and steam that UC purchases. They account for 34 percent of UC's emissions. California's RPS will require utilities to provide a third of their energy from renewable sources by 2020, which will reduce UC's Scope 2 emissions, but will also increase UC's electricity rates. In addition to the RPS, California utilities are also required to comply with cap-and-trade and several other environmental policies that will exert upward pressure on electricity rates in the state. Procuring green wholesale power will limit UC's exposure to these rising costs.

Scope 3 emissions are other indirect emissions from sources not controlled by the University, primarily commuting and air travel emissions. The University's Scope 3 emissions constitute about 25 percent of the remaining carbon footprint and will also need to be negated to meet the ACUPCC commitment to climate neutrality.[2]

The Climate Solutions Steering Group's recommendations focus on Scope 1 and 2 emissions.

2. It could be argued that most air travel does not "belong" to the University, because it is done for the direct benefit of, and is funded by, research sponsors—primarily, the federal government. Since the federal government has also made a public commitment to reduce its carbon footprint, it may adopt policy that allows direct or indirect reimbursement for carbon offsets associated with federally sponsored research travel. Commuter emissions will decline as alternative transportation programs and telecommuting expand, and lower-emission vehicles come onto the market. Commuters may be taxed for their carbon emissions a decade from now, either in the form of a direct gasoline tax or indirect taxes aimed at petroleum companies. If the University were to procure offsets in order to negate this final vestige of carbon footprint (after implementing all other strategies), the likely recourse would be to build this cost into commuter parking fees.

PART 2. Recommended Strategies

To achieve its 2014 policy goal, UC must intensify its existing, sizable, and successful energy-efficiency program and expand campus-based renewable energy production. To achieve the 2020 goal, as well as eventual climate neutrality without resorting to the purchase of carbon attributes, a much larger scale energy conservation effort will be required. Local "reduce/produce" strategies must be coupled with a systemwide program of energy development or procurement that will manage the cost of renewable energy and provide sufficient biomethane to negate carbon emissions of natural gas-fueled central plants. Only systemwide strategies can provide a sufficient renewable energy supply, negate carbon costs, and control energy costs.

The following recommended strategies will need to be inherently scalable so they can be staged and phased in as feasible, and ultimately expanded fully to achieve climate neutrality.

1. Minimize energy demand through deep energy efficiency.

> ***The importance of energy efficiency cannot be stressed enough. The less energy campuses use, the lower their emissions as well as their costs. This is true now and in the future. Deep energy efficiency—measures that reduce energy consumption and associated carbon emissions by half or more—is the most immediate, cost-feasible strategy to effect a substantial reduction in UC's carbon footprint.***

Energy efficiency has been the leading emission reduction strategy for most campuses to date. A massive, multi-year, energy efficiency retrofit program—the Statewide Energy Partnership (SEP) program—is well underway on the campuses and medical centers and is key to attaining the GHG reduction goal for 2014. This program includes more than 1,000 energy-saving retrofit projects University-wide.[3] It is financed by utility-administered incentives under California Public Utilities Commission regulation, in combination with 15-year, UC-issued revenue bonds ("energy bonds") that will be serviced through utility savings derived from the program.

The viability of deep energy-efficiency projects is being demonstrated on several campuses, and these measures need to be scaled up throughout the system. Two examples of deep energy-efficiency initiatives currently underway are:

1. **UC Davis's Smart Lighting Initiative:** a comprehensive set of measures that will result in a 60 percent reduction in the electricity consumed by campus lighting.

2. **UC Irvine's Smart Labs Initiative:** an integrated system of air quality and occupancy sensors, advanced HVAC and lighting controls, high-efficiency lighting, and modifications to exhaust systems. In combination, these measures reduce energy consumed by campus labs by 50 percent (more in some cases).

Near-term energy-efficiency projects, many now underway, will generate considerable immediate savings net of debt service. Savings from current SEP projects undertaken since 2004 total 230 million kWh, 17.7 million therms, and approximately 168,000 $MTCO_2e$—all ongoing, per year results. In addition, these projects are expected to save approximately $32 million per year, net of debt service.

3. The University's Annual Sustainability Report summarizes hundreds of actions and projects that will help reduce UC's carbon footprint.
See: http://www.universityofcalifornia.edu/sustainability/reports.html

Deep energy efficiency—measures that reduce energy consumption and associated carbon emissions by half or more—is the most immediate, cost-feasible strategy to effect a substantial reduction in UC's carbon footprint.

More advanced deep energy efficiency projects, yet to be launched, will generate a smaller savings margin net of debt service, but can yield remarkable energy savings—many in excess of 50 percent. About 20 percent of these savings will need to be sequestered and committed to ongoing maintenance of advanced energy features. This is critically important because the efficiency levels of "smart" buildings—which depend on sensors, advanced controls, and software—can decay over time. Sophisticated technical staff will be required to sustain high-performance smart energy systems. Without this support, cost and carbon savings could disappear within a few years.

The SEP program has already demonstrated that energy efficiency can accomplish a significant fraction of UC's carbon footprint abatement. Therefore, we recommend that the SEP program be expanded to a scale that will enable the University to achieve its 2014 goal and to advance toward its 2020 GHG policy goals. The investment to increase the program scope may approach $480 million, which would be financed and paid off in a manner similar to the current SEP. Project delivery costs would be minimized through such measures as systemwide, discounted bulk purchasing of energy efficient equipment, and sharing of engineering resources.

In addition to continued campus-level planning and implementation with centralized funding and support, the continuation of utility incentives will also be necessary to sustain the funding model of the current program, especially as larger-payback, deep energy-efficiency projects are undertaken.

2. Procure renewable energy at sufficient scale to negate the University's Scope 2 emissions.

> ***Neither campus-based energy production nor business-as-usual utility procurement can provide sufficient supplies of renewable energy to achieve UC's climate goals. The 2020 policy is so much more challenging than the 2014 goal that it can only be attained through off-site renewable energy at a scale never before contemplated by any university.***

Campuses and medical centers are augmenting energy-efficiency programs with on-site renewable energy, such as such as solar photovoltaic, solar thermal, or biomethane. While this can supplant purchased electricity and contribute efficiently to emission reductions, the scale of reduction required to meet the 2020 goal and, ultimately, climate neutrality is such that no campus or medical center (with one or two possible exceptions) will be able to meet its energy needs with on-site production. For example, only a fraction of a campus's carbon footprint can be abated by maxing-out solar panels on rooftops, parking lots, and structures. Tens of thousands of acres of solar installations would be needed to approach the 2020 GHG policy goal and climate neutrality. Furthermore, the University cannot achieve its 2020 goal, or climate neutrality, by continuing to buy electricity from the state's utility companies, because a large proportion of the electricity in California's grid will come from fossil fuel generation for the foreseeable future.

To obtain an adequate supply of climate neutral power cost-effectively, it will be necessary to procure renewable power or hydroelectricity, as a system, on a much larger scale and over a much longer term than UC has considered in the past. Gaining access to off-site power requires the ability to develop or procure it and the right to import it from suppliers to campuses. The program must be scalable, starting with pilot projects that can be expanded as they demonstrate technical and economic feasibility. In this way, the University can obtain climate neutral power at prices comparable to utility rates.[4]

A combination of related strategies will be required to accomplish this:

a. Adopt a long-term (20-year) perspective whereby the University comprehensively plans for energy acquisition, and averages and stabilizes pricing over a much longer term than it has historically done. This will enable UC to manage its energy costs in ways that avoid direct and indirect carbon-driven costs.

b. Establish the legal and business mechanisms required to import and distribute wholesale power;

c. Pursue statutory and regulatory changes to enable the wholesale procurement of off-site renewable (and nonrenewable) power.

This energy procurement strategy may prove more feasible if developed in collaboration with other public entities in order to facilitate economies-of-scale and risk sharing. We therefore recommend that UC:

d. Seek membership in the Northern California Power Agency (NCPA).

Joining NCPA will enable UC to develop a comprehensive wholesale power procurement strategy to manage costs while assembling a carbon-efficient electricity portfolio that is cost-competitive with grid electricity. (See The Power of Partnership, next page.)

NCPA membership is currently available only to campuses that are direct access customers. Direct access rights were established during deregulation more than a decade ago to enable large customers to buy power from entities other than their local utility provider. Currently six UC campuses are on direct access. As part of its wholesale power strategy, UC is exploring legislative changes that would give additional campuses direct access, thus enabling them to join the NCPA.

To further refine the wholesale power strategy described in this report, UC has retained the consulting firm E3 to develop a detailed cost modeling tool that will enable the University to evaluate the carbon intensity and financial feasibility of various wholesale power contracts and business solutions for renewable energy. When complete, this model will allow the University to assess alternative scenarios with reference to the costs and emissions of a business-as-usual reference case in which the University continues to rely on utility companies. This will enable campus-by-campus analysis, based on the tariff structures of several hundred utility accounts, and will create forecasts over a 20-year time frame (the length of a typical contract for renewable power).

4. Note that it will not be technically or economically feasible to obtain 100 percent climate neutral power in the short- or medium-term. Therefore UC would purchase a mix of "green" power from climate neutral generators and "brown" power from high-efficiency natural gas generators, and gradually transition to climate neutral power. Procuring low-cost, wholesale "brown" power from high-efficiency sources will help to cushion the initial cost premium of wholesale green power. UC will ultimately assemble a wholesale power portfolio that is comparable in cost to utility power, but more carbon-efficient.

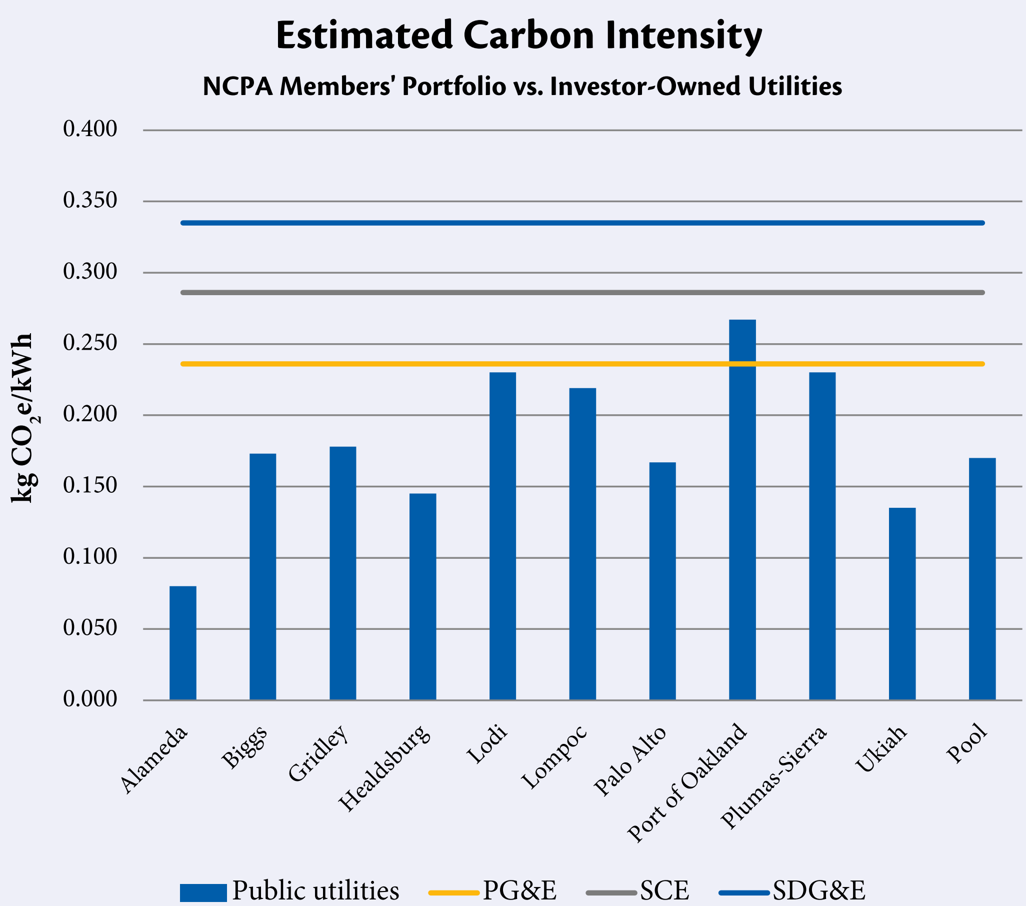
The Power of Partnership

The Northern California Power Agency (NCPA) is a not-for-profit joint powers authority founded in 1968 to help community-owned utilities make investments to ensure an affordable, reliable, and clean energy supply for electric ratepayers. Its members collectively reflect a 50 percent carbon-free resource portfolio.

NCPA members provide a compelling case study for the University, having successfully pursued a long-term energy strategy, dramatically reduced carbon intensity, controlled prices, and achieved scale—exactly the goals that the University of California needs to achieve.

NCPA members' energy portfolio carbon emissions compare favorably to those of California's investor-owned utilities.

As an NCPA member, the University would gain experienced partners who can identify opportunities to contract for cost-effective climate neutral power, guide wholesale procurement decisions, and share the risk of project development. NCPA membership would also provide tools to economically benefit from providing ancillary services to the California Independent System Operator, which provides access to the bulk of the state's wholesale transmission grid.



3. Procure biomethane, which is essentially climate neutral, for use in the University's natural gas infrastructure to negate Scope 1 emissions.

> ***The largest part of UC's carbon emissions problem—natural gas combustion in its central plants—also represents the largest opportunity to collapse UC's carbon footprint.***

Biomethane is harvested from controlled decomposition of organic matter derived from a variety of sources, including wastewater treatment plants, landfills, dairy farms, and food processing. Biomethane is essential to neutralize carbon emissions from UC's central plants and to mitigate UC's cap-and-trade compliance costs.

In addition to being essentially climate neutral, biomethane production yields important indirect benefits, including air and water quality improvements at the point of production, organic fertilizer byproducts, and reduction of the need for natural gas extraction. Biomethane has been proven at scale in Europe, but the U.S. biomethane market is still in its infancy. UC will therefore need to pursue a phased approach to biomethane procurement.

The development of a California biomethane industry could help the state meet its climate and renewable energy goals while improving air and water quality in the Central Valley. We recommend that the University exploit its strong ties with California agriculture utilizing the UC Cooperative Extension infrastructure to leverage an early, large-scale position in the biomethane industry that will emerge in California.

Taking Action Now

Four compelling reasons point toward the need to move forward aggressively now:

1. Even modest facilities growth could negate much of the carbon abatement achieved by energy efficiency measures.
2. If no progress is made toward developing or procuring biomethane, UC will have to bear higher costs for grid electricity and natural gas, and incur reputational damage for failing to meet its targets.
3. Renewable energy in the quantities required cannot be developed, or even procured, overnight. The scale of such an endeavor requires aggressive business planning now for the projects that will need to come online during the latter half of this decade.
4. The University's cost of capital is very low at present. This per-year capital expense is comparable to the annual savings increment that will be realized by procuring or investing in renewable power with a lower rate of cost escalation than grid power.

Thus, no financial penalty is incurred for early action to procure renewable power. However, delayed action does incur the penalty of procuring carbon offsets in 2020 if renewable power falls short of what is needed to achieve mandated limits.

The Right Business Model

The Climate Solutions Steering Group is "agnostic" regarding business models. We recommend that renewable power be either developed or procured, and we are advocating no particular business model at this time. Ownership of renewable energy assets; control of design, construction, and operations; and the financing model and ultimate ownership of the infrastructure will depend on a number of variables, including risks, cost of capital, tax advantages, operating costs and expertise, and benefit projections. Nonprofit institutional collaborations utilizing a joint powers authority or public/private partnerships may prove beneficial due to the scale and risk-sharing advantages for renewable energy projects of the scope we are recommending. For any given project, the business model that achieves the most optimal trade-off among the variables should be employed. Creative financial strategies are needed that can, in effect, exploit long-term savings to underwrite the initial cost premium of renewables.

Biomethane has been proven at scale in Europe, but the U.S. biomethane market is still in its infancy. UC will therefore need to pursue a phased approach to biomethane procurement.

Biogas Plant, Germany.

PART 3. Carbon Costs and Cost Avoidance

The High Cost of Carbon

> ***State environmental policies and regulations will increase UC's energy costs. Future carbon cost drivers will include both regulatory and voluntary costs which could total in the tens of millions (per year) by 2020.***

Although many factors and unknowns populate an emerging, and as yet incomplete, picture of future energy costs in a carbon-regulated California, expected cost drivers will include:

- Direct emissions allowances that will accompany California's cap-and-trade regulations, taking effect in 2013, which place a price on carbon emissions.
- Indirect, embedded carbon costs resulting from the RPS which requires energy suppliers to increase generation from renewable energy sources to 33 percent by 2020; and from additional regulations on state utilities, including the phase-out of power plants that rely on once-through ocean cooling.

This means that, if UC were to take no actions to reduce its carbon emissions between 2013 and 2020, it would incur an estimated $126 million to $475 million in cumulative added costs:

- $69 million to $269 million in increased costs of natural gas associated with California's cap-and-trade policies
- $57 million to $207 million in electricity rate increases associated with various environmental regulations and policies

The "best guess" cost estimates we have developed are based on carbon costs and projections at the time this report is published, and we have also included high and low projections to reflect a range of assumptions. Projections for both direct emissions allowances and embedded carbon costs range widely based on:

- the extent to which policy and regulations (as distinguished from price signals) succeed at reducing energy demand and carbon intensity per unit of energy, and the resultant effect on carbon allowance costs;
- the GHG abatement investments effected by regulated entities;
- regulations limiting the supply of compliance-grade RECs and offsets, including limitations on where they are sourced;
- the degree to which RPS compliance affects utilities' costs to generate and transmit renewable energy, and the level of rate increases that result; and,
- the way in which all of these costs are distributed across different ratepayer classes (i.e., the likelihood that large commercial customers will bear a higher proportion of cost increases so that residential customers are shielded from full rate impacts).

The overarching assumption behind these recommendations is that cap-and-trade regulations and their associated costs will remain in effect in the State of California. We acknowledge the possibility that economic or political factors could lead to delayed timetables on carbon cost mitigations in the administration of

California's climate policy, or even the abandonment of AB 32. However, we believe that some form of market-based climate regulation will remain in place for the foreseeable future, including the decades beyond 2020 when the AB 32-mandated cap-and-trade program is scheduled to sunset.

How Much More Will Carbon Cost?

Figure 4 illustrates the additional carbon-related costs that the University will bear as a result of carbon regulation. These projections are based on a range of possible assumptions.

Carbon Attributes: An Unimpressive Stopgap

When calculating carbon costs, it should be noted that paying for a cap-and-trade emissions allowance confers the right to emit carbon, but it does not *negate* carbon emissions. Thus, any institution that has signed the ACUPCC to achieve climate neutrality must also factor in the cost of buying carbon attributes (Renewable Energy Credits (RECs) or carbon offsets) to negate carbon-emitting operations and consumed energy.

Some institutions that have made a commitment to climate neutrality are relying heavily on carbon attributes. A typical strategy includes (1) investing in operational practices and retrofit projects (and possibly installing some on-site renewable energy) to improve efficiency and abate part of their carbon footprint; (2) waiting for the price/performance ratio of renewable energy to improve as new technologies and economies-of-scale emerge; and (3) procuring carbon attributes to negate the balance of their carbon footprint that remains after reducing consumption. Most such institutions do not face near-term GHG policy goals as challenging as the University of California's. And few comprehensive research universities, with their massive carbon footprints, are considering the procurement of carbon attributes as the means to attain climate neutrality.

Carbon attributes are inconsistent and unproven in terms of efficacy. RECs and offsets essentially pay someone else to abate UC's carbon emissions. Carbon attributes are regarded as last resort strategies in all UC campuses' Climate Action Plans. The Climate Solutions Steering Group has heard no support for a climate solutions strategy that relies on the procurement of carbon attributes.

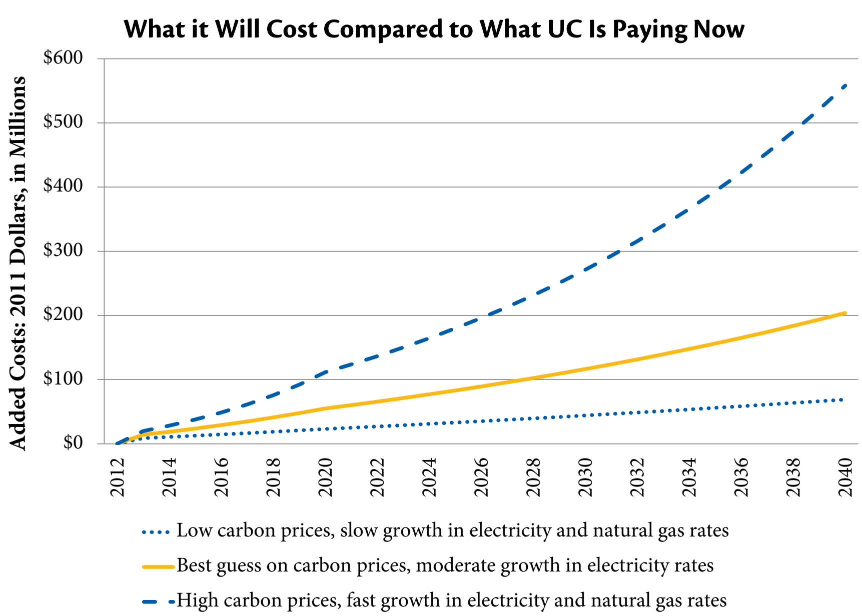


Figure 4. The range of potential future increases in energy costs. These projections consider a range of carbon price, and of escalations in electricity and natural gas rates. At the low end, carbon prices are assumed to stay at the California Air Resources Board price floor from 2013 to 2020, and escalate by 2.5% each year thereafter. The mid-range estimate assumes carbon at $40 per metric tonne in 2020, escalating at 5% per year until 2040. At the high end, carbon is assumed to hit $90 in 2020 and escalate by 7.5% each year thereafter. Assumptions for electricity rate increases are 1.5%, 3%, and 5% (respectively), and assumed escalation in natural gas rates are 1%, 1.5%, and 3%, respectively. All increases constitute real cost escalation in excess of price inflation, and thus reflect 2011 dollars.

Avoiding the Cost of Carbon

> ***The high cost of carbon compliance can be avoided by creating an energy infrastructure to ultimately negate compliance costs while also enabling UC to achieve climate neutrality.***

Although there are significant investments associated with the recommended climate strategies, they will negate carbon costs associated with cap-and-trade regulations, hold down electricity costs and, over time, prove considerably less expensive than the approach we call "business-as-usual" (i.e., taking no action to significantly alter our energy procurement methods as per Strategies 2 and 3 of this report). Business-as-usual costs, while lower at first, will sharply escalate in a cap-and-trade and RPS environment as the state's GHG caps are lowered, the cost of emissions allowances climbs, and renewable energy quotas increase. Alternatively, the costs of compliance can be avoided through strategic investment in an energy infrastructure that will negate compliance costs while also positioning UC to deliver on its commitment to climate neutrality.

How Much Are Recommended Solutions Going to Cost?

> ***Whether UC pursues the recommended strategies or follows a business-as-usual path, the cost will be substantial. We will face a fundamental tradeoff: annual compliance and carbon costs vs. investment in long-term solutions.***

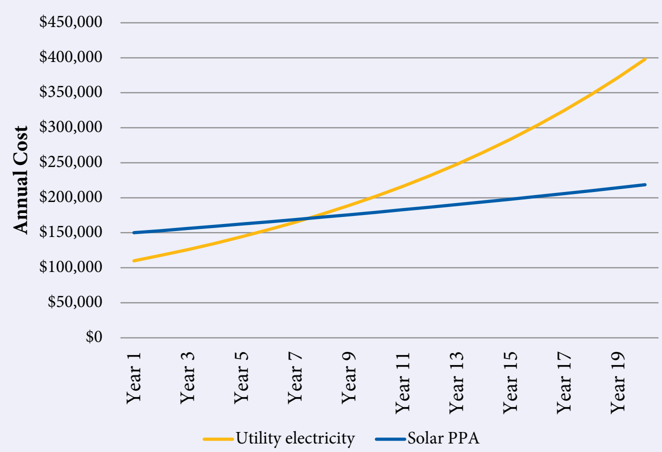
Embarking on the aggressive and comprehensive strategies recommended in this report will entail a significant investment. The total cost will be offset by the avoidance of hefty direct and indirect carbon costs, by renewable energy costs that will trend lower than grid energy costs, and by dollar and carbon savings that result from deep energy efficiency measures.

The Renewable Energy Adoption Challenge

The central challenge in adopting renewable power is the initial added cost when compared to business-as-usual. While not a precise business model for a specific project proposal, this typical example illustrates how renewable energy proves considerably less costly in the long run, as carbon costs increase dramatically while green power costs remain relatively flat.

Suppose an institution enters a solar power purchase agreement (PPA) for one million kWh per year priced initially at 15 cents/kWh, escalating 2 percent per year after year 1. Meanwhile, the business-as-usual baseline cost of 11 cents/kWh for utility power escalates 7 percent per year due to embedded carbon cost factors.

Net Present Value of PPA = + $500K



Under these circumstances, business-as-usual utility costs escalate faster than renewable energy costs, and the life-cycle value of renewable solar energy shifts into the positive realm despite higher initial costs, as denoted by positive net present value(NPV). Over time, renewable energy proves less costly, particularly after year 7 when the cost curves intersect. And if the business-as-usual scenario had included the costs of carbon attributes, the NPV of renewable energy would be considerably greater.

Figure 5 illustrates the relative costs of recommended strategies vs. business-as-usual. This illustration is based on the mid-range, "best guess" cost projections shown in Figure 5.

Figure 5 illustrates one possible scenario among many. It is intended to illustrate is that implementing proactive measures to reduce the University's carbon footprint will be financially beneficial in a carbon-constrained world. Under this scenario, which is a compilation of the cost breakdowns that follow, the University would achieve its 2020 goals and approach climate neutrality for Scope 1 and Scope 2 emissions by 2030.

Figure 5 also includes projected cost savings associated with an expanded energy efficiency program, as described in Part 2, Section 1. In the assumptions underlying Figure 5, the University will have paid off the debt it incurred to finance energy efficiency projects, starting in 2029. This accounts for the sharp decline in added costs 2029–2034.

Figures 6 and 7 break down two recommended strategies and show the added costs associated with each of the strategies separately in relation to business-as-usual costs. All assumptions in Figures 6 and 7 are consistent with those listed for Figure 5.

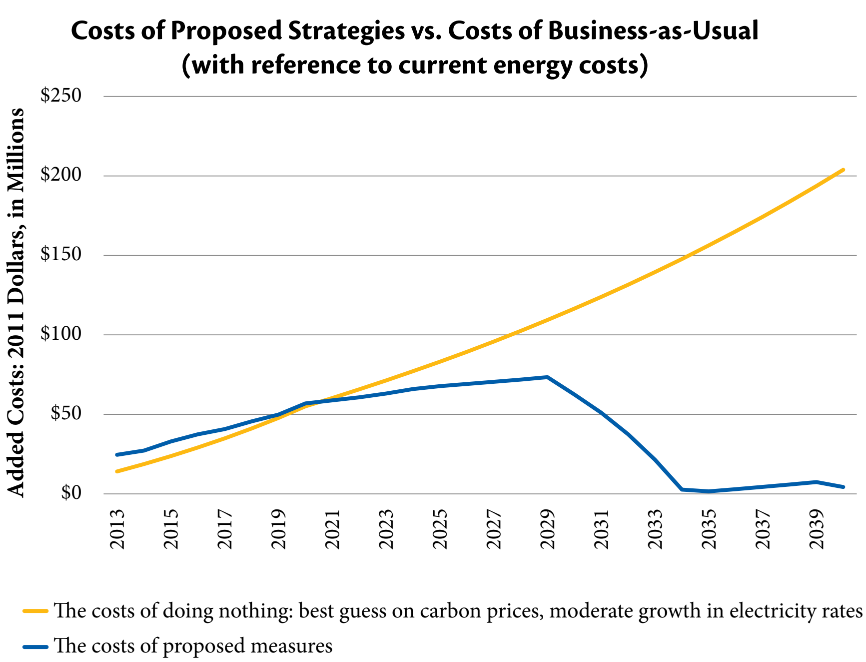


Figure 5: The added costs per year of the proposed strategies vs. the added costs of business-as-usual. The gold line is identical to the mid-range estimate in Figure 4. The blue line represents the cost of the proposed strategies. Both projections rely on the same assumptions regarding carbon prices and increases in electricity and natural gas rates. The blue line further assumes that UC steadily increases its supply of biomethane to 30 percent of demand by 2020 (and 95 percent by 2040); UC's wholesale power portfolio meets all RPS requirements; 83 percent of procured electricity is climate neutral by 2020; and UC's energy-efficiency program more than doubles annual energy savings of the current program by 2020. Other possible factor-mixes could also meet the 2020 GHG policy goal.

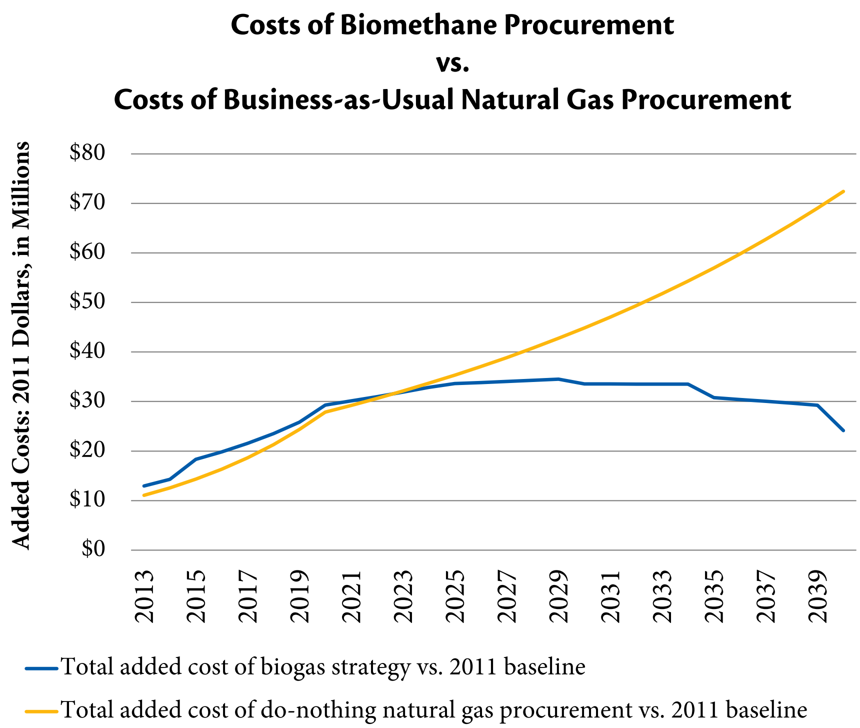


Figure 6. Added costs of biomethane procurement (Strategy 3) vs. business-as-usual cost of natural gas procurement.

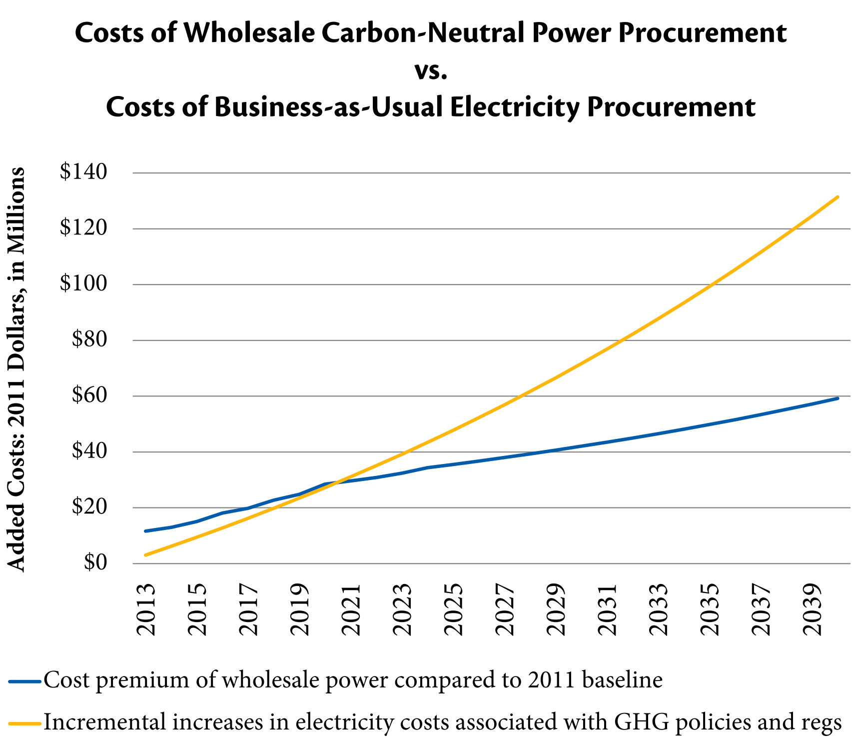
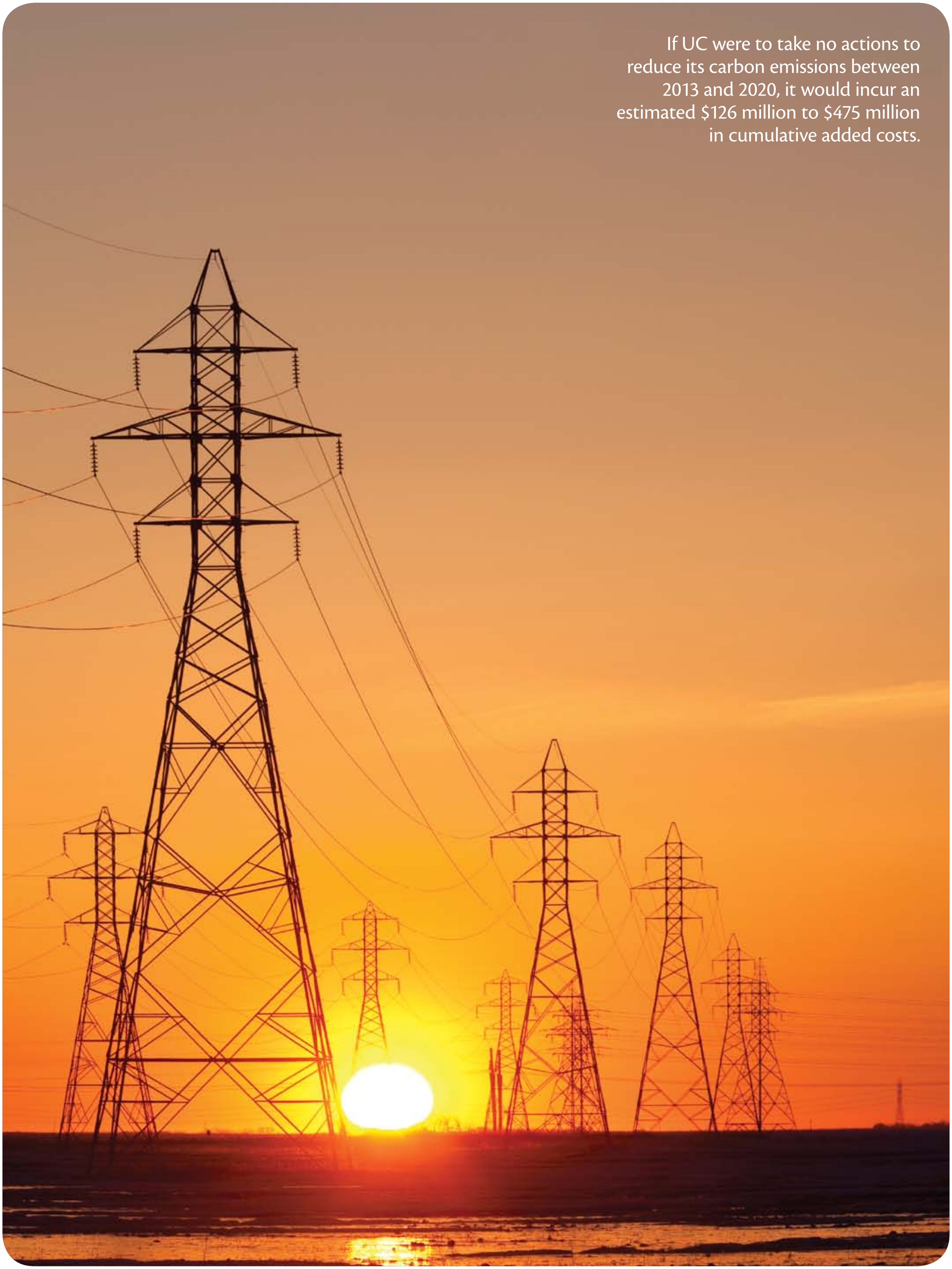


Figure 7. Added costs of wholesale carbon-neutral power procurement (Strategy 2) vs. business-as-usual cost of electricity procurement.

If UC were to take no actions to reduce its carbon emissions between 2013 and 2020, it would incur an estimated $126 million to $475 million in cumulative added costs.



PART 4. Call to Action

An Urgent Call To Action

> ***It is critical that the University act on renewable energy projects or procurement now. UC has only three years to attain the first University policy goal, and only eight years to achieve its 2020 target.***

Renewable energy in the quantities required cannot be developed, or even procured, overnight. The time frames for planning and implementation need to be commensurate with the scope of the challenge and its deadlines.

Reaching the 2014 milestone will entail a sizeable expansion in the SEP program augmented by on-site renewable energy projects at each campus. These projects must be underway by the end of 2012. Reaching 2020 targets and, ultimately, meeting its climate neutrality commitment will require that UC lay the groundwork to procure and distribute wholesale green power while supporting the parallel development of biomethane for its combustion-based infrastructure. These strategies must be launched soon in order to come online within eight years.

The general timeline and cost savings in the examples provided in this report emphasize the importance of developing a life-cycle-based, long-term perspective on managing and financing the path to climate neutrality. The days of procuring energy on a year-to-year basis are past, as is the prospect of being a passive consumer in energy markets. The University of California must leverage its scale, its financial strength, its commitment to excellence, and its leadership to shape an effective climate neutral business strategy.

The Danger of Complacency

As the University continues to garner awards and high ratings for its sustainability efforts, there is a danger of becoming complacent or gaining a false sense of assurance, as though "more of the same" will put UC on a certain path to the 2020 GHG policy goal and climate neutrality soon thereafter. However, soaring green ratings and sustainability awards must not be interpreted as indicators of progress toward formal climate commitments.

The University of California is currently *not* on track to meet its 2020 greenhouse gas emissions goal of attaining 1990 emissions levels. And it cannot attain its climate goals solely by expanding energy-retrofit projects, increasing landfill diversion rates, moving facilities up the LEED ladder, or doing more local-sourcing in dining halls. Such sustainability actions are highly beneficial, but the scale of the University's carbon abatement challenge calls for solutions of commensurate scale, as recommended in this report.

The University must take action now to alter its trajectory toward an outcome that will be disappointing and costly in two ways:

- the economic costs of unabated carbon, which will accelerate as 2020 approaches and will continue to rise as California pursues a 2050 policy goal of 80 percent reduction in carbon emissions;

- the reputational costs if UC, now a recognized sustainability leader, fails to achieve the 2020 GHG policy goal or its ACUPCC climate commitment.

Moreover, without effective action, UC's facilities and operations will fall seriously out-of-step with the findings that its own faculty are generating. It would be unfortunate if University operations continue to contribute to climate degradation even as our researchers reveal and model its global costs.

On the other hand, if UC's business strategy for clean energy development or procurement can optimize scale, avoided carbon costs, and life-cycle costs, the cumulative savings will exceed the costs, and the University of California will emerge as one of the first—and surely the largest—distinguished research university to attain climate neutrality.

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