# Local Renewable Energy Transition Strategies

Gerald W. Braun

*Received: 10 December 2020 Accepted: 5 January 2021 Published: 15 January 2021*

---

## Abstract

Introduction-The US renewable energy transition re-started about a decade ago, leveraging scale-up and maturation of solar and wind industries that expanded globally after California's pioneering wind and solar deployment in the late 1980s.1Completing a global renewable transition will necessarily build on existing global, national and regional energy systems. But without engagement by the half million local jurisdictions around world, the transition will be as slow and uneven as it has been to date. Is there a renewable energy transition strategy that is adaptable to conditions around the world and is already working well where it is being applied. The strategy must be not only affordable but economically beneficial, or it will not be adopted in many cases until it is. There must also be a demonstrated way of financing its elements.

---

***Index terms—***

# 1 Introduction

he US renewable energy transition re-started about a decade ago, leveraging scale-up and maturation of solar and wind industries that expanded globally after California's pioneering wind and solar deployment in the late 1980s.1

Completing a global renewable transition will necessarily build on existing global, national and regional energy systems. But without engagement by the half million local jurisdictions around world, the transition will be as slow and uneven as it has been to date. Is there a renewable energy transition strategy that is adaptable to conditions around the world and is already working well where it is being applied? The strategy must be not only affordable but economically beneficial, or it will not be adopted in many cases until it is. There must also be a demonstrated way of financing its elements.

A simple calculation using US solar investment statistics provides a measure of how much investment will be required in the ten years remaining before climate change reaches a potential tipping point, beyond which it is impossible to plan based on current information. More than $2.7 trillion has been invested in building up global renewable energy capacity over the past decade **??** Author: e-mail: gbraun12@sbcglobal.net . In those same 10 years, renewable electricity sources more than doubled their share of the global power mix, from 5.9% in 2009 to 13.4% last year. Current market forecasts suggest that renewable power capacity could double again over the next five years. This near term doubling rate might continue, but renewable power's share in 2030 would be about 25% of global energy, not 100%. Thus, it becomes clear that fully decarbonizing all or most of the half million local economies on earth, while making them sufficiently resilient against economically crippling disruption, will require unprecedented rates of investment, to say the least. **??** California's initial renewable power deployment aborted in the early 90s as California regulators restructured California's electricity systems to expand natural gas generation. Since 2001, while California's population and economy expanded, new natural gas and renewable electricity generators helped reduce GHG emissions from California's in-state electricity generation by about a third, to nine percent of total state-wide emissions in 2017. Figure 1 ii Shows that the transition in the U.S. so far has relied on meeting new power generation capacity needs and filling supply gaps resulting from coal fired power plant retirements with a three part portfolio of new natural gas, solar and wind generation.

Figure 2 iii Shows the trajectory of the solar part of the portfolio in California, indicating that "utility solar", i.e., plants feeding electricity into high voltage transmission systems currently accounts for roughly 50 percent of capacity additions, while on-site deployment on residential and non-residential (mostly commercial) property accounts for the other half.

## 2 Renewable Energy's Role in Local Climate Action

Is there renewable transition strategy that both accelerates deployment and is generally recessionproof? There may be if local climate adaptation measures drive local renewable energy investments already having an impact. Figure 3 shows affordable local climate action options available on two major renewable deployment tracks to energy sector decarbonization and resilience, electricity and gas fuel. iv In many local cases, increasing on-site solar electricity production is the most potent available measure to shrink the local carbon footprint. In parallel, locally produced bio-methane that is ”carbon negative” lowers GHG emissions much more, even when burned, than if organic feedstocks were left to decompose and release methane into the atmosphere.

Microgrids increase local energy resilience, partially in the case of solar/battery powered microgrids, and fully in the case of hybrid solar/gas microgrids.

Solar energy for space and water heating can have a major impact, though in the US, it typically must be supplemented by gas fuel or backed up by grid electricity.

Personal vehicles can be fueled with solar generated hydrogen or battery-powered, preferably from a decarbonization perspective, with locally produced solar electricity. 2 2 Renewable hydrogen prospects are receiving a surge of government and industrial attention in Japan and Germany because of hydrogen's importance as an enabler of long term electricity storage and fuel cell electric vehicle deployment.

Where grid electricity from mixed sources has a high renewable content, i.e., greater than 75%, it is an acceptable substitute for locally produced solar electricity. Micro combined heat and power (micro CHP) fueled by low, zero or negative carbon gas provides full resilience and is the best option in the absence of electric service via a community or neighborhood solar/gas microgrid. A modest level of collaboration is already occurring in the matter of local solar electricity deployment, as electric utilities approve grid interconnections of ”behind the meter” on-site solar installations, and local governments ensure compliance with local building codes. The result of even this modest On the gas fuel track, current planning guidance gaps are beginning to be filled.vi Balanced planning and implementation on each local renewable deployment track could double the combined near term impact and open new decarbonization and resilience pathways and synergies for the future. However, there is an urgent need for datadriven planning and collaboration among local governments, energy utilities, major employers and energy retailers. Collaboration opportunities are numerous, though capturing them confronts equally numerous barriers and limitations as explained in a later section. vii 3 In California local climate action planning increasingly emphasizes building sector electrification. Some local jurisdictions, e.g., most recently Oakland, have banned natural gas hook ups for new buildings. California's mild winters and the avoidance of solar customer acquisition costs in new construction make this an economically plausible renewable transition element in California's coastal areas and central valley. Figure 4 also shows every California country producing renewable energy. Some are exporters. Most are importers. Each exporting county's renewable product mix differs from all others. Most electricity generated by ”utility scale” solar power plants is exported via California's state-wide power grid to other areas. Customer charges on these exports now exceed production costs by as much as a factor of two and continue to escalate.

Locally produced solar electricity is typically unavailable to renters or residents of low income neighborhoods, creating ”solar deserts” akin to ”food deserts”. Can expansion of renewable energy production be accelerated if grid access charges for ”community solar” ix and other community renewable projects evolve to properly account for local energy resilience benefits and actual project-specific grid usage? How much expansion of regional transmission systems can be avoided by expanding local renewable energy production?

## 3 b) Make or Buy

In the U.S., the trade-off between local and centralized solar electricity deployment has shifted dramatically in the last ten years. At the same time, top level planning implications, e.g., in California, have yet to register. Not only have solar costs plummeted across a five order of magnitude project size range, but, predictably, the cost differences between large and medium and medium and small have become less important to state and local economies than costs of transporting and storing solar electricity.

So, a fundamentally important trade-off, crucial to climate action and adaptation, is not even on state policy radar screens. There is now enough experience with both centralized renewable supply expansion and more locally beneficial on-site and community renewable energy deployment to begin putting policies in place to make informed trade-offs. The right balance must be primarily a local choice because renewable resource opportunities and energy usage differ from one community to the next. Getting to the right balance is economically and otherwise crucial to local governments and the communities they serve, but it is impossible to achieve without closer engagement with energy users, local solar retailers and energy engineers.

## 4 c) Solar Cost Shifts

More rapid and consequential shifts in solar electricity production costs have been driven by manufacturing progress curves and organizational learning in the solar project engineering and construction industry over the past decade. Impacts of scale economies and other contributing factors are quantified in Figure ??. ?? The cost metric in the figure is installed system cost, an appropriate metric for tracking progress in reducing the cost of projects in a specific market segment, e.g., projects financed by utilities or utility solar project developers.

# 5 Figure 5: Trends in the Full Costs of Solar PV Systems in

the US There are significant differences in system productivity among system sizes and types, but these differences are relatively minor except for tracking vs. fixed tilt utility systems. Across a wide system size range, equipment cost fall in a narrow range , but "soft" costs, notably "customer acquisition" can be especially high in areas where residential and commercial solar are just beginning to penetrate.

Opportunistic pricing of residential and commercial systems where retail competition is still weak or non-existent results in higher soft "costs". Likewise, as installed costs continue to decline in all segments, regions where grid usage charges are set to recover costs rather than discourage deployment will see faster growth and more cost-efficient deployment.

As a metric for cost comparisons between local solar projects and utility solar projects, installed system cost is an inappropriate and misleading metric. The value of electricity produced on-site is two to three times that of electricity delivered to a site by a regional lobal Journal of Researches in Engineering ( ) Volume Xx XI Issue II Version I J electricity grid, and customer charges for transmission in the largest U.S. market, California, now exceed costs of solar generation at any scale.

Financing costs and methods, etc. differ markedly among the solar electricity market segments. 4

# 6 d) A Good Deal Getting Better

In energy utility rate-setting, customer energy transport and delivery charges are additive to the cost of importing solar electricity from distant solar resource areas. because cost recovery periods.

Comparative economics of centralized vs. local solar production will continue to shift in favor of local production as solar supply costs trend downward and as large projects come on stream and drive a need for longer duration and more costly energy storage.

While solar PV has become a cost-effective choice for utilities seeking to add centralized generation capacity or replace existing capacity, it is an even better choice for electricity users that gets better each year as grid electricity prices continue to escalate. Property owners now recapture their on-site solar investments in as little as 5-6 years, depending on grid electricity prices and maturity and competition in the local retail solar industry. Their investments deliver major resilience, environmental and economic benefits to cities and counties, better enabling them to invest in environmental justice initiatives and a broader array of climate adaptation measures. In this integrative context, the modest and ever-shrinking difference between unit costs of utility solar electricity generation capacity and unit costs of installed local solar electricity systems are relatively inconsequential.

# 7 e) Local Deployment Capacity

Deployment capacity is key to cost-efficient investment for all solar technologies and project scales. Radical increases in solar project deployment capacities around the world mirror shifts in industrial policies of industrial nations. Within U.S., shifts have been more gradual, and differences are explained in part by political divisions among the states and differences in retail energy prices offered by state regulated utilities. States with long standing, supportive policies had local solar deployment capacities in place to build on before Federal solar tax credits became available via an economic stimulus ten years ago. Solar deployment in states with supportive policies and relatively high electricity rates increased more rapidly than in other states. For example, California electricity rates are relatively high. Its counties and cities that have relatively mature local solar deployment capacity are seeing double digit annual on-site solar expansion. 4 Levelized cost of electricity is an especially inappropriate comparative metric between costs of small medium and large solar projects because the parameters and calculation of levelized costs apply only to utility investments.

# 8 f) The Reliability Shift

Increasing severity of natural disasters erodes the reliability of local activity that depends on energy imports. Reliability of electricity service to California communities and energy users has plummeted in recently for communities and energy users subject to "power safety shut-offs" during seasons when high winds increase wildfire risks. Few California communities are completely immune.

# 9 g) The Resilience Shift

Extended energy service disruptions devastate local economies. The obvious and urgent response is to increase local energy resilience. Energy resilience is the local capacity to restore energy service quickly and indefinitely. Increased local renewable energy production and judicious renewable fuel use can provide at least partial energy resilience, thus mitigating local energy service vulnerabilities. Once technical and institutional impediments are removed, home and business energy investments 5 can be integrated with smarter local energy "distribution" infrastructure to make local energy service fully resilient. 6

# 10 h) The Equity Shift

Economically insecure neighborhoods need to be more, not less, energy secure than their economically secure counterparts. Fairness requires that the benefits of local renewable energy supply be available to all. For example, in places where solar energy saves money and backs up traditional energy service for local businesses and homeowners, it must do the same for renters, who, on average, may have greater need for cost savings and energy security. Working with local solar retailers and energy service providers, local governments can plan and implement strategies to bridge the solar divide. One step forward in California will be to stop adding transmission charges to renewable electricity generated locally and delivered locally without passing through the regional transmission system.

# 11 IV.

# 12 Local Renewable Transitions a) Strategic Situation

In California, on-going expansion of centralized renewable electricity supply is responsive to the state's carbon neutrality goals. It enables less reliance on large power plants that convert fossil fuels to electricity. Usage changes, demand response capacities, and energy storage investments are needed to capture decarbonization benefits of large renewable projects. 5 I.e., investments in on-site solar heat and electricity production, community renewable gas and electricity production and battery and fuel cell electric vehicles that exchange electricity with local electricity grids 6 "Full resilience" means the ability to quickly restore unrestricted and uninterrupted 24/7 energy services.

lobal Journal of Researches in Engineering ( ) Volume Xx XI Is sue II Version I J Investing exclusively in large renewable power plants is an incomplete decarbonization strategy that becomes more costly as renewable penetration increases. In California, it now causes rather than mitigates local electricity service disruptions. 7

# 13 b) Strategic Responses

Parallel expansion of local renewable supply is key to timely, but also just, safe and economically beneficial local renewable energy transitions.

Three foundational elements of strategic local renewable transitions are: 1) accelerated local renewable resource development by local governments in collaboration with local electricity service providers and with Community Choice xi wholesale electricity procurement programs (in states where they are authorized), 2) allowing property owners to generate "net positive" solar electricity based on fair allocation related grid infrastructure and operating costs, and 3) collaboration between energy utilities and local governments to implement and expand "net negative" carbon capacities for building and transportation fuel production. The terms, net negative and net positive are defined below.

# 14 c) Accelerated Local Renewable Resource Development

Counties and cities own and permit the use of land within their jurisdictions. Sites that are environmentally and otherwise suitable for renewable energy development should be inventoried and assessed to determine their economic value for purposes of renewable project development in anticipation of renewable project developer interest. Some California jurisdictions now have experience that validates the critical need for anticipatory evaluations and decisions.

# 15 d) Net Negative Carbon Local Fuel Production

Carbon intensities of major energy sources vary widely, generically, and project by project within a generic category. Figure 6xii shows generic intensities for current and emerging transportation fuels. 8 7 Energy resilience, long a concern in disaster-prone areas, e.g. coastal areas in the southeastern US, is now a concern in California in the wake of recent, unprecedented wildfires. Technically and economically informed state-wide decarbonization and resilience planning has become a critical need, but responsibility and authority to do it at the local level remains diffuse. Regional energy utilities rely heavily on out-of-state imports and have divested, or retired, portions of the energy production fleets they once owned while the state relies on commodity energy markets it operates to attract investment in new in-state supply. **??** An alternative fuel's carbon intensity (CI) value is divided by its Energy Economy Ratio (EER) obtain the EER-adjusted CI value, representing the emissions that occur from the use of alternative fuel per MJ of conventional fuel displaced.

It shows that bio-methane produced from organic waste streams has widely varying carbon intensities, some deeply negative and some modestly positive. From a climate perspective negative is good. Note that projects can have carbon intensities anywhere in the range indicated by the vertical bars. The figure shows that substituting bio-methane, aka renewable natural gas (RNG), for diesel fuel has the greatest potential decarbonization benefit in the transport sector, depending on proper project design and implementation. Other recent studies suggest that sufficient bio-methane production feedstocks are available to support highly impactful substitution of bio-methane for natural gas (geologic methane) for building space and water heating. Net positive solar electricity production should be allowed and equitably compensated in the interest in least societal cost energy supply. Local economies will not long be well served by rules that result in underutilization of on-site solar energy production potential. It will be increasingly vital that net electricity policies strike the best balance between meeting local grid owner concerns and local government interests in economically beneficial and equitable local climate action. For example, feed-in tariffs have been demonstrated effective in Europe and some parts of the US. As with fuel and electricity decarbonization, a combination of feed in tariffs and net metering policies will have greater decarbonization and resilience benefits than either alone.

Collaborative engagement between local governments and energy utilities will be essential to work out in each local case how best to transition from a local solar electricity deployment policy relying on net energy metering alone and one that offers multiple options to achieve more equitable access to locally produced solar electricity while maximizing benefits to local economies.

Meanwhile, should utilities and state legislators and regulators encourage investment in net positive annual on-site renewable energy production? Should net positive production be valued at the average cost of the utility's solar purchases plus related transmission costs? Environmental impacts of centralized production and high voltage transmission should weigh in the balance when judging the merits of enabling state legislation.

V.

# 16 An Economically Beneficial Local Renewable Transition

Local renewable transitions can strengthen local economies in ways that cities and counties so far rarely consider, e.g., job creation and taxable assets. 9 9 Benefits of more local dollars recirculating locally are harder to quantify but may be even more important.

xiii Economic benefits of local renewable transitions accrue primarily to energy users able to generate solar energy on property they own. In California, on-site solar investments pay back in five to ten years and result in essentially zero cost energy for decades. Their benefits also accrue to local governments and local economies in the form of dollars that recirculate locally, create local jobs and add to property values. Figure 7 shows the result of an analysis to roughly scope the economic impacts of on-site solar electricity production in one California country. Having Yolo County, California has a population of roughly 200,000, and a mix of urban and rural areas. Its experience illustrates how quickly local renewable transitions can progress, either on or under the radar of planners and policy makers. **??**0 VI.

# 17 Limitations Impeding Local Renewable Transitions

County-wide on-site solar deployment in the past five years accounts for most of the local solar capacity that now meets twelve percent of the county's electricity usage. In some cities within the county the number of new systems has increased at an annual rate of nearly twenty percent per year.

Benefits to the county economy include well paying jobs and less money leaving the county to pay for grid electricity imports, which now total several tens of million dollars. The combined annual benefits at the end of 2020 are estimated at $90 millions. These combined benefits strengthen the county's ability to fund the implementation of climate adaptation and resilience measures and address inequities, including lack of access to cost-saving locally produced solar electricity by non-property owners.

Indirect and hard-to-quantify benefits include local electricity supply sufficient to materially enable faster recovery in the wake of disasters and mitigate loss of economic productivity in during public safety power shut-offs and blackouts costs by disasters and physical and cyber-attacks.

# 18 a) Monopolistic Inertia

Local governments and energy utilities of all stripes are monopolies. Monopolistic utility service models have held up well over many decades. But now they impede decarbonization and local energy resilience, oppose barriers to equitable local renewable energy production, and enmesh local climate action in **??**0 A two and a half year old county-wide Community Choice program may result in improved "radar" going forward lobal Journal of Researches in Engineering ( ) Volume Xx XI Is sue II Version I J bureaucratic inertia. Energy service in the U.S. is regulated according to state laws that are heavily influenced by energy utilities. In the California, they function as virtual money machines, collecting and spending revenues, purchasing energy they once produced, outsourcing other business functions to the extent possible and managing risks of litigation and failures of energy trading processes they do not oversee. 11

# 19 b) The Local Energy Collaboration Gap

To varying degrees, they view on-site renewable energy production as a threat to erode the revenue streams on which they and their employees depend. Meanwhile, local governments struggle to implement state mandates across a wide range of services and incur significant code development and enforcement costs and risks.

In the U.S., energy utilities and local jurisdictions typically do not pro-actively collaborate, share data or concern themselves with abovementioned benefits of customer self-generation. In an energy resilience context, the need to do so is urgent. Lack of budget and staff capacity limits serious collaborative engagement. It may be time to authorize revenue collection on both sides to capture the societal benefits of local renewable energy transitions. For example, to fund collaborative engagement, should cities and counties be allowed to tax local solar property when and wherever it has become cost-effective on a life cycle basis? Doing so in the past would have impeded local solar deployment, but it may be time for judicious adjustments.

# 20 c) Deployment Capacity Limitations

California's ability to ramp up local solar electricity deployment in the past decade is owed to a cadre of one thousand local solar retailers and installers that grew and matured in the years prior to Federal solar tax credits, thanks to a $3B incentive program funded by the state legislature in 2006. Other states rely on utility scale renewables to decarbonize in part because local solar deployment is building on a less robust and profitable base of retailers and installers. Even in California, the retail solar industry's capacity to deploy larger non-residential systems is less evenly distributed and less mature. Cities and counties interested in capturing the local economic benefits of solar energy adoption can take steps to ensure access to competitive solar bids from locally owned solar retailers, e.g., by committing to net zero carbon conversions of public schools and local government buildings and vehicles.

11 California's regional energy utilities rely heavily on out-of-state imports and have divested, or retired, portions of the energy production fleets they once owned, while the state relies on commodity energy markets it operates to attract investment in new instate supply.

# 21 d) Business Model Limitations

Energy utility business models typically view wholesale energy as a commodity undifferentiated according to where it is produced. Nevertheless, state regulation typically does not preclude utilities procuring and offering locally produced renewable energy for local use. In California, Community Choice wholesale electricity suppliers are starting to do just that, acquiring experience that could lead state regulated utility counter-parts to follow suit. Utilities in other states may also lead the way. Figure 8 shows a solar micro community in a new net-zero-carbon Florida city. The city will have a population of twenty thousand when fully built out. A utility-owned 150MW solar power plant already operating on land donated by the developer will supply electricity to residents and businesses at the same prices the utility charges customers elsewhere in its service territory. Could settled US cities collaborate with their energy utilities and/or wholesale energy providers 12 e) Planning Capacity Limitations to achieve comparable results?

Technically and economically informed statewide decarbonization and resilience planning has become a critical need, but responsibility and authority to do it at the local level remains diffuse. Technically and economically informed local energy transitions pay for themselves when local clean energy planning and implementation capacities are competent and mature. When planning is not founded on actual local energy system models and analysis, important trade-offs are not addressed, e.g., between 1) On-site solar vs. Community renewables, 2) Imports and local production, 3) New projects vs. Retrofits, 4) Zero carbon vs. Fully energy resilient, 5) Expedient vs. Cost-efficient actions, 12 E.g. including mature Community Choice providers now operating in some states. Local governments must play a stronger planning and implementation role despite funding and other limitations. Getting local trade-offs right, capturing opportunities and lowering barriers is near impossible without collaboration among local governments and energy utilities. Getting the trade-offs right requires creating local energy system models, updating them and checking progress against them. xiv Inputs to integrated local energy analysis and planning need to be extracted from multiple databases. So, planning and decision-making must be intensely collaborative, starting with data sharing.

# 22 VII.

# 23 Summary

Where local renewable energy transitions are moving forward apace, energy user investments are now the primary driver. Local investments in on-site solar electricity and heat production can now deliver compelling life cycle cost savings in most of California, and attractive savings in many other states.

These investments have become the climate action gold standard by quickly replacing grid electricity and geologic methane with zero carbon energy and enabling local retail energy businesses to grow and prosper.

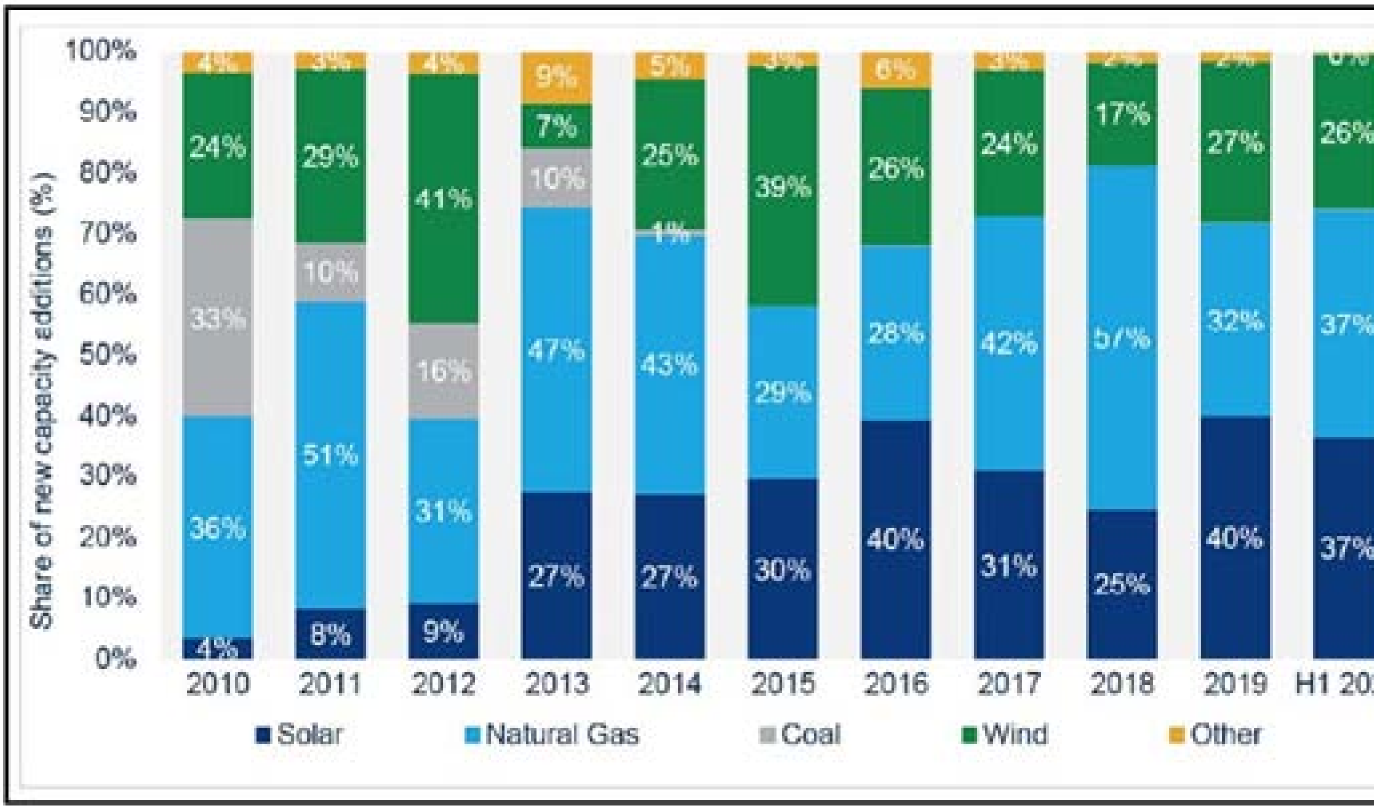
Expansion of local renewable supply is key to more timely, just, and safe state and national renewable energy transitions. US cities and counties should encourage private investment in local solar energy production because it enables faster local decarbonization and energy resilience -also because it strengthens local economies in many ways. Community renewable power and fuel production makes local energy transitions more timely - also more equitable. Local decarbonization and energy resilience progress requires technically and economically informed planning, which in turn requires greatly expanded collaboration among local governments, energy utilities and local businesses, including energy equipment contractors and retailers, fuel distributors, and major local employers. [1] [2] [3]

---

[1] © 2021 Global Journals

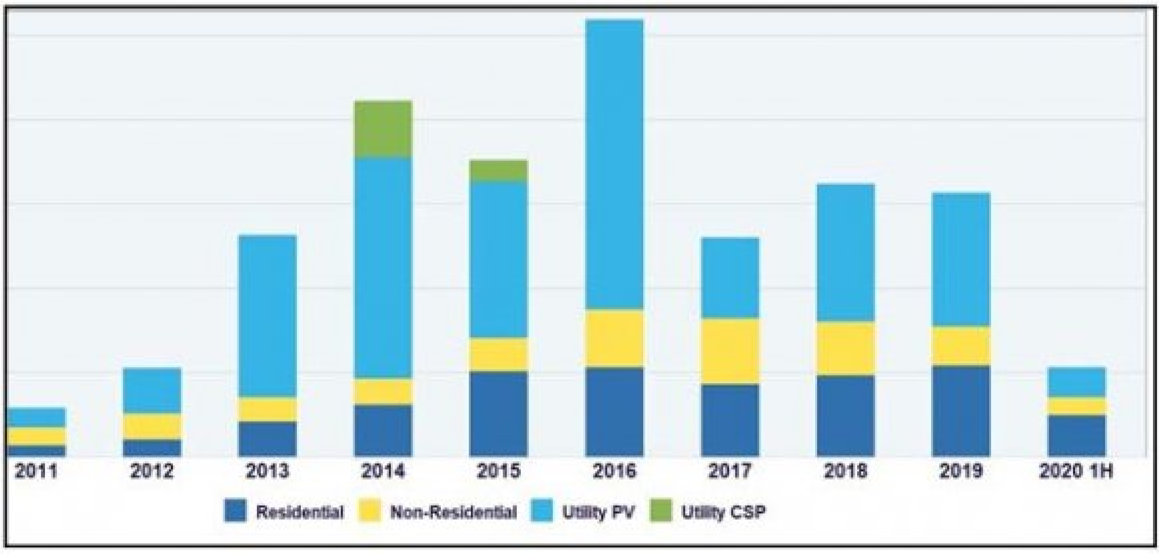
[2] Year 2 021 Local Renewable Energy Transition Strategies © 2021 Global Journals

[3] Year 2021 Local Renewable Energy Transition Strategies © 2021 Global Journals



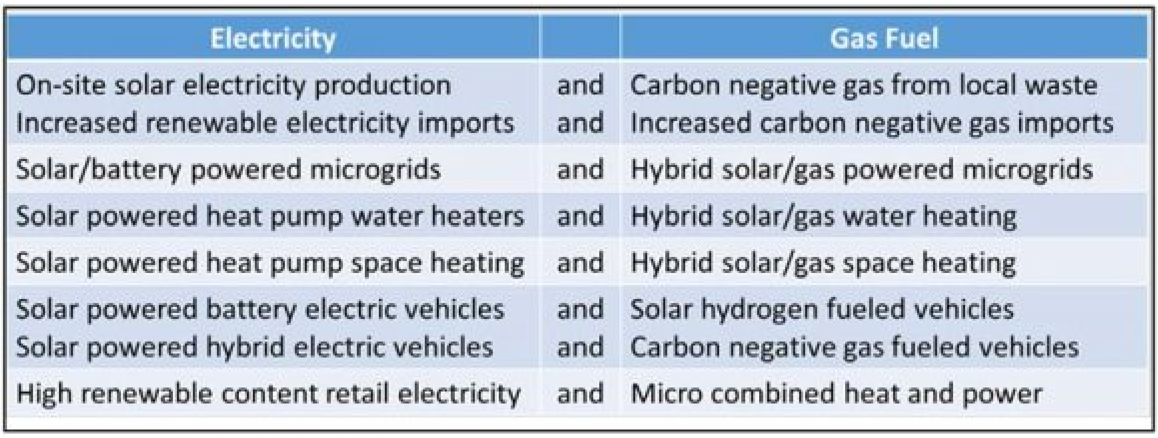
1

Figure 1: Figure 1 :



2

Figure 2: Figure 2 :



| Electricity | | Gas Fuel |
|---|---|---|
| On-site solar electricity production | and | Carbon negative gas from local waste |
| Increased renewable electricity imports | and | Increased carbon negative gas imports |
| Solar/battery powered microgrids | and | Hybrid solar/gas powered microgrids |
| Solar powered heat pump water heaters | and | Hybrid solar/gas water heating |
| Solar powered heat pump space heating | and | Hybrid solar/gas space heating |
| Solar powered battery electric vehicles | and | Solar hydrogen fueled vehicles |
| Solar powered hybrid electric vehicles | and | Carbon negative gas fueled vehicles |
| High renewable content retail electricity | and | Micro combined heat and power |

Figure 3: T

**3**

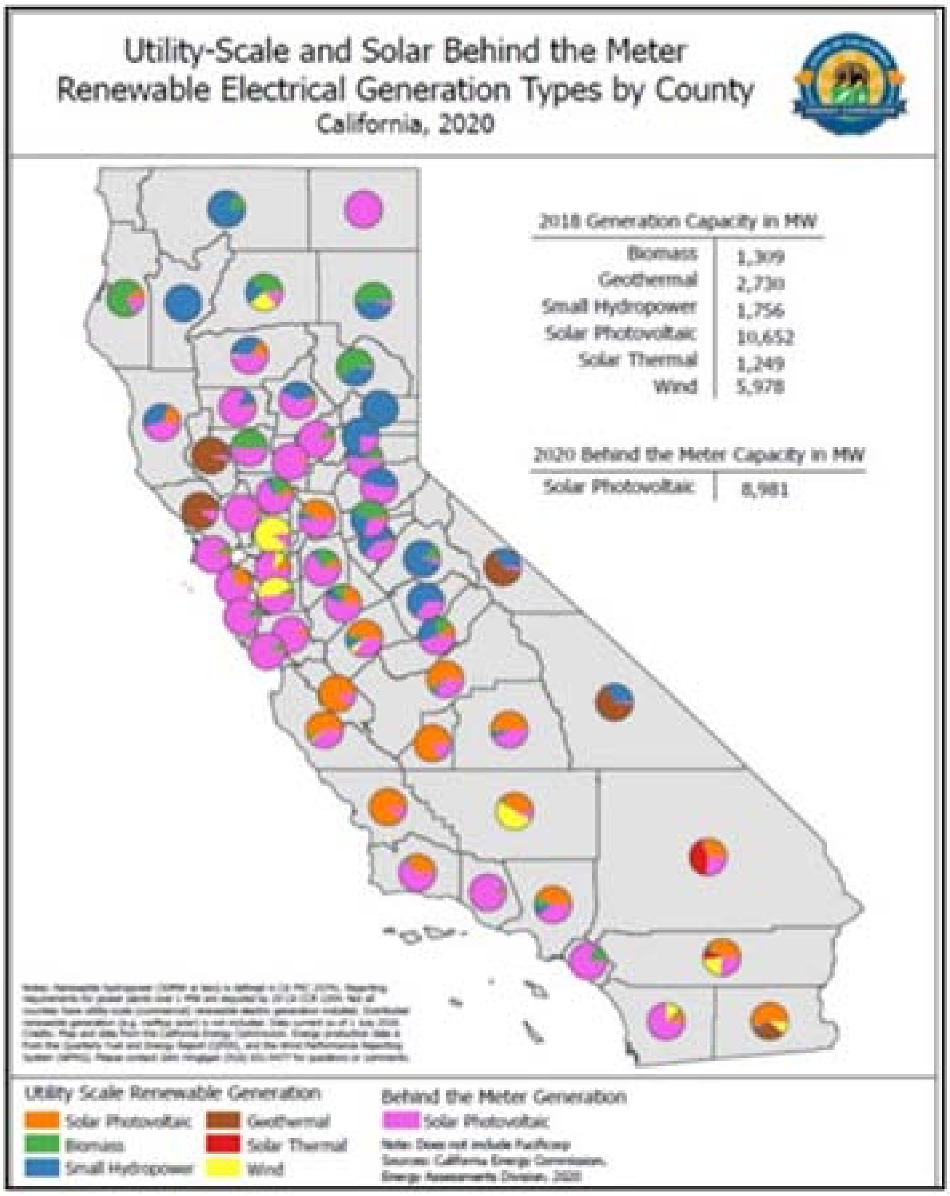
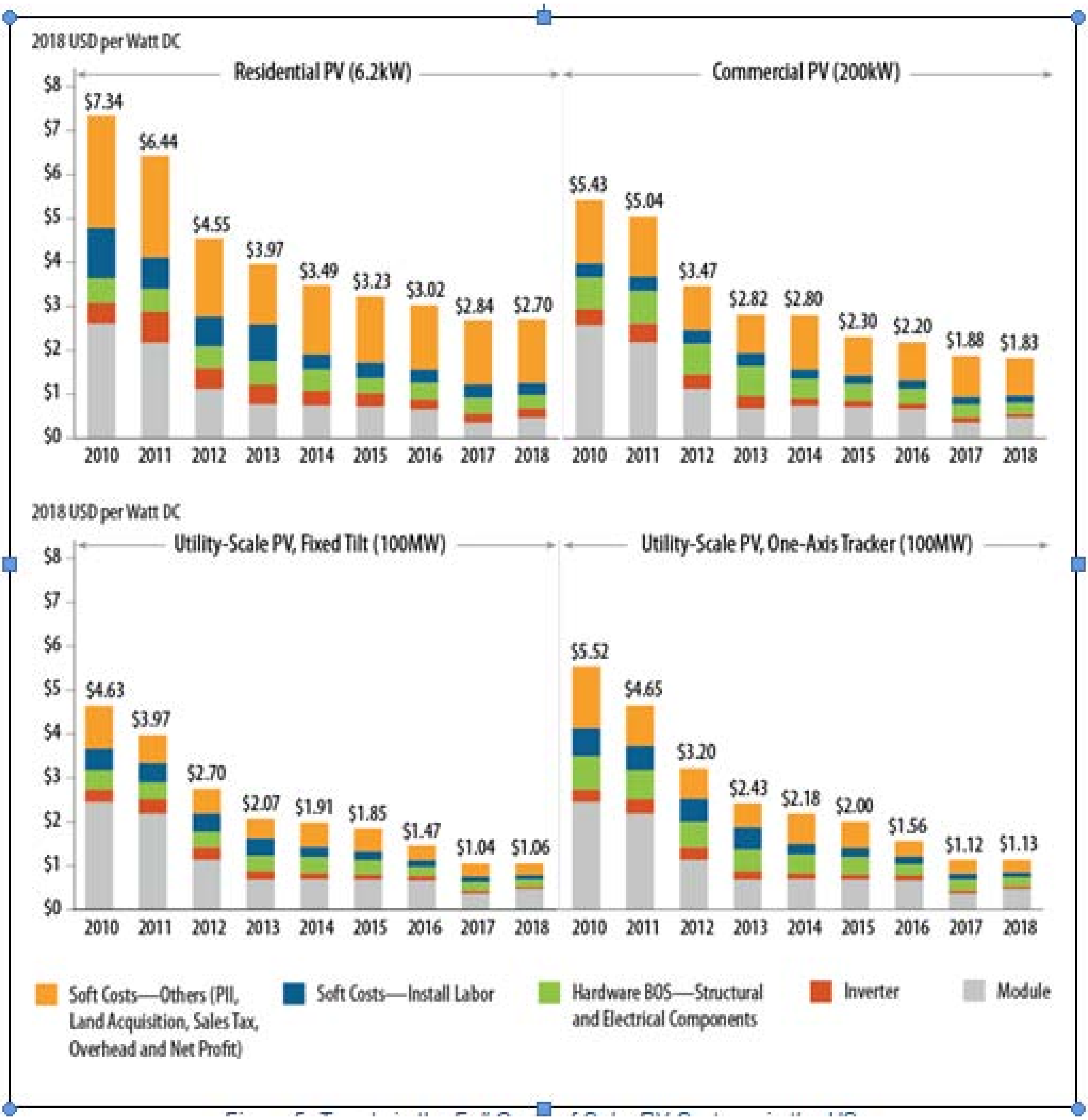


Figure 4: Figure 3 :



4

Figure 5: Figure 4 :

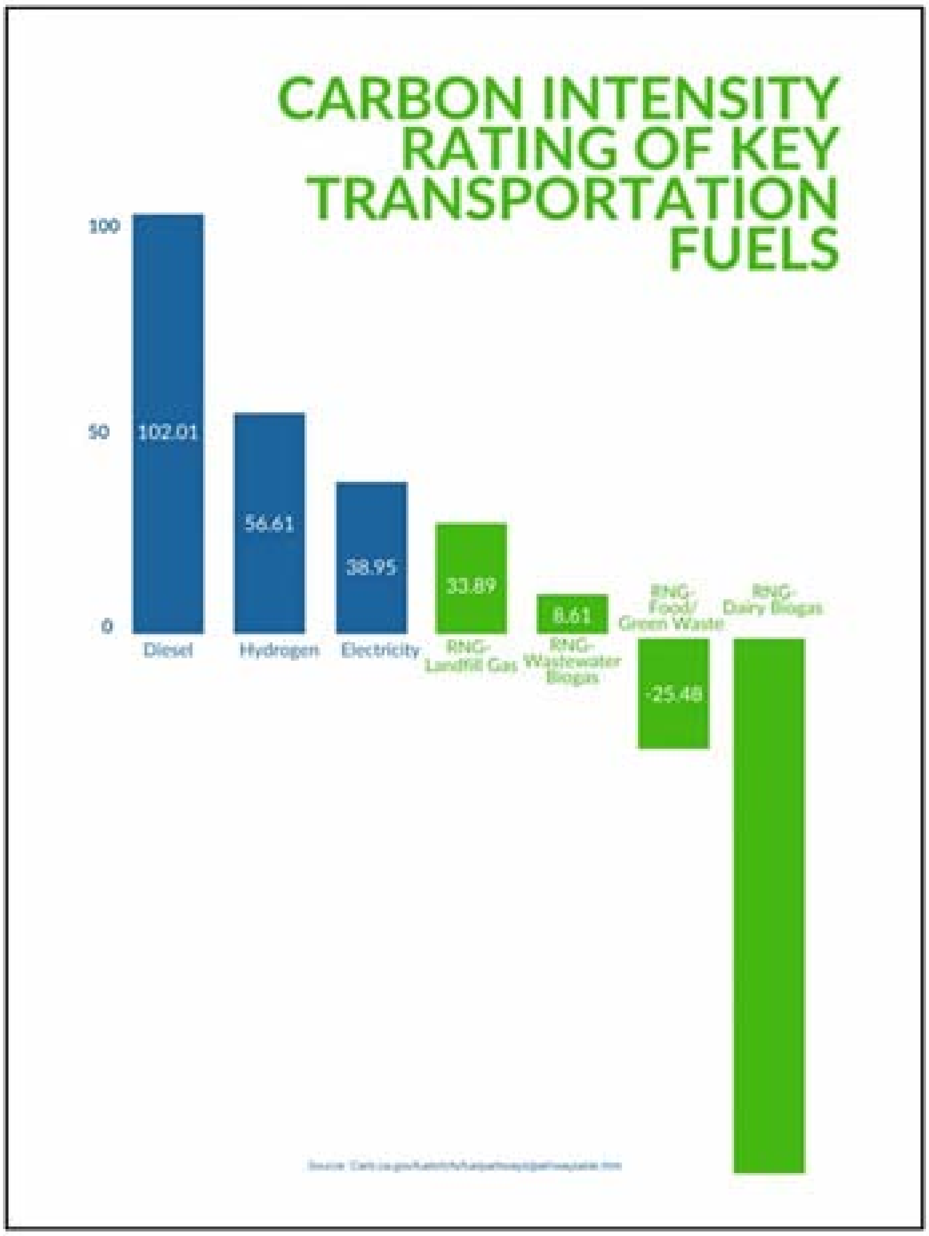
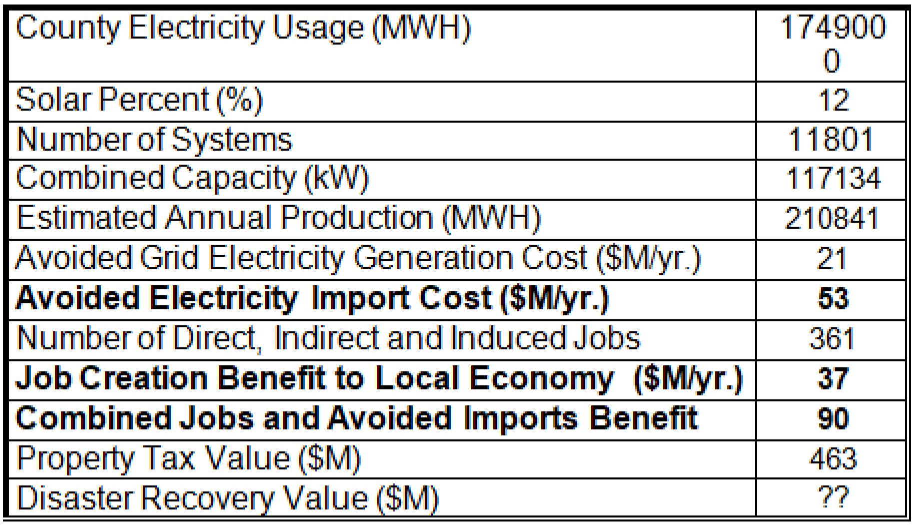


Figure 6: lobal



| | |
|---|---|
| County Electricity Usage (MWH) | 174900<br>0 |
| Solar Percent (%) | 12 |
| Number of Systems | 11801 |
| Combined Capacity (kW) | 117134 |
| Estimated Annual Production (MWH) | 210841 |
| Avoided Grid Electricity Generation Cost ($M/yr.) | 21 |
| **Avoided Electricity Import Cost ($M/yr.)** | **53** |
| Number of Direct, Indirect and Induced Jobs | 361 |
| **Job Creation Benefit to Local Economy ($M/yr.)** | **37** |
| **Combined Jobs and Avoided Imports Benefit** | **90** |
| Property Tax Value ($M) | 463 |
| Disaster Recovery Value ($M) | ?? |

**6**

Figure 7: Figure 6 :

**7**

Figure 8: Figure 7 :

[Ibid] , Ibid .

[Braun and Hazelroth ()] *Energy Infrastructure Finance: Local Dollars for Local Energy*, G Braun , S Hazelroth . `https://www.sciencedirect.com/science/article/pii/S1040619015001104` 2016.

[Braun] *Local Fuel Gas Decarbonization and Resilience for Southern California*, G Braun . p. 2020.

[Braun ()] *State Policies for Collaborative Local Renewable Integration*, G Braun . `https://www.sciencedirect.com/science/article/pii/S1040619019302969` 2019.