Title

Financing end-use solar technologies in a Restructured Electricity Industry: Comparing the Cost of Public Policies

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Other Policies: Maximum Cost Reductions Possible

C.1 Overview

Several policies were not considered in Section 3.4.1 because they are bounded in size. As stand-alone policies they cannot achieve the cost targets that we established. They are: sales and property tax reductions, low-interest loans, accelerated depreciation, and tax depreciation for homeowners. This appendix analyzes the maximum effect that each of these policies can have and their associated costs.

C.2 Sales Tax Reduction

The elimination of the sales tax creates an upper bound on the size of the subsidy for a sales tax reduction. Table C-1 examines the impact of reducing the sales tax to 0% from the base case rate of 8.5%.

Table C-1. Sales Tax Elimination Policy Analysis

Technology and Development Alternative	Cost of Power (¢/kWh)	ΔFederal	ΔState	ΔLocal	ΔTotal
SDHW - Homeowner	10.7	$40	-$195	-$43	-$198
SDHW - POU	8.4	$0	-$204	$0	-$204
SDHW - IOU	12.7	-$12	-$207	-$43	-$262
SDHW - NUD/corp. finance	11.6	$16	-$205	-$43	-$232
SDHW - NUD/proj. finance	16.2	-$34	-$213	-$43	-$290
PV - Homeowner	19.5	$437	-$1,600	-$443	-$1,607
PV - POU	14.1	$0	-$1700	$0	-$1700
PV - IOU	25.6	-$100	-$1,718	-$443	-$2,261
PV - NUD/corp. finance	22.8	$186	-$1,695	-$443	-$1,954
PV - NUD/proj. finance	39.9	-$590	-$1,837	-$443	-$2,870

C.3 Property Tax Reduction

The elimination of the property tax is the upper bound of this subsidy. Table C-2 examines the impact of reducing the property tax to zero percent from the base case three percent.

Table C-2. Property Tax Elimination Policy Analysis

Technology and Development Alternative	Cost of Power (¢/kWh)	ΔFederal	ΔState	ΔLocal	ΔTotal
SDHW - Homeowner	9.9	$0	$0	-$540	-$540
SDHW - IOU	12.0	$0	$0	-$540	-$540
SDHW - NUD/corp. finance	10.6	-$33	-$6	-$540	-$579
SDHW - NUD/proj. finance	15.1	-$116	-$21	-$540	-$677
PV - Homeowner	17.0	$0	$0	-$5,656	-$5,656
PV - IOU	23.2	$0	$0	-$5,656	-$5,656
PV - NUD/corp. finance	19.5	-$448	-$82	-$5,656	-$6,186
PV - NUD/proj. finance	36.1	-$1,412	-$258	-$5,656	-$7,326

C.4 Low-Interest Loan

The upper bound of a low-interest loan policy is a zero-percent interest loan. Table C-3 examines the effects of such a policy.

Table C-3. Zero-Percent Interest Loan Policy Analysis

Technology and Development Alternative	Cost of Power (¢/kWh)	Cost of Policy	ΔFederal	ΔState	ΔLocal	ΔTotal
SDHW - Homeowner	7.9	-$1,709	$511	$116	$0	-$1,081
SDHW - POU	6.1	-$966	$0	$0	$0	-$966
SDHW - IOU	11.7	-$690	$0	$0	$0	-$690
SDHW - NUD/corp. finance	11.3	-$690	$240	$21	$0	-$429
SDHW - NUD/proj. finance	14.9	-$685	$26	-$22	$0	-$681
PV - Homeowner	10.7	-$18,137	$5,574	$1,271	$0	-$11,292
PV - POU	7.6	-$10,052	$0	$0	$0	-$10,052
PV - IOU	21.7	-$7,274	$0	$0	$0	-$7,274
PV - NUD/corp. finance	21.5	-$7,274	$2,330	$239	$0	-$4,705
PV - NUD/proj. finance	36.4	-$5,557	-$462	-$308	$0	-$6,327

C.5 Accelerated Depreciation/Homeowner Tax Deduction

Allowing commercial entities to depreciate solar energy property in one year is the largest possible subsidy under this policy. Allowing homeowners to deduct 100% of their solar energy investment in the first year is an equivalent policy. These two policies are considered together in Table C-4.

Table C-4. Federal One-Year Accelerated Depreciation/100% Homeowner Tax Deduction Policy Analysis

Technology and Development Alternative	Cost of Power (¢/kWh)	∆Federal	∆State	∆Local	∆Total
SDHW - Homeowner	9.6	-$684	$0	$0	-$684
SDHW - IOU	12.9	-$133	-$9	$0	-$142
SDHW - NUD/corp. finance	11.4	-$198	-$21	$0	-$219
SDHW - NUD/proj. finance	16.2	-$207	-$22	$0	-$231
PV - Homeowner	17.1	-$5,705	$0	$0	-$5,705
PV - IOU	26.3	-$1,115	-$69	$0	-$1,184
PV - NUD/corp. finance	22.2	-$1,783	-$198	$0	-$1,981
PV - NUD/proj. finance	39.7	-$2,066	-$249	$0	-$2,315

Table C-5. State One-Year Accelerated Depreciation/100% Homeowner Tax Deduction Policy Analysis

Technology and Development Alternative	Cost of Power (¢/kWh)	∆Federal	∆State	∆Local	∆Total
SDHW - Homeowner	11.1	$41	-$147	$0	-$106
SDHW - IOU	13.4	$0	-$16	$0	-$16
SDHW - NUD/corp. finance	12.2	-$10	-$17	$0	-$27
SDHW - NUD/proj. finance	17.2	-$8	-$16	$0	-$24
PV - Homeowner	20.4	$343	-$1,222	$0	-$879
PV - IOU	27.5	$2	-$134	$0	-$132
PV - NUD/corp. finance	24.3	-$85	-$143	$0	-$228
PV - NUD/proj. finance	42.7	-$111	-$148	$0	-$259

Full Cost Analysis of Policies

D.1 Overview

This appendix disaggregates the costs of the policies discussed in Chapter 5 to each level of government (federal, state, and local).

D.2 Disaggregated Cost Results

Tables D-1 through D-4 display the options for reducing the real levelized cost of SDHW to 10¢/kWh for the homeowner, IOU, corporate-financed NUD, and project-financed NUD alternatives, respectively (the POU is not modeled, because its cost is already below 10¢/kWh). Tables D-5 through D-9 show the options for reducing the real levelized cost of PV to 15¢/kWh for the homeowner, POU, IOU, corporate-financed NUD, and project-financed NUD alternatives, respectively.

The tables report: (1) the level of the policy necessary, (2) the present value of the direct cost of the policy to the entity that implements it,[73] (3) the present value of the indirect effects on federal, state, and local taxes, and (4) the present value of the total cost of the subsidy.[74] The results are presented as costs for a single system. The assumed capital costs for systems are $2,400 and $20,000, before taxes, for SDHW and PV systems, respectively.

The tables are organized in the following manner: the top line indicates the tax revenues (or costs) that the federal, state, and local governments receive (or lose) for each base-case system that is installed (with no new policy). For each policy option, the level and direct cost of the option is displayed on the left. On the right, under ∆Federal, ∆State, and ∆Local, the change in the tax revenues (or costs) from the base case[75] is given. On the far right, under

[73] It may be the federal, state, or local government, or ratepayers through a wires charge.

[74] All tax revenues and policy costs are reported as present values. All revenues and payments to and from the government are assumed to be made at the end of the year. The only exception are grants, which are paid at the beginning of the first year. The discount rate used for all government entities is 6.5%. This is the discount rate that Jenkins, Chapman, and Reilly (1996) use in their tax analysis. It is also almost identical to the 6.6% nominal discount rate recommended by the NIST Handbook 135, *Energy Prices and Discount Factors for Life-Cycle Cost Analysis 1995*, for federal projects dealing with conservation and renewables (Short, Packey, and Holt 1995). We only consider taxes that are directly related to the project: state and federal income taxes of the project owner, state sales taxes on the equipment, and local property taxes on the equipment.

[75] The base case is assumed to be a system sold with no new policy.

ΔTotal, the overall cost of the subsidy relative to the base case total is given. Presenting the information in this manner distinguishes the change that the policy creates from the status quo while still allowing the new tax level to be easily calculated by summing the values.

As an example, consider the case of a PI payment used to subsidize SDHW developed under the corporate-financed NUD alternative (Table D-3). In the base case, the federal government loses $249 per system, the state government gains $203, and the local government gains $540; the total tax revenue for all government entities is $494 per system. A PI payment of 3.3¢/kWh ($1997 for the first 10 years) is needed to reduce the real levelized cost to 10¢/kWh. The PI payment can be made by the federal, state, or local government, or by ratepayers through a non-bypassable wires charge. The present value of the cost to that entity is $716. The indirectly caused changes (relative to the base case) in the present value of the federal, state, and local tax revenues are: -$47, -$8, and $0, respectively. In this case, federal and state governments indirectly lose revenue (per system, relative to the base case) from the policy because of reduced income taxes (caused by the reduction in the cost of energy). The present valued total cost of the new subsidy is $771 per system relative to the base case. Assume that the federal government instituted a PI subsidy. The federal revenues lost per system relative to the base case would be -$716 -$47 = -$763. The total federal revenues lost per system would be -$763 -$249 = -$1,012. The same procedure applies for state, local, and total.

It is useful to compare the changes in policies required for lowering system costs to outright reductions in the capital cost of the systems. Public policies to promote emerging technologies are often viewed as temporary supports until the cost of the technologies becomes low enough for them to compete directly in the market. Hence, the first "policy" presented in each table is the effect of an autonomous capital cost reduction as a reference point. It also gives a reference for how much more (or less) tax revenue would be generated relative to the base case, per system, at this price, in the absence of an explicit subsidy.

Table D-1. Policies to Reduce the Cost of SDHW to 10¢/kWh - Homeowner

			Federal	**State**	**Local**	**Total**
Base-Case Tax Revenue (Cost per system) ➜			**-$511**	**$88**	**$540**	**$117**
“Policy”	**Level**	**Cost**	**∆Federal**	**∆State**	**∆Local**	**∆Total**
Capital Cost Reduction ($/W)	**$2,003**	**NA**	**$85**	**-$15**	**-$89**	**-$19**
Federal ITC	21.2%	-$519	$0	$0	$0	-$519
State ITC	29.5%	-$721	$202	$0	$0	-$519
Federal PTC (¢/kWh)[76]	2.4	-$511	$0	$0	$0	-$511
State PTC (¢/kWh)[77]	3.3	-$710	$199	$0	$0	-$511
PI (¢/kWh)[78]	3.5	-$755	$199	$45	$0	-$511
Grant (taxable)	30.3%	-$767	$202	$46	$0	-$519
Grant (nontaxable)[79]	21.2%	-$519	$0	$0	$0	-$519
Grant (nontaxable, capital cost buy-down)[80]	26.2%	-$693	$136	$31	$0	-$526
Low-Interest Loan[81]	5.33%	-$775	$227	$52	$0	-$496
Direct Customer Payment (¢/kWh)[82]	1.3	-$488	$0	$0	$0	-$488

[76] 10 years, $1997, increasing with inflation.

[77] 10 years, $1997, increasing with inflation.

[78] 10 years, $1997, increasing with inflation.

[79] The standard version of the nontaxable grant is a payment in the first year of the project.

[80] The capital cost reduction version of the nontaxable grant is a buy-down of the capital cost, which reduces the size of the capital expenditure that needs to be financed (in this case, a smaller loan is needed).

[81] The cost of the low-interest loan is calculated in the following manner: The payment streams from two loans are modeled—the first at the base-case debt rate of the development scenario, the second at the low-interest debt rate being considered. The second payment stream is subtracted from the first, and the resulting yearly figures are discounted back to a present value. This should accurately represent the opportunity cost of capital lost to the entity giving the low-interest loan. The discount rate remains tied to the “market rate” loan. In other words, the discount rate remains unchanged from the base case.

[82] 20 years, $1997, increasing with inflation.

Table D-2. Policies to Reduce the Cost of SDHW to 10¢/kWh - IOU

			Federal	State	Local	Total
Base-Case Tax Revenue (Cost per system) ➜			**$157**	**$233**	**$540**	**$930**
"Policy"	**Level**	**Cost**	**∆Federal**	**∆State**	**∆Local**	**∆Total**
Capital Cost Reduction ($/W)	**$1,578**	**NA**	**-$54**	**-$80**	**-$185**	**-$319**
Federal ITC	34.6%	-$847	-$262	-$48	$0	-$1,157
State ITC	46.7%	-$1,143	-$2	-$8	$0	-$1,153
Federal PTC (¢/kWh)[83]	3.6	-$755	-$406	-$75	$0	-$1,236
State PTC (¢/kWh)	5.4	-$1,161	$0	-$75	$0	-$1,236
PI (¢/kWh)[84]	5.7	-$1,236	$0	$0	$0	-$1,236
Grant (taxable)	97.2%	-$2,460	$1,087	$198	$0	-$1,174
Grant (nontaxable)[85]	43.4%	-$1,061	-$86	-$16	$0	-$1,163
Direct Customer Payment (¢/kWh)[86]	3.5	-$1,322	$0	$0	$0	-$1,322

[83] 10 years, $1997, increasing with inflation.

[84] 10 years, $1997, increasing with inflation.

[85] This is the standard "payment" version of the nontaxable grant.

[86] 20 years, $1997, increasing with inflation.

Table D-3. Policies to Reduce the Cost of SDHW to 10¢/kWh - NUD/Corporate

			Federal	State	Local	Total
Base-Case Tax Revenue (Cost per system) ➜			**-$249**	**$203**	**$540**	**$494**
"Policy"	**Level**	**Cost**	**ΔFederal**	**ΔState**	**ΔLocal**	**ΔTotal**
Capital Cost Reduction ($/W)	**$1,794**	**NA**	**$62**	**-$51**	**-$137**	**-$126**
Federal ITC	27.3%[87]	-$423[88]	-$221	-$40	$0	-$684
State ITC	23.4%	-$572	-$92	-$23	$0	-$687
Federal PTC (¢/kWh)[89]	2.0	-$437	-$283	-$51	$0	-$771
State PTC (¢/kWh)[90]	3.1	-$673	-$47	-$51	$0	-$771
PI (¢/kWh)[91]	3.3	-$716	-$47	-$8	$0	-$771
Grant (taxable)	44.5%	-$1,125	$392	$72	$0	-$661
Grant (nontaxable)[92]	24.3%	-$595	-$57	-$21	$0	-$673
Grant (nontaxable, capital cost buy-down)[93]	23.6%	-$614	-$3	-$11	$0	-$628
Direct Customer Payment (¢/kWh)[94]	2.3	-$869	$0	$0	$0	-$869

87 The existing 10% federal ITC is increased to this new level.

88 This is the cost of the ITC above the base-case 10% level.

89 10 years, $1997, increasing with inflation.

90 10 years, $1997, increasing with inflation.

91 10 years, $1997, increasing with inflation.

92 This is the standard "payment" version of the nontaxable grant. A nontaxable grant reduces the basis for the 10% federal ITC by the amount of the grant.

93 This is the "capital cost reduction" version of the nontaxable grant. A lower amount of debt and equity is needed to finance the project. A nontaxable grant reduces the basis for the 10% federal ITC by the amount of the grant.

94 20 years, $1997, increasing with inflation.

Table D-4. Policies to Reduce the Cost of SDHW to 10¢/kWh - NUD/Project

			Federal	State	Local	Total
Base-Case Tax Revenue (Cost per system) ➜			**$443**	**$329**	**$540**	**$1,312**
"Policy"	**Level**	**Cost**	**ΔFederal**	**ΔState**	**ΔLocal**	**ΔTotal**
Capital Cost Reduction ($/W)	**$1,149**	**NA**	**-$231**	**-$171**	**-$282**	**-$684**
Federal ITC[95]	68.2%	-$1,423[96]	-$571	-$104	$0	-$2,098
State ITC	79.7%	-$1,949	-$133	-$43	$0	-$2,125
Federal PTC (¢/kWh)[97]	8.4	-$1,798	-$781	-$142	$0	-$2,721
State PTC (¢/kWh)[98]	12.8	-$2,767	$188	-$142	$0	-$2,721
PI (¢/kWh)[99]	8.6	-$1,846	-$324	-$59	$0	-$2,229
Grant (taxable)	139.2%	-$3,522	$1,325	$242	$0	-$1,955
Grant (nontaxable)[100]	78.9%	-$1,929	-$54	-$45	$0	-$2,028
Direct Customer Payment[101] (¢/kWh)	7.3	-$2,756	$0	$0	$0	-$2,756

95 The existing 10% federal ITC is increased to this new level.

96 This is the cost of the ITC above the base-case 10% level.

97 10 years, $1997, increasing with inflation.

98 10 years, $1997, increasing with inflation.

99 10 years, $1997, increasing with inflation.

100 This is the standard "payment" version of the nontaxable grant. A nontaxable grant reduces the basis for the 10% federal ITC by the amount of the grant.

101 20 years, $1997, increasing with inflation.

Table D-5. Policies to Reduce the Cost of PV to 15¢/kWh - Homeowner

			Federal	State	Local	Total
Base-Case Tax Revenue (Cost per system) ➜			**-$4,257**	**$730**	**$5,656**	**$2,129**
"Policy"	**Level**	**Cost**	**△Federal**	**△State**	**△Local**	**△Total**
Capital Cost Reduction ($/W)	**3.41**	**NA**	**$1,357**	**-$233**	**-$1,802**	**-$678**
Federal ITC	42.9%	-$8,740	$0	$0	$0	-$8,740
State ITC	59.6%	-$12,139	$3,399	$0	$0	-$8,740
Federal PTC (¢/kWh)[102]	14.3	-$8,598	$0	$0	$0	-$8,598
State PTC (¢/kWh)	19.9	-$11,941	$3,343	$0	$0	-$8,598
PI (¢/kWh)[103]	21.1	-$12,703	$3,343	$762	$0	-$8,598
Grant (taxable)	61.2%	-$12,914	$3,399	$775	$0	-$8,740
Grant (nontaxable)[104]	42.9%	-$8,740	$0	$0	$0	-$8,740
Grant (nontaxable, capital cost buy-down)[105]	53.7%	-$11,656	$2,287	$521	$0	-$8,848
Low-Interest Loan	0.71%	-$13,322	$3,970	$905	$0	-$8,447
Direct Customer Payment (¢/kWh)[106]	11.0	-$8,351	$0	$0	$0	-$8,351

102 10 years, $1997, increasing with inflation.

103 10 years, $1997, increasing with inflation.

104 This is the standard "payment" version of the nontaxable grant.

105 This is the alternate "capital cost reduction" version of the nontaxable grant. The size of the loan is reduced by the size of the grant.

106 30 years, $1997, increasing with inflation.

Table D-6. Policies to Reduce the Cost of PV to 15¢/kWh - POU

			Federal	State	Local	Total
Base-Case Tax Revenue (Cost per system) ➜			**-$1,071[107]**	**$1,700**	**$0**	**$629**
"Policy"	**Level**	**Cost**	**△Federal**	**△State**	**△Local**	**△Total**
Capital Cost Reduction ($/W)	**4.93**	**na**	**$0**	**-$24**	**$0**	**-$24**
Low-Interest Loan	5.37%	-$274	$0	$0	$0	-$274
PI (¢/kWh)[108]	2.3[109]	-$290[110]	$0	$0	$0	-$290
Grant (nontaxable)[111]	1.5%	-$303	$0	$0	$0	-$303
Direct Customer Payment (¢/kWh)[112]	0.2	-$278	$0	$0	$0	-$278

107 The $1,071 loss to the federal government is from REPI payments that are already in effect. Although this is not a tax policy, it is a government expenditure.

108 10 years, $1997, increasing with inflation. This is in addition to the 1.5¢/kWh ($1992, increasing with inflation) REPI that currently exists for POUs.

109 The existing 1.5¢/kWh ($1992) REPI is increased to this new level

110 This is the cost of the PI above the base-case 1.5¢/kWh ($1992) REPI.

111 This is the standard "payment" version of the nontaxable grant.

112 30 years, $1997, increasing with inflation.

Table D-7. Policies to Reduce the Cost of PV to 15¢/kWh - IOU

			Federal	State	Local	Total
Base-Case Tax Revenue (Cost per system) ➜			**$1,273**	**$1,932**	**$5,656**	**$8,861**
"Policy"	**Level**	**Cost**	**△Federal**	**△State**	**△Local**	**△Total**
Capital Cost Reduction ($/W)	**2.52**	**NA**	**-$632**	**-$959**	**-$2,809**	**-$4,400**
Federal ITC	52.0%	-$10,600	-$3,283	-$599	$0	-$14,482
State ITC	70.2%	-$14,309	-$36	-$101	$0	-$14,446
Federal PTC (¢/kWh)[113]	15.7	-$9,458	-$5,093	-$929	$0	-$15,480
State PTC (¢/kWh)	24.2	-$14,551	$0	-$929	$0	-$15,480
PI (¢/kWh)[114]	25.8	-$15,480	$0	$0	$0	-$15,480
Grant (taxable)	146.0%	-$30,798	$13,612	$2,483	$0	-$14,703
Grant (nontaxable)[115]	65.2%	-$13,282	-$1,076	-$196	$0	-$14,554
Direct Customer Payment[116] (¢/kWh)	12.6	-$17,538	$0	$0	$0	-$17,538

113 10 years, $1997, increasing with inflation.

114 10 years, $1997, increasing with inflation.

115 This is the standard "payment" version of the nontaxable grant.

116 30 years, $1997, increasing with inflation.

Table D-8. Policies to Reduce the Cost of PV to 15¢/kWh - NUD/Corporate

			Federal	State	Local	Total
Base-Case Tax Revenue (Cost per system) ➜			**-$2,186**	**$1,673**	**$5,656**	**$5,143**
"Policy"	**Level**	**Cost**	**△Federal**	**△State**	**△Local**	**△Total**
Capital Cost Reduction ($/W)	**2.87**	**NA**	**$900**	**-$718**	**-$2,408**	**-$2,225**
Federal ITC	37.9%[117]	-$5,686[118]	-$3,557	-$648	$0	-$9,891
State ITC	37.7%	-$7,678	-$1,844	-$410	$0	-$9,932
Federal PTC (¢/kWh)[119]	9.7	-$5,855	-$4,392	-$801	$0	-$11,048
State PTC (¢/kWh)	15.0	-$9,003	-$1,244	-$801	$0	-$11,048
PI (¢/kWh)[120]	15.9	-$9,577	-$1,244	-$227	$0	-$11,048
Grant (taxable)	71.6%	-$15,101	$4,663	$850	$0	-$9,588
Grant (nontaxable)[121]	39.4%	-$8,024	-$1,344	-$391	$0	-$9,759
Grant (nontaxable, capital cost buy-down)[122]	39.1%	-$8,480	-$262	-$193	$0	-$8,935
Direct Customer Payment[123] (¢/kWh)	9.5	-$13,224	$0	$0	$0	-$13,224

[117] The current 10% federal ITC is increased to this new level.

[118] This is the cost of the ITC above and beyond the current 10% federal ITC for NUDs.

[119] 10 years, $1997, increasing with inflation.

[120] 10 years, $1997, increasing with inflation.

[121] This is the standard "payment" version of the nontaxable grant. A nontaxable grant reduces the basis for the 10% federal ITC by the amount of the grant.

[122] This is the alternate "capital cost buy-down" version of the nontaxable grant. The size of the equity and debt that needs to be financed is bought down by the grant. A nontaxable grant reduces the basis for the 10% federal ITC by the amount of the grant.

[123] 30 years, $1997, increasing with inflation.

Table D-9. Policies to Reduce the Cost of PV to 15¢/kWh - NUD/Project

			Federal	State	Local	Total
Base-Case Tax Revenue (Cost per system) ➜			**$7,535**	**$3,446**	**$5,656**	**$16,637**
"Policy"	**Level**	**Cost**	**△Federal**	**△State**	**△Local**	**△Total**
Capital Cost Reduction ($/W)	**1.57**	**NA**	**-$5,176**	**-$2,367**	**-$3,885**	**-$11,428**
Federal ITC[124]	87.5%	-$15,789[125]	-$9,144	-$1,668	$0	-$26,601
State ITC	106.1%	-$21,623	-$4,292	-$988	$0	-$26,903
Federal PTC (¢/kWh)[126]	33.2	-$19,953	-$11,473	-$2,093	$0	-$33,519
State PTC (¢/kWh)[127]	51.1	-$30,697	-$729	-$2,093	$0	-$33,519
PI (¢/kWh)[128]	34.1	-$20,484	-$6,408	-$1,169	$0	-$28,061
Grant (taxable)	186.9%	-$39,415	$12,131	$2,212	$0	-$25,072
Grant (nontaxable)[129]	105.9%	-$21,585	-$3,301	-$996	$0	-$25,882
Direct Customer Payment[130] (¢/kWh)	28.1	-$39,110	$0	$0	$0	-$39,110

124 The existing 10% federal ITC is increased to this new level.

125 This is the cost above and beyond the existing 10% federal ITC.

126 10 years, $1997, increasing with inflation.

127 10 years, $1997, increasing with inflation.

128 10 years, $1997, increasing with inflation.

129 A nontaxable grant reduces the basis for the 10% federal ITC by the amount of the grant.

130 30 years, $1997, increasing with inflation.

D.3 Qualitative Description of the Indirect Cost Interactions

To develop a feel for the overall direction of our findings, we begin by describing qualitatively the indirect effects of each policy on federal, state, and local tax revenues. Often conflicting effects partially offset each other. The descriptions below should help in understanding the net impact of these effects.

D.3.1 Capital Cost Reduction

- Reduces taxable revenue stream for IOU and NUDs because of lower lease price, causing a decrease in federal and state income tax revenues.
- Reduces the size of the 10% federal ITC for NUDs, causing an increase in federal income tax revenues.
- Decreases state sales tax revenues for homeowner, POU, IOU, and NUDs.
- Decreases local property tax revenues for homeowner, POU, IOU, and NUDs.

D.3.2 Federal ITC

- Reduces taxable revenue stream for IOU and NUDs because of lower lease price, causing a decrease in federal and state income tax revenues.
- Reduces depreciable base for IOU and NUDs, causing an increase in federal and state income tax revenues.
- Tends to increase the equity fraction for project-financed NUD, causing a decrease in the debt payment and thus an increase in federal and state income tax revenues.

D.3.3 State ITC

- Reduces taxable revenue stream for IOU and NUDs because of lower lease price, causing a decrease in federal and state income tax revenues.
- Lowers state income taxes, causing a decrease in the state income tax deduction from federal taxes, thus increasing federal tax revenues for homeowner, IOU, and NUDs.
- Lowers the depreciable base for state income taxes by 100% of the value of the ITC, increasing state tax revenues.
- Tends to increase the equity fraction for project-financed NUD, causing a decrease in the debt payment and thus an increase in federal and state income tax revenues.

D.3.4 Federal PTC

- Reduces taxable revenue stream for IOU and NUDs because of lower lease price, causing a decrease in federal and state income tax revenues.
- Tends to increase the equity fraction for project-financed NUD, causing a decrease in the debt payment and thus an increase in federal and state income tax revenues.

D.3.5 State PTC

- Reduces taxable revenue stream for IOU and NUDs because of lower lease price, causing a decrease in federal and state income tax revenues.
- Lowers state income taxes, causing a decrease in the state income tax deduction from federal taxes, thus increasing federal tax revenues for homeowner, IOU, and NUDs.
- Tends to increase the equity fraction for project-financed NUD, causing a decrease in the debt payment and thus an increase in federal and state income tax revenues.

D.3.6 Production Incentive

- Reduces taxable revenue stream for IOU and NUDs because of lower lease price, causing a decrease in federal and state income tax revenues.
- PI payments are taxable income for homeowner, IOU, and NUDs; thus they cause an increase in federal and state income tax revenues.

D.3.7 Taxable Grant

- Reduces taxable revenue stream for IOU and NUDs because of lower lease price, causing a decrease in federal and state income tax revenues.
- Grant is taxable income for homeowner, IOU, and NUDs; thus taxable grants cause an increase in federal and state income tax revenues.
- Tends to increase the equity fraction for project-financed NUD, causing a decrease in the debt payment and thus an increase in federal and state income tax revenues.

D.3.8 Nontaxable Grant (Payment)

- Reduces taxable revenue stream for IOU and NUDs because of lower lease price, causing a decrease in federal and state income tax revenues.
- Tends to increase the equity fraction for project-financed NUD (although has less of an effect than for tax credits and taxable grants), causing a decrease in the debt payment and thus an increase in federal and state income tax revenues.
- Reduces basis for 10% ITC for NUDs by the value of the grant, causing an increase in federal income tax revenues.
- Reduces the depreciable base by 100% of the value of the grant, causing an increase in both state and federal income tax revenues.
- Reduction of the 10% federal ITC increases the depreciable base for NUDs, causing a decrease in federal and state income tax revenues.

D.3.9 Nontaxable Grant (Buy-Down)

- Reduces taxable revenue stream for IOU and NUDs because of lower lease price, causing a decrease in federal and state income tax revenues.
- Reduces the size of the loan, causing a lower debt interest deduction for homeowner, IOU, and NUDs, thus increasing federal and state income tax revenues.
- Reduces basis for 10% ITC for NUDs by the value of the grant, causing an increase in federal income tax revenues.
- Reduces the depreciable base by 100% of the value of the grant, causing an increase in both state and federal income tax revenues.
- Reduction of the 10% federal ITC increases the depreciable base for NUDs, causing a decrease in federal and state income tax revenues.

D.3.10 Low-Interest Loan

- Reduces taxable revenue stream for IOU and NUDs because of lower lease price, causing a decrease in federal and state income tax revenues.
- Reduces debt interest deduction for homeowner, IOU, and NUDs, causing an increase in federal and state income taxes.
- Reduces the 10% federal ITC for NUDs by the debt fraction, causing an increase in federal income tax revenues.
- Reduction of the 10% federal ITC increases the depreciable base for NUDs, causing a decrease in federal and state income tax revenues.

D.3.11 Direct Customer Payment

- No indirect tax effects.

APPENDIX E

Net Metering

This study has examined the cost to homeowners of end-use solar technologies under different ownership and financing scenarios and the effect of various public policies to lower these costs. In Chapter 3, we calculated the costs (on a per kWh basis for energy displaced or produced) that a developer must charge a homeowner in order to finance the technologies. In Chapter 5, we identified cost targets ($0.10/kWh for SDHW and $0.15 for PV) for use in comparing public policies. The targets were chosen somewhat arbitrarily, but were intended to indicate the costs at which the technologies might become competitive with utility-supplied electricity. However, as described in Chapter 6, we did not examine the customer adoption process or consider other issues associated with the market penetration of end-use solar technologies. In particular, we did not directly compare the costs of the technologies (which we did calculate) to their value to the homeowner (which we did not calculate).

Net metering laws affect the value a homeowner places upon the electrical output of a grid-connected PV system (Starrs 1996). The value of PV electricity production is determined either by the utility's retail rate for PV electricity production that is used to meet household electricity demands, or by the utility's avoided cost for PV electricity production in excess of household demand, which must then be sold to the utility. Net metering laws allow the homeowner to value a greater fraction of PV electricity production at the utility's retail rate. Since, in most parts of the U.S., utility retail electricity rates are significantly higher than utility avoided costs, net metering laws increase the value of electricity produced by grid-connected PV.

Net metering laws operate by allowing the electric meter on a household with a grid-connected PV to turn backwards whenever the PV system produces more electricity than the household requires. The "banking" feature allows the homeowner to meet a greater fraction of household electricity consumption with PV electricity production and thereby increase the value of electricity produced by the system.

Net metering laws also affect the sizing decision for grid-connected PV systems. PV sizing decisions are driven by the desire to maximize the value of the output from a PV system. Sizing for PV systems is complicated by the fact that both PV electricity production and household electricity demand fluctuate over time. Maximum PV output is rarely coincident with maximum household demand. Without a net metering law, there is a strong incentive to significantly undersize a PV system relative to maximum household electricity demand in order to minimize the amount of excess electricity produced because the excess would be sold to the utility at (currently, low) avoided costs. With a net metering law, a greater portion of PV production can be credited against household consumption (and hence valued at the retail rate) regardless of the coincidence of PV output and household demands. The amount that can be credited depends on the period between meter readings (or true-ups). It can range up to the point at which total PV production exceeds total household consumption within the period. Hence, net metering laws eliminate disincentives to undersize grid-connected PV systems and, other things being equal, would tend to increase the total amount of PV electricity that is produced.

Calculating the value of a net metering law is straightforward: With a net metering law, all PV production is valued at the retail rate. Without a net metering law, production in excess of coincident household demand is valued at the avoided cost, while production less than coincident household demand is still valued at the retail rate. The value of a net metering law is just the difference between these two situations, which is equal to the difference between the utility's retail rate and its avoided cost times the amount of PV electricity production that is in excess of coincident household demand.

Here is a simple numerical example that relates this calculation to the levelized costs presented earlier in the report: Assume 50% of PV production is in excess of coincident household electricity demand, the retail rate is $0.10/kWh, and the avoided cost is $0.02/kWh. If there is a net metering law, the value of PV production is $0.10/kWh. If there is no net metering law, the value of PV production falls to $0.06/kWh (= 0.50*$0.10 + (1-0.50)*$0.02). If, following the analysis in Chapter 5, a public policy is successful in lowering the cost to the homeowner to $0.15/kWh, then under a net metering law the net cost to the homeowner of leasing the PV is $0.05/kWh (= $0.15 - $0.10). Without a net metering law, the net cost is $0.09/kWh (= $0.15 - $0.06) or nearly twice the cost.