- The Public Utilities Regulatory Policies Act (PURPA), passed by Congress 1978, required local utilities to grant grid interconnection access to independent power generators, which stimulated utility-scale solar development. However, PURPA capped the amount of energy that a generating facility could sell at 30 MW. Although this cap was raised to 80 MW in 1989, Luz was forced to build a series of facilities that were less efficient and more expensive per MW than the optimal 200 MW capacity.
- PURPA also required utilities to purchase energy produced by non-utility-owned generating facilities. The California Energy Pricing Policy for solar energy was based on the avoided cost of producing electricity from oil or natural gas, whichever was lower. Although improved technology brought the solar electricity cost down to $0.08 per kWh, gas prices dropped 80 percent between 1981 and 1989 and oil prices fell to $18 a barrel. The avoided cost pricing policy brought the purchase price down to $0.05 per kWh, making more expensive solar projects economically infeasible.
- Annual energy tax credit cycles severely limited the company's ability to secure long-term funding from investors. Each calendar year Luz had to race to obtain site approval, secure financing and complete a facility. In 1989, the tax credit period was cut to nine months and, as a result, Luz endured a cost overrun that consumed two-thirds of their remaining capital.

The failure to complete all of the Luz SEGS projects was due to an unrealistic timeline for tax credit cycles and an electric purchase pricing policy tied to volatile commodity market prices. Conditions remained unfavorable for utility-scale solar development until the 2005 Energy Policy Act increased and extended renewable energy tax credits.

Changing Federal Incentives

Between 1981 and 1989, The Reagan Administration cut funding for renewable energy research and development by nearly 90 percent (Figure 4.1) which left the solar industry unable to continue development of technologies that could compete with lower cost, fossil fuel based sources of energy. For the next decade, while the United States experienced rapid economic development and enjoyed relatively low oil and natural gas costs (Figure 4.2), utility-scale solar developers were on hiatus. The shift in the willingness to invest in renewable energy generation came about in the late 1990s as scientists continued to issue dire warnings about climate change and energy analysts forecasted rapidly rising oil costs tied to peak oil predictions. The September 11, 2001 terrorist attacks further encouraged politicians to renew their efforts to improve energy security and protect against geopolitical risks and rapidly rising oil prices by introducing bills to address climate change and promote renewable energy development.

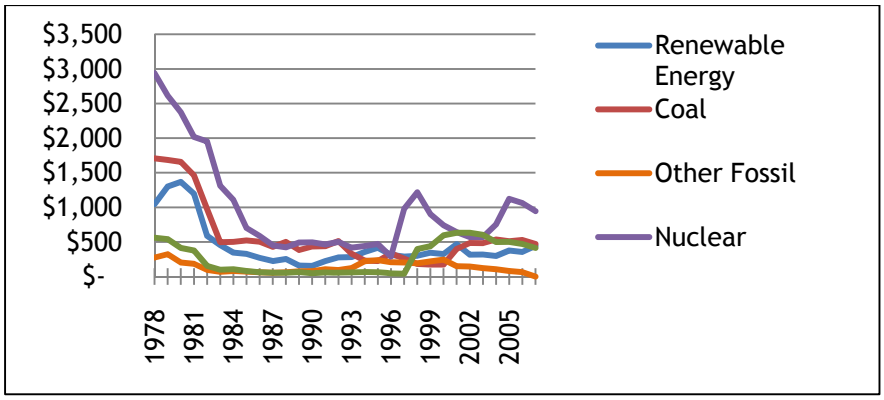

Figure 4.1 Department of Energy Research and Development Expenditures, 1978-2007 (million 2007 dollars). Federal energy research and development expenditures (along with tax incentives and direct subsidies) are intended to accelerate development of cost-effective technologies and bring them to market sooner than if R&D is funded by the private sector alone. President Reagan cut energy research and development budgets by nearly 90 percent and eliminated renewable energy production tax incentives when he took office in 1981. Data Source: Energy Information Administration.[193]

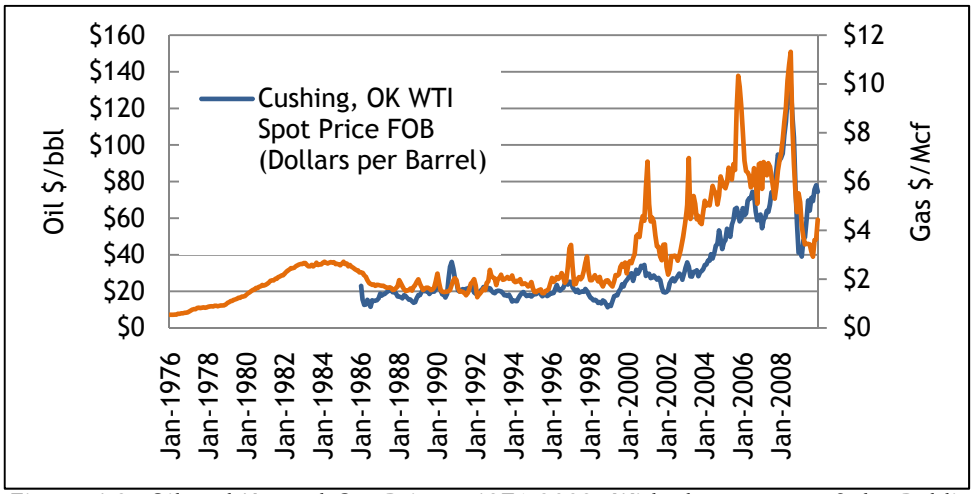

Figure 4.2 Oil and Natural Gas Prices, 1976-2009. With the passage of the Public Utilities Regulatory Policies Act, the California Energy Pricing Policy tied prices for utility-scale solar energy generation to natural gas and oil prices for energy generation. When prices remained low throughout the 1990s, solar developers could not compete with the low cost of fossil fuel-based energy generation until federal and state tax incentives and subsidies improved the marketability of solar energy for both utility-scale and distributed generation. Data Source: Energy Information Administration.[194,195]

Several acts passed by Congress in the following years significantly increased funding and incentives available to state governments and developers for renewable energy programs and projects (Table 4.1). The Energy Policy Act of 2005 gave a short term boost to the developers and investors waiting for better economic incentives to build utility-scale solar facilities by increasing tax incentives available to commercial developers from 10 to 30 percent for a period of two years and by extending the production tax credit through 2007. Although this helped stimulate the market, the timeframe for the

Table 4.1 Federal Policies Impacting Solar Development. [196,197,198,199]

	Investment Tax Credits	Production Tax Credits	Renewable Energy Grants	Loan Guarantees	Clean Renewable Energy Bonds	Direct Spending Measures
2005 Energy Policy Act	Increased the commercial solar investment tax credit from 10 percent to 30 percent for 2 years	Extended renewable energy production tax credit of $.019/kWh for first ten years of operation through 2007			Allocated a total of $1.2 billion over 2 years for non-taxable entities that could not use ITC or other tax benefits ($84 million for solar in 2007)	
2008 Energy Improvement and Extension Act	Extended commercial 30 percent investment tax credit for solar energy through 2016. Allowed using ITCs to offset alternative minimum tax	Extended the placed-in service date for production tax credit for solar facilities through December 31, 2010			Authorized an additional $2.4 billion for a period of 3 years ($839 for solar)	
2009 American Recovery and Reinvestment Act	Established 30 percent advanced energy manufacturing credits for manufacturing facility retrofits; Repealed subsidized energy financing limitation on investment tax credit		Established 30 percent grant program in lieu of investment tax credit for facility construction beginning in 2009 or 2010.	Established renewable energy loan guarantee program for generation and transmission projects underway by September 30, 2011		Appropriates direct spending for renewable energy projects, grid development, research and development

incentives was not long enough to provide certainty to developers since projects could take many years to complete and come on line. Without certainty about tax incentives and their impacts on the project development costs, utility-scale solar development remained sluggish.

Between 2002 and 2007, tax expenditures for renewable energy increased from $238 million to $790 million.[200] For example, tax expenditures for Clean Renewable Energy Bonds (CREBS) were appropriated as part of the Energy Policy Act and the American Recovery and Reinvestment Act. CREBS are one tax mechanism whereby tax exempt entities may issue interest-free bonds. The government or public utility issuing the bond pays back only the principal while the bond holder receives a tax credit in lieu of interest payments. Although direct spending for renewable energy research and development declined slightly between 2002 and 2006, 2007 appropriations grew by 23 percent over 2002 amounts, including an increase from $99 million for solar energy in 2006 to $203 million in 2007 (Figure 4.1).[201] Returns associated with solar stock investments grew through the fall of 2008, reflecting optimism among investors until the collapse of the banking industry caused sources of private capital necessary for a new solar industry to dry up practically overnight (Figure 4.3).[202] The Energy Improvement and Extension Act of 2008, passed on October 3, created some certainty about access to financing by extending production and investment tax incentives, which eventually helped lure investors back to utility-scale solar energy projects. By 2009, with the passage of the American Recovery and Reinvestment Act, federal investment programs such DOE's Solar Energy Technologies Program (SETP) also provided significant support for renewable energy implementation by focusing on market transformation, systems integration, CSP deployment, and PV development (Table 4.2, Figure 4.4). The SETP is partnering with the BLM to develop the Solar PEIS in order to promote successful project development.

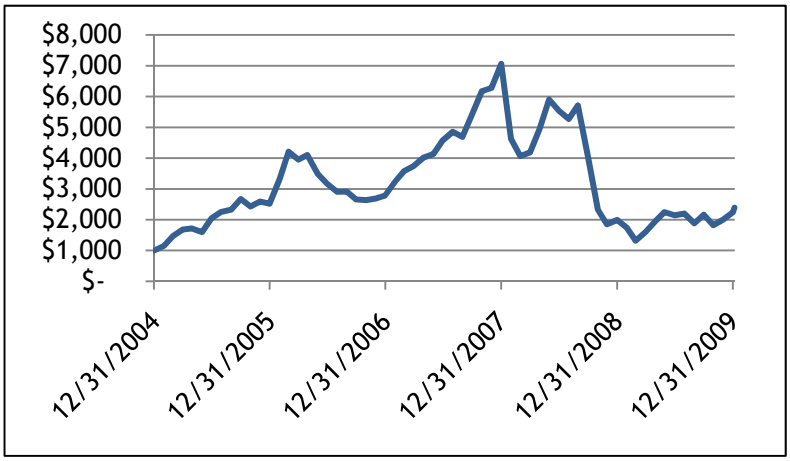

Figure 4.3 Ardour Global Solar Energy Index Total Returns in $US. Returns for investors in solar energy dropped following the credit crisis of 2008 and developers suffered from the loss of private capital for project development.

Table 4.2 Subprograms of the DOE's Solar Energy Technologies Program. [203]

Market Transformation	•Address non-R&D barriers to solar energy adoption •Partner with various organizations to develop codes and standards, coordinate decision-makers, promote workforce development, provide technical assistance and support the Solar America Cities program
Systems Integration	•Address economic bariers to solar energy grid integration •Develop technologies and strategies in partnership with utilities and solar industry
Concentrating Solar Power	•Leverage industry partners and national laboratories to increase R&D and deployment efforts •Achieve market competitiveness by 2015 and baseload competitiveness by 2020 •Work with the BLM to develop Programatic Environmental Impact Assessment and other activities necessary for utility-scale solar development in the southwest United States
Photovoltaics	•Invest in technologies across the development pipeline •Minimize cost of solar energy through new devices and processes, prototype design and pilot production, systems development and manufacturing

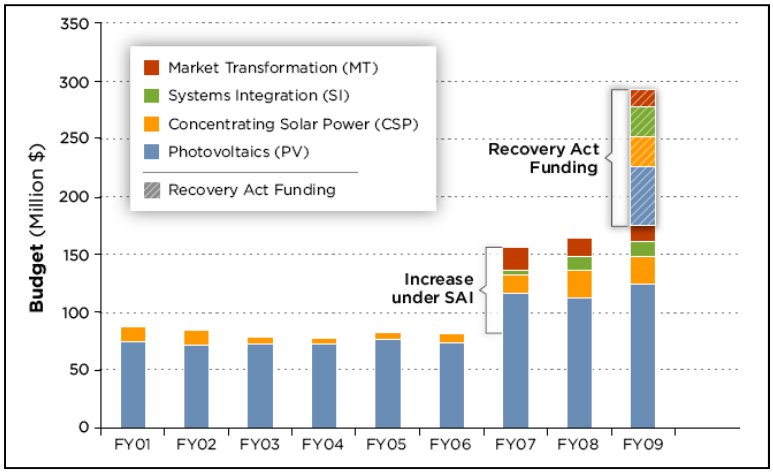

Figure 4.4 Department of Energy Solar Energy Technologies Program Investment. Renewed federal investment in solar industry technologies improved after 2006 with the Department of Energy's Solar Energy Technologies Program (SETP). The Solar America Initiative (SAI) accounted for most of the $75 million budget increase from FY 2006 to FY 2007. The American Recovery and Reinvestment Act added nearly $118 million to the SETP budget, including $26 million for CSP. [204]

Private financing for solar industry development is often directed towards entrepreneurial entrants and early actors in market development. The financing may be different forms of equity or debt, carrying different levels of risk and attracting different kinds of investors. The infusion of private capital is critical for moving technologies developed through federal research and development dollars to the market. In 2008, the solar industry in the United States experienced an increase of venture capital and private equity investment from $61 million in 2004 to $2.3 billion in 2008, corresponding to a four-year capitalized annual growth rate of 148 percent.[205] Today, the risk for solar investors remains high as the market develops and public funding in the form of tax credits, special bonds, or loan guarantees are important incentives for investment in projects and businesses along the solar value chain. Without both private and public sector financial support, utility-scale solar projects cannot be developed.

The path to widespread adoption of solar energy technologies is currently dependent on incentives that create price parity between solar electricity and electricity generated from non-renewable sources. As the market expands, technical improvement and innovation will lower the cost of solar electricity generation. Increased deployment will allow the solar industry to reach economies of scale, reducing the need for subsidies. But whether the goal should be to phase out solar subsidies is questionable. At a recent solar industry conference, one panelist noted: "Other [subsidized energy] industries don't say 'how do we get rid of our subsidy.' Are we picking the wrong battle? We should be working on a level playing field."[206] The solar industry has fought a long battle to bring both utility-scale and distributed solar energy technology into the mainstream. Renewable energy policies and subsidies are necessary for maintaining the industry and bringing solar energy on line.

Utility-Scale Solar Development in California

In 2002, the State of California recognized the economic, social and environmental benefits of renewable energy and adopted one of the country's first RPS. The RPS required Investor Owned Utilities (IOU) to increase sales of energy generated from renewable resources by at least 1 percent each year to reach a total of at least 20 percent by 2017. The RPS legislation modified the pricing policies for renewable energy by directing the CPUC to establish market price referent (MPR) to represent the avoided costs of non-renewable power purchases. The MPR is used to calculate the net present value of the levelized cost of energy (LCOE) for a long term contract. Unlike previous pricing policies, the MPR is calculated based on installed capital costs, fixed and variable operations and maintenance costs, natural gas fuel costs, cost of capital, and environmental permitting and compliance costs. If an IOU enters a contract with pricing below the MPR, the cost can be recovered in retail sales. Contracts for long term purchases above the MPR may qualify for above-MPR funds from the state's RPS program.[207] However, these funds are limited. The modified pricing policies help utilities control the costs of meeting RPS goals and the contracts help to make utility-scale projects feasible once again from a developer's perspective.

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