Title.
Emeryville, California: Planning for Locally Produced & Sustainable Electricity Sources.

Audience.
The primary intended audience includes the Emeryville City Council, as well as the residents, businesses, workers, and anyone else who may have an interest in the welfare and sustainability of the City.

Other potential audience members include cities and counties looking for ways to decrease their dependency on non-renewable electricity sources, as well as those looking to increase the amount of electricity produced locally. Additional interested parties may include planners, policy makers, environmental organizations, and concerned citizens who are interested in addressing the social, economic, or environmental ramifications of electricity consumption and production in urban areas.

Background.
Incorporated in 1896\(^1\), the City of Emeryville is bounded in the north by the City of Berkeley, to the south and east by the City of Oakland, and to the west by the San Francisco Bay. Emeryville is only 1.2 square miles,\(^2\) but contains an Amtrak train station as well as the I-80 freeway feeding drivers to the Bay Bridge.

While today many people know Emeryville because of its numerous retail hubs (the East Baybridge Shopping Center, Bay Street Mall, Powell Street Plaza Shopping Center, and Emeryville Marketplace Shopping Center), in the past Emeryville was known for its industry and entertainment. Beginning in the late 19\(^{th}\) century until after World War II, Emeryville was known for its paint factories, rail yards, slaughter houses, and canneries. Over the years, Emeryville has also been home to the Oakland Oaks baseball team, numerous gambling houses, and a horse racing track\(^3\).

As industrial facilities started relocating away from Emeryville (or closing for good), Emeryville found itself in the position of needing to reinvent itself. In response, Emeryville created two redevelopment zones that now cover ninety-five percent of the City. The first, created in 1976, consists of 503 acres. This redevelopment area, covering the majority of the western-most and eastern-most parts of Emeryville expires in 2019.

The second redevelopment zone (The Shellmound Project Area) was adopted in 1987,

\(^1\) City of Emeryville. *Emeryville General Plan* (Amended January 19, 2010), 1-2.
\(^2\) City of Emeryville. *Emeryville General Plan* (Amended January 19, 2010), 1-1.
consists of 270 acres located primarily in the center of the City, and expires in 2028.\textsuperscript{4} The remaining five percent of Emeryville, not included in a redevelopment zone, is a portion of the peninsula belonging to the Watergate Condominiums and the Emeryville Marina. Due to it’s redevelopment zones, political will, business interests, and citizen support Emeryville today is home to over ten thousand residents, numerous retail businesses (such as Home Depot and the Bay Street Mall), biotech and pharmaceutical developments (such as Novartis and Bayer), as well as the movie maker Pixar.

In addition to the redevelopment zones located within the City of Emeryville, Emeryville is also part of a Joint Planning Agency (JPA) that in some ways blurs the jurisdictional boundaries of the City. The JPA was created in order to establish the East Baybridge Shopping Center which is split in half by the Oakland/Emeryville border that runs diagonally through it (most notably with the front of the Home Depot in Emeryville and the back of the store in Oakland).

IKEA, while not part of a JPA, is also split between two cities. IKEA’s retail space is located in Emeryville, while the parking structure is in Oakland. Both the JPA and IKEA development function in the same manner: Emeryville responds to emergencies, issues planning permits and conducts design review, while Oakland is responsible for building permits and inspections. For the purpose of this research, the entirety of both the JPA and IKEA will be included within the project area of Emeryville. This is because, feasibly speaking and functionally speaking, these areas are associated with Emeryville and are addressed in the Emeryville General Plan.

While Emeryville’s economic engines of the past and present seem far removed from each other, they all have been dependent on two things: Emeryville’s central location, and the need for a dependable and relatively inexpensive supply of energy. While in previous times energy sources were often limited to heavily polluting options (such as burning wood, coal, and oil), today there are more opportunities for energy generation using less polluting, and more sustainable, methods (such as solar and wind generation).

In recognition of the need to limit greenhouse gas emissions, reduce the United States’ dependency on non-renewable resources (such as coal and oil), and society’s general need to be more sustainable, several policies and goals have been set forth by the State of California. In November of 2008, State Governor Arnold Schwarzenegger signed Executive Order S-14-08, mandating that by the year 2020, “all retail sellers of electricity shall serve 33 percent of their load with renewable energy.” While this is a statewide goal, Emeryville stated in its Climate Action Plan “that a community should take full ownership of the impacts associated with its energy consumption,” therefore, it is reasonable to use Executive Order S-14-08 as a minimum standard of achievement for the City of Emeryville.

\textsuperscript{4} City of Emeryville. \textit{Redevelopment Project Areas Map}.
\textsuperscript{5} State of California. \textit{Executive Order S-14-08} (November 17, 2008).
\textsuperscript{6} City of Emeryville. \textit{City of Emeryville Climate Action Plan} (November 2008), 18.
The City of Emeryville has also set its own policies and goals in its General Plan, including:

- “ST-P-8: The City shall establish incentives for energy retrofits to support implementation of photovoltaic and other renewable energy technologies that result in an energy savings of at least 20 percent when compared to consumption that would occur with traditional energy sources.”

- “Action 1: Adopt and implement a policy to increase the use of renewable energy to meet ten percent of the city’s peak electric load within seven years.” (This was adopted in 2005, making the achievement year 2012).

- “Action 2: Adopt and implement a policy to reduce the city’s peak electric load by ten percent within seven years through energy efficiency, shifting the timing of energy demands, and conservation measures.” (This was adopted in 2005, making the achievement year 2012).

- “ST-G-6: Energy conservation- Fifty percent reduction in energy consumption for all sectors- transportation, industrial/commercial, residential, and waste, over 2008 levels, by 2017.”

Emeryville has been a historical leader in the Bay Area for seizing economic opportunities that have presented themselves: from its industrial beginnings, to its retail and biotech growth, as well as the residential development that has taken place throughout the City. The question now is if Emeryville can (per its own goals and policies) reduce its energy consumption while increasing energy production in order to become a regional leader in sustainability.

**Research question.**
What is the City of Emeryville’s potential for producing its own electricity? How can Emeryville meet the energy conservation policies and goals it has set for itself, as well as the sustainable energy production goals set by the State of California?

**Relevance.**
Localized and sustainably produced electricity is an important and relevant question for several reasons:

I. **Modern life is completely dependent on electricity.** Basic communication technologies, refrigeration, lights, as well as a diversity of transportation options are all dependent on a reliable source of electricity. In the event of a major black-out we find ourselves unable to charge our cell phones and use the internet; after only half a day our food begins to spoil, yet often there is no way to prepare it under such circumstances; our lights are out and we have no heat or air.

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7 City of Emeryville. *Emeryville General Plan* (Amended January 19, 2010), 7-33.
conditioning; transportation options such as light rail shut down after a short supply of reserves run out, and hospitals are forced to limit themselves to only the most critical of services. It is also very hard to make coffee.

While localizing the sustainable production of many resources (such as food and water) is very important, ultimately even locally produced food and water need electricity for their sanitization, production, and storage. Most people get hungry or thirsty at some point every day, so at least in a small way one may be conscious of the importance of access to food and water. However, while completely dependent on electricity, as long as there is no interruption in its supply, there is no reason for most people to think about electricity beyond flipping a switch or plugging in a device.

While localizing electricity production will not make Emeryville less dependent on electricity, it will help residents and businesses become more aware of their electricity production, and perhaps subsequently their consumption as well.

II. Not only is society dependent on electricity, but society is also largely dependent on non-renewable sources of electricity. Non-renewable sources of electricity production (such as coal) release greenhouse gasses into the air, adding to the problem of global climate change. Resource extraction methods to obtain materials such as coal often lead to pollution and environmental degradation which may also result in human health impacts. Furthermore, as these sources are not renewable, we have a limited window of opportunity to put long-term viable alternatives into use before our non-renewable sources become too expensive (due to scarcity) or simply not available.

III. Despite, or perhaps because of our dependency, impacts of electricity production on environmental and human health are often ignored. Governments and communities of all sizes can help reduce the negative impacts of electricity production by taking responsibility for the electricity they consume. Historically, zoning developed in part to prevent the location of heavy, pollution producing industries close to residences. However, despite zoning regulations, low-income and marginalized individuals continue to live closer to pollution producing industries (including energy production facilities and refineries) than do higher-income and non-marginalized individuals. Subsequently, marginalized

13 Michael Brune, Coming Clean: Breaking America’s Addiction to Oil and Coal (San Francisco: Sierra Club Books, 2008), 40-44.
communities endure disproportion health impacts compared to non-marginalized communities\textsuperscript{16}.

One way communities can address this environmental justice issue is to take responsibility for their own electricity consumption by producing their own power locally using renewable electricity sources. If communities take responsibility for their own consumption, other communities will be spared the potential adverse impacts of electricity generation. Furthermore, due to the wonders of NIMBYism (Not In My Back Yard-ism) communities that actively decide to invest in localized electricity generation facilities will be more likely to use cleaner, more sustainable technologies.

**IV. Localizing electricity production can potentially reduce the need for production.** Over ten percent of generated electricity can be lost through transmission\textsuperscript{17}: thus, it may be possible to reduce electricity production by limiting the distance electricity needs to travel between points of production and consumption.

California produces over seventy percent of the electricity it uses within the state\textsuperscript{18}, but in 2008 less than fourteen percent of that electricity came from renewable sources (such as solar and wind)\textsuperscript{19}.

In the past, when burning fossil fuels was the only realistic option for obtaining electricity; the soot, smoke, and other pollution produced at electricity plants made locating such facilities in urban areas very undesirable. Renewable electricity production sources (such as wind and solar) result in no emissions during energy production, allowing electricity to be produced safely within communities on residential, school, and business rooftops. As the production of renewable electricity grows, placing renewable electricity generation sources in urban areas will help reduce the need for costly and inefficient electricity transmission.

**V. Investment in renewable and sustainable electricity sources may have long term economic benefits.** Global competition for business and economic investment requires cities to stand out as dependable and desirable places to invest\textsuperscript{20}. Cities that produce electricity using sustainable methods may have a competitive economic advantage: if a city is able to promote itself as being sustainable, and

\textsuperscript{17} U.S. Department of Energy. \textit{National Transmission Grid Study} (May 2002), 63.
\textsuperscript{18} California Energy Commission. \textit{California’s Major Sources of Energy} (updated April 7, 2009), \url{http://energyalmanac.ca.gov/overview/energy_sources.html} [accessed on September 27, 2010].
\textsuperscript{19} California Energy Commission. \textit{Total Electricity System Power} (2009), \url{http://energyalmanac.ca.gov/electricity/total_system_power.html} [accessed on September 27, 2010].
not dependent on fossil fuels, it may increase its ability to attract business compared to other similar cities. Additionally, direct economic benefits may be possible if long term electricity costs can be kept low through initial investment in sustainable electricity production.

**Hypothesis.**
While Emeryville is ahead of other cities in addressing energy issues via its Climate Action Plan21, the City’s small size22 will require creative solutions in order to achieve significant increases in sustainable electricity production. Solar installations will probably be identified as one of these solutions, even though the large number of multi-family residential units reduces the amount of rooftop area available for solar infrastructure (compared to suburban areas where many single-family detached residential units can support solar infrastructure).

Emeryville is not considered to be a wind resource area by the California Energy Commission as the strength of the wind in Emeryville is not sufficient23. Subsequently, wind production will probably not be a major contribution to Emeryville’s sustainable electricity portfolio.

Electricity conservation and efficiency efforts will likely be more efficiently directed at large retail, office, and residential buildings as they use more land in Emeryville than single-family detached and small multi-family units.24

Emeryville has set very ambitious goals for itself with aggressive time lines25. The question will likely end up having less to do with if Emeryville can achieve its goals, but rather when it will be able to realistically achieve the goals it has set forth. This will depend on political will, funding availability, as well as citizen and business enthusiasm.

**Methods.**
This research will focus on both electricity consumption and sustainable electricity production in the City of Emeryville, California (including the aforementioned JPA and IKEA).

Non-stationary uses (the transportation sector) will not be included in this research as the sources of energy used for motorized vehicles (petroleum products, bio-diesel, electricity, etc.) are continually being modified and changed. Additionally, the efficiency of these

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vehicles is also fluctuating. These two factors make it very difficult to incorporate the transportation sector into the scope of this research topic.

Non-electrical sources of energy (for example, natural gas and wood used for heating and cooking) will also not be included in this research paper. Natural gas used to make electricity will be included in the report, but the direct use of natural gas in homes and businesses will not be examined. Addressing the topic of weaning dependency from non-electric and non-renewable resources is enough for another independent research report.

1. Data Collection: existing data regarding electricity production and consumption in Emeryville, as well as comparative data in other jurisdictions (such as Alameda County, the State of California, and nationwide).


b) Reason for collecting the data: to establish levels of city-wide electricity consumption going back at least five years, as well as state-wide rates of electricity consumption and production in California and nationally in the U.S. This data will provide context to Emeryville’s current level of consumption, as well as allow the opportunity to observe comparative trends. In addition to data regarding the quantity of electricity, data will also be collected regarding the type of electricity: what was the source of electricity production (hydro-electric, coal, natural gas, nuclear, etc), the cost of electricity, and (if possible) where the electricity was produced (in-state, out of state, in the United States, outside of the United States, and ideally the number of miles transmitted). This data will provide a picture of how sustainable Emeryville’s current electricity sources are.

c) Data collection procedures: search online and City of Emeryville databases for the information. If not found online, directly contact the potential data source via either email, phone call, or both. Collect data into organized files in order to easily retrieve the data. Contacts include __________ at the City of Emeryville and __________ at PG&E.

d) Method of data analysis: using Excel, compare the quantitative and qualitative aspects of the data collected, and analyze this data to help estimate the future electricity needs of the City of Emeryville. Comparisons of annual kilowatt hour (kWh) usage over a minimum of a five year period will be made to show annual increases and/or decreases in electricity consumption, sustainable production, as well as increases and/or decreases in the amount of electricity being imported to the State of California.

Information gathered using these methods will primarily contribute to Section 3 of the final report.
2. Data collection: existing policies, goals, and regulations regarding sustainable energy production and consumption in Emeryville, as well as pertinent federal and state energy related policies affecting the City of Emeryville.

   a) **Data sources:** the City of Emeryville Climate Action Plan, the City of Emeryville General Plan, City of Emeryville ordinances, the California Energy Commission, California State Building Code, and the U.S. Department of Energy.

   b) **Reason for collecting the data:** to fully understand existing laws, policies, and regulations regarding energy that may inhibit or assist the development of sustainable electricity generation, electricity conservation, and energy conservation within the City of Emeryville.

   c) **Data collection procedures:** search the City of Emeryville documents mentioned in “data sources” as well as the websites of the State of California and Federal Departments listed under “data sources.”

   d) **Method of data analysis:** Review the documents for consistency by developing a comparative matrix, as well as a time line of when policies and goals were adopted, baseline measurement years, and the years designated for specified achievements. This will help to provide context for what has been achieved, what needs to be achieved, as well as help guide policy recommendations.

   Information gathered using these methods will primarily contribute to Section 2 of the final report.

3. Data Collection: Interviews

   a) **Data sources:** (Environmental Services, City of Emeryville) and (Kyoto USA), (Program Manager for SmartSolar- a company specializing in solar powered garden products), (Program Manager for Smart Lights- a company specializing in energy audits for small businesses), (from the California Wind Energy Collaborative at UC Davis), and (Berkeley Energy Office). Building managers for businesses and multi-unit residential complexes (such as IKEA, Home Depot, Watergate Condominiums and Pacific Park Plaza Condominiums) will also be interviewed.

   b) **Reason for collecting the data:** All people being interviewed are from northern California, providing a local perspective to complement literature review sources. has worked for the City of Emeryville for over eight years, and knows the most about energy, and energy related issues, as they pertain to the
City of Emeryville. __________ of Kyoto USA has worked on getting solar installations in school districts throughout the East Bay and is an expert on financing solar installations. __________ and __________ work locally in the solar energy installation field. My interviews with them will focus on their perceptions of physical and policy barriers to increasing solar installations in Emeryville, as well as the practical limitations of installation size and electricity generation. __________ is an expert in wind energy. My interview with __________ (or another member of the California Wind Energy Collaborative at UC Davis if he is not available) will focus on the opportunities and challenges to increasing localized and sustainable electricity from wind generation. Building managers within the City of Emeryville will be interviewed to provide perspectives on the effectiveness of implemented policies and goals, as well as incentives and barriers to conserving electricity and installing sustainable electricity generation equipment. I also plan to meet with __________ of the Berkeley Energy Office in order to discuss the successes and setbacks that the City of Berkeley has experienced in implementing their Climate Action Plan.

c) **Data collection procedures**: Scheduled, in person interviews. Taking typed notes, and using a voice recorder if agreeable to the interviewee. All interviews will adhere to IRB requirements and all interviewees will be informed of the IRB process.

d) **Method of data analysis**: Interviews will be used to help assess the effectiveness of current policies and goals, incentives and barriers to success, and to help identify new opportunities for achieving electricity conservation and sustainable production goals. Interview information will be reviewed for themes and insights; a matrix may be prepared to help with this analysis.

Information gathered using these methods will contribute to Sections 4, 5 and 6 of the final report, and may influence my recommendations provided in Section 7.


a) **Data sources**: Emeryville General Plan, Alameda County GIS parcel maps, estimated solar panel coverage and electricity generation in Emeryville.

b) **Reason for collecting the data**: to estimate the amount of solar electricity Emeryville will be able to produce at General Plan build-out.

c) **Data collection procedures**: collect information about total buildable area and allowable lot coverage (which correlates to potential roof area from the General Plan FAR map and the Alameda County GIS parcel maps. Use this information to produce calculations projecting Emeryville’s potential for roof-top solar production.
d) Method of data analysis: calculations based on the total available solar collection area and rates of electricity generation from solar panels.

Step 1: Calculate the maximum potential for roof-top area at General Plan build-out (do this by applying the FARs found in the General Plan to all areas of potential growth- as defined in the General Plan- ). For example, if one acre (less public right of ways) has an FAR of .5, at General Plan build-out the maximum area that could be available for roof-top solar collection would be .5 acres.

Step 2: Find roof-top solar capacity by dividing the amount of maximum potential for roof top area by an amount that reflects rooftop constraints (such as HVAC equipment, skylights, etc.). Obtain this number from solar experts or through literature review. For example: if most solar installations cover between 40 and 60 percent of roof-top area, estimate solar roof-top capacity to be 50 percent. Divide the amount roof-top area found in Step 1, by this percentage. Continuing with the example from Step 1, if our maximum potential for roof-top area is .5 acres, divide that by the estimated solar roof-top capacity of 50 percent. This means that the maximum solar capacity in our example is .25 acres.

Step 3: Calculate the potential energy generation from the answer in Step 2 by using software available for free at http://www.pvwatts.org/. This software is used by solar energy professionals to estimate solar electricity production based on regional weather patterns. Calculate the amount of electricity that can be generated from the total potential solar panel area.

Information gathered using these methods will primarily contribute to Section 5 of the final report.

5. Literature review: potential non-solar sources of sustainable electricity generation at General Plan build-out.

a) Data sources: Emeryville General Plan, Climate Action Plan Study, and literature review.

b) Reason for collecting the data: to estimate the potential for sustainable electricity generation technologies, other than solar, at build-out of the Emeryville General Plan.

c) Data collection procedures: using search engines such as Academic Search Premier and Science Direct, locate peer-reviewed articles dealing with developing
electricity generation technologies and electricity generation strategies in urban areas.

d) Method of data analysis: Articles will be read and assessed for sustainable electricity generation methods that may be used in Emeryville, CA. Analysis will include a written summary of findings as well as a matrix of successful and unsuccessful strategies for incorporating sustainable electricity generation technologies in urban areas. This matrix will include information on types of technologies, where they have been tried, costs, and the amount of potential energy generation.

Information gathered using these methods will primarily contribute to Section 6 of the final report.

Report outline.

1. Introduction: It’s Electric! (7 pages)
   a. Background
   b. Research Question
   c. Relevance
   d. Approach
   e. Intended Audience
   f. Report Structure

2. Existing Energy Policies and Goals (5 pages)
   a. Relevant Federal policies
   b. Relevant State of California policies
   c. Relevant City of Emeryville policies and goals

3. Trends in Electricity Use: A Comparative Guide (5 pages)
   a. Averages and trends in electricity use statewide and nationally
   b. Averages and trends in electricity use in the City of Emeryville
   c. Discussion of how policies and goals in the City of Emeryville have (or haven’t) influenced electricity consumption thus far.
4. **Potential for Electricity Conservation and Efficiency (5 pages)**
   a. Successful and unsuccessful methods for conserving energy in urban areas.
   b. Potential methods to help the City of Emeryville reach its energy conservation goals.

5. **Potential for Solar Electricity Generation in the City of Emeryville (5 pages)**
   a. Calculations of roof-top potential for solar generation in Emeryville
   b. Potential of solar generation as a method for achieving City of Emeryville goals and policies

6. **Potential for Non-Solar Sustainable Generation Methods in the City of Emeryville (7 pages)**
   a. Literature review presenting what has and hasn’t been successful in other urban areas.
   b. Applicability of successful methods found in the literature review to contribute to achieving the policy goals of the City of Emeryville.

7. **Conclusion: Next Steps for Emeryville, CA (5 pages)**
   a. Findings
   b. Recommendations
   c. Areas for further study

**Bibliography.**

*Items cited in the research proposal:*


Items read that are not cited in the research proposal:


*Doughman, Pamela M. “California’s Climate Change Policy: Raising the Bar.” Environment, 49 no. 7 (September 2007): 34 – 43.


Identified items that look useful and that I plan to read:


State of California. *Assembly Bill No. 117, Chapter 838* [2002].

State of California. *Executive Order S-14-08* [November 17, 2008].


**Schedule of tasks.**

January:

February
- Update graduation information with Professor Nixon.
- Conduct preliminary interviews with City of Emeryville staff (Peter Schultze-Allen and Charlie Bryant) to update them on the status of my project and collect any additional/new data.
- 6th, Sunday: begin assessment of previous work done on Lit Review.
- 14th, Monday: continue data collection and begin data analysis for Section 2 (Existing Policies and Goals)
- 20th, Sunday: complete finding all sources for Lit Review.
- 27th, Sunday: complete organization and notes for Lit Review.
- 27th, Sunday: complete finding sources for Section 3 (Trends in Electricity Use)

March:
- 6th, Monday: complete organization and notes for Lit Review
• 6th, Monday: complete initial data collection and analysis for Section 2 (Existing Policies and Goals)
• 12th, Saturday: complete draft of Section 2 (Existing Policies and Goals)
• 12th, Saturday: begin writing Draft Lit Review research for Section 4 (Conservation and Efficiency)
• 28th, Monday: turn in Draft Literature Review
• 29th, Tuesday: begin contacting individuals to set up interviews.

April:
• Continue work on Lit Review.
• 4th, Monday: begin interviews.
• 18th, Monday: turn in Final Literature Review
• 19th, Tuesday: begin contacting individuals to schedule interviews.
• 23rd, Saturday: update/revise Section 1 (Introduction)
• 24th, Sunday: begin writing Section 3 (Trends in Electricity Use)

May:
• 2nd, Monday: complete interviews.
• 6th, Friday: complete draft of Section 3 (Trends in Electricity Use).
• 7th, Saturday: begin outlining Sections 4 – 7 for Draft Report.
• 16th, Monday: turn in Draft Report Sections (minimum 4,000 words).

June:
• Complete draft of Section 4 (Conservation and Efficiency).
• Complete basic GIS course to help with Section 5.

July:
• Complete draft Section 5 (Solar Electricity).

August:
• Complete draft of Section 6 (Sustainable Generation Methods - not solar).

September:
• Complete draft of Section 7 (Conclusion and Next Steps).

October:
• Turn in first full draft.

November:
• Turn in second full draft.

December:
• Turn in final report for advisor review.
• Turn in finished report in both PDF and print versions.