C-BED Community-Based Energy Development: Front-Loaded Pricing

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Front-loaded pricing enhances the viability of community wind projects by improving cash flow and thus reducing the need for difficult-to-raise community capital. Front-loaded pricing is achieved through the use of net present value calculations based on a C-BED invention called "NPV rate."

Introduction. There is a significant difference between community capital and conventional capital. Specifically, it takes a much longer time period to secure capital from community sources than it does to secure capital from conventional sources. Conventional capital is formed when a small group of people who have access to concentrated wealth make a decision. Thus, conventional capital can be made available very quickly, sometimes in a single meeting. Community capital, on the other hand, is inherently disparate and distributed, and therefore requires much time to gather and manage. Community wind projects benefit through reduced dependence on difficult-to-raise capital.

This paper describes the use of net present value (NPV) calculations in order to successfully deploy front-loading of price in power purchase agreements (PPAs). Deployment of front-loading reduces capital requirements for community-based projects by improving cash flow, thus resulting in greater deployment of the rural economic development benefits of community-based energy development.

Net Present Value (NPV). NPV is a concept routinely applied to all financial transactions that involve a payment schedule, and is based on the concept that "money today is worth more than the same money tomorrow." People who borrow money pay interest to the lender over the period of the debt to account for the time value of money, agreeing to a discount rate (or 'interest rate') as the rate at which the value of the borrowed money is discounted over time. The NPV is the current value of the sum of interest payments and principal repayments over the time period of a payment schedule. The higher the discount rate and the longer the loan period, the lower the NPV.

About C-BED.org

C-BED, Community-Based Energy Development, is an organization of farmers and landowners, main street businesses and bankers, wind developers and component fabricators, educators, renewable energy advocates, and other members of our local communities. We formed C-BED in order to develop renewable energy resources in a way that optimizes local economic development in the communities in which we live and work.

The mission of C-BED is to foster, promote, and secure, through all appropriate means, the local economic development and environmental benefits attached to renewable energy production facilities that are owned by ordinary members of local communities.

C-BED grew from the experience of community-based wind developers and community activists. We developed specific policy tools in order to support direct community participation in the growing wind industry. Our approach is based on our own experience in the wind farming business, and thus represents solutions to the real-world challenges we faced when we built our wind farms.

NPV Rate. NPV rate is a C-BED invention that leverages NPV to reduce the cash flow constraints associated with community-owned energy projects. Since power purchase agreements (PPAs) between electric utilities and energy producers are for a fixed time period (typically 20 years for wind projects), and since the amount of electricity produced by a specific C-BED project can be predicted based on modeling and wind measurements, it is possible to establish the NPV—a lump sum amount in today's dollars—that represents the dollar value of all of the electricity that's going to be produced over the 20-year life of the project. Dividing that NPV by the total kWh of electricity produced over the same time period gives us the NPV rate. In formula terms, the NPV rate is the present value of electricity in dollars divided by the total expected energy production (expressed as $/kWh).

How Discount Rate Affects the Value of Electricity. Because NPV rate incorporates the time value of money in the price of the electricity, it is possible to determine up front (at the time the PPA is negotiated) the value for each kWh of electricity produced over the entire 20-year life of a project.

Figure 1 shows the fixed price value of electricity in dollars per kWh for all discount rates between 6% and 10% when the NPV rate is set at $0.027/kWh. So, for example, if we assume an NPV rate of $0.027/kWh, it can be mathematically shown that the value of the electricity generated is equivalent to a fixed price of $0.047/kWh over the 20 years when assuming a discount rate of 6%. The value of that same electricity over the same 20 years jumps to $0.063/kWh when a discount rate of 10% is assumed.

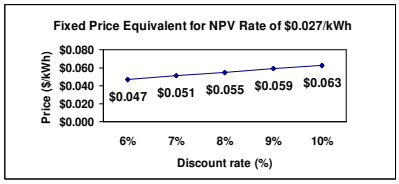


Figure 1

The NPV rate, then, results in an accurate value for the electricity being sold over time by taking into account prevailing discount rates important in the electric utility business.

Setting the Discount Rate. Establishment of appropriate discount rates for C-BED projects should be based on each individual *utility's* discount rate—the rate used by the utility in financing projects in its everyday business. For example, a utility that pays 7% interest for 20-year debt financing in the course of its ordinary business would be required to negotiate a purchase price of up to

$0.051/kWh for C-BED electricity as shown in figure 1 (assuming we're in a jurisdiction that uses a maximum NPV rate of $0.027/kWh). Another utility in the same jurisdiction that gets debt financing at 8% would be required to negotiate up to $0.055/kWh for the same electricity from the same C-BED project. Why treat different utilities differently? Because the relative discount rate each utility uses in the course of its everyday business accurately reflects the relative value of C-BED electricity compared to acquiring electricity elsewhere (for instance, if the utility were to build a new generation facility itself).

Setting the NPV Rate. NPV rates will vary on a per project basis. In a market-driven environment, the primary determinant of project viability is the difference between cost and price. The higher the NPV rate, the more financially viable the C-BED projects are, and the more expensive the electricity is to the purchasing utility. The lower the NPV rate, the less financially viable the C-BED projects are, and the less expensive the electricity is to the purchasing utility. For the C-BED owners, the established NPV rate must be sufficient to pay the debt for the large capital purchase along with operations and maintenance costs, with enough left over to make the project economically profitable. For the purchasing utility, the established NPV rate must be low enough to reasonably compete with other sources of electricity in the marketplace.

The establishment of a maximum NPV rate is a political decision. Minnesota, the first jurisdiction in which an NPV rate has been defined, specified that utilities must consider C-BED projects as part of their mix of electricity sources. In return, a maximum NPV rate of $0.027/kWh was established in order to protect utilities from highly uneconomical projects being forced into the system. The approach used in Minnesota allows maximum flexibility in determining the most efficient price for a specific project, and can accommodate less visible requirements under the control of the utility, such as geographical distribution of projects for load management purposes.

Societal values can affect NPV rate structures. For instance, a jurisdiction could mandate a renewable portfolio standard (RPS), which could result in a utility being required to purchase a certain amount of renewable energy by a specific date. A higher NPV rate could then be used by the utility as an inducement to encourage additional C-BED projects in order to meet the RPS mandate. Additional voluntary actions on the part of utilities, such as purchase of C-BED electricity as part of a rural economic development initiative, or as a community-focused public relations campaign, can also result in favorable NPV rates for C-BED projects. Such an environment can result in an overall win-win situation for both communities and the utilities that serve them.

Front-Loading. Community wind projects are made significantly more efficient financially by front-loading the revenue from the projects, that is, by establishing a higher price for electricity in the early years balanced by a lower price in the later years. During negotiations between the utility and the C-BED owners for a given NPV rate, the utility has relatively little vested interest in whether or not the price is front-loaded, since use of the NPV rate assures the utility that it will pay the same dollar value for the electricity either way. The C-BED owners, on the other hand, require significantly greater cash flow during the first ten years of the project to cover the substantial debt repayment associated with the purchase and installation of the capital equipment.

Figure 2 shows a sample project's fixed price compared to its front-loaded price equivalent. The front-loaded price is higher in the first ten years when debt service payments on the equipment are high, then falls in year eleven when the loan is paid off. The gentle increases result from present value calculations.

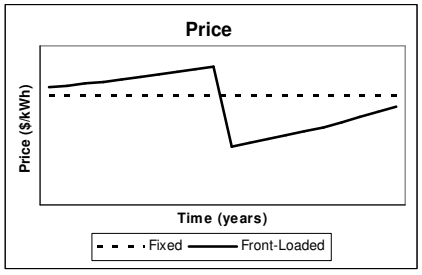


Figure 2

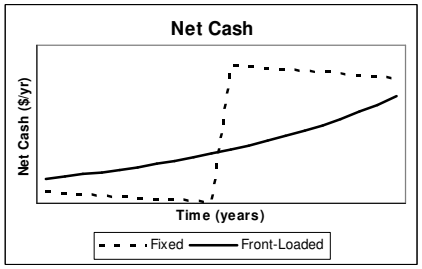


Figure 3

Figure 3 shows the resulting relative net cash of the same project using a (problematic) fixed price scenario compared to a (desirable) front-loaded price scenario. The combination of NPV rate and front-loading ensures financial efficiency in order to allow C-BED projects to succeed for both the C-BED owners and the utilities with which the C-BED owners negotiate.

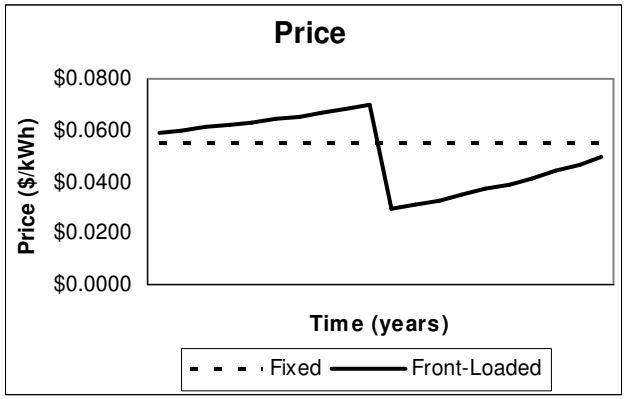
Please refer to the C-BED Calculator on the C-BED web site for the mathematical details behind the C-BED front-loading model (a sample printed version is attached as an appendix to this paper).

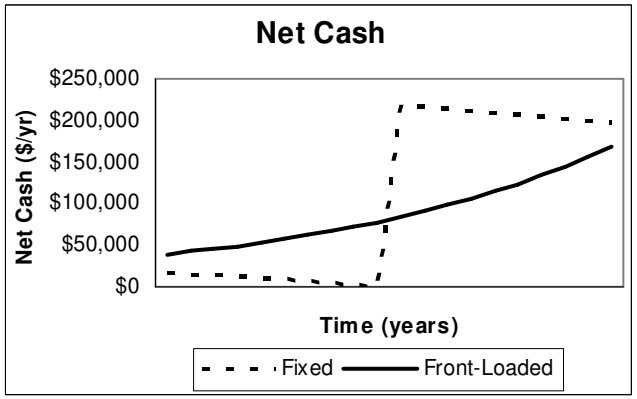
Conclusion. Front-loaded pricing, achieved through the use of NPV rate, provides an important mechanism to support community-based energy development. Deployment of the concepts described in this paper results in highly optimized market conditions for both the community-based seller and the utility purchaser of the electricity.

C-BED Calculator

Note: this model is for conceptual purposes only; tax and depreciation considerations are not included; assumes 50/50 debt/equity ratio and 10-year debt term
A more detailed pro forma C-BED model is available to developers w ho become members of C-BED.org
Author: Laurence LaFond; http://w w w .c-bed.org; spreadsheet last modified: 2006-06-17

Energy production inputs:	
Project size (MW):	2.0
Capacity factor ($/kW):	30%
Total energy produced (kWh/yr):	5,256,000
Financial inputs:	
Cost factor ($/kW):	$1,500
Total project costs ($):	$3,000,000
Interest rate on debt (%):	8.10%
Operation & Maint ($/kWh):	$0.0100
Discount rate for NPV calcs (%):	8.00%
Fixed price equivalent ($/kWh):	$0.0550
NPV rate ($/kWh):	**$0.0270**





	Outflows & Expenses		Fixed Price Net Cash (Problematic)					Front-Loaded Price Net Cash (Desirable)				
Yr	Debt Service ($/yr)	Operation & Maint ($/yr)	Price ($/kWh)	Payments to Project ($/yr)	Present Value of Payments to Project ($/yr)	Net Cash ($/yr)	Present Value of Net Cash ($/yr)	Price ($/kWh)	Payments to Project ($/yr)	Present Value of Payments to Project ($/yr)	Net Cash ($/yr)	Present Value of Net Cash ($/yr)
1	-$219,342	-$52,560	$0.0550	$289,080	$267,667	$17,178	$15,906	$0.0592	$310,920	$287,889	$39,019	$36,128
2	-$219,342	-$54,137	$0.0550	$289,080	$247,840	$15,601	$13,376	$0.0600	$315,619	$270,592	$42,140	$36,128
3	-$219,342	-$55,761	$0.0550	$289,080	$229,481	$13,977	$11,096	$0.0610	$320,614	$254,514	$45,511	$36,128
4	-$219,342	-$57,434	$0.0550	$289,080	$212,482	$12,304	$9,044	$0.0620	$325,928	$239,567	$49,152	$36,128
5	-$219,342	-$59,157	$0.0550	$289,080	$196,743	$10,581	$7,201	$0.0631	$331,583	$225,670	$53,084	$36,128
6	-$219,342	-$60,931	$0.0550	$289,080	$182,169	$8,807	$5,550	$0.0642	$337,604	$212,748	$57,331	$36,128
7	-$219,342	-$62,759	$0.0550	$289,080	$168,675	$6,979	$4,072	$0.0655	$344,019	$200,732	$61,918	$36,128
8	-$219,342	-$64,642	$0.0550	$289,080	$156,181	$5,096	$2,753	$0.0668	$350,855	$189,556	$66,871	$36,128
9	-$219,342	-$66,581	$0.0550	$289,080	$144,612	$3,157	$1,579	$0.0681	$358,144	$179,161	$72,221	$36,128
10	-$219,342	-$68,579	$0.0550	$289,080	$133,900	$1,159	$537	$0.0696	$365,919	$169,491	$77,998	$36,128
11		-$70,636	$0.0550	$289,080	$123,981	$218,444	$93,687	$0.0295	$154,874	$66,423	$84,238	$36,128
12		-$72,755	$0.0550	$289,080	$114,798	$216,325	$85,906	$0.0312	$163,732	$65,020	$90,977	$36,128
13		-$74,938	$0.0550	$289,080	$106,294	$214,142	$78,740	$0.0330	$173,193	$63,683	$98,255	$36,128
14		-$77,186	$0.0550	$289,080	$98,420	$211,894	$72,142	$0.0349	$183,302	$62,407	$106,116	$36,128
15		-$79,502	$0.0550	$289,080	$91,130	$209,578	$66,068	$0.0369	$194,107	$61,191	$114,605	$36,128
16		-$81,887	$0.0550	$289,080	$84,380	$207,193	$60,478	$0.0391	$205,660	$60,030	$123,773	$36,128
17		-$84,343	$0.0550	$289,080	$78,129	$204,737	$55,334	$0.0415	$218,019	$58,924	$133,675	$36,128
18		-$86,874	$0.0550	$289,080	$72,342	$202,206	$50,602	$0.0440	$231,243	$57,868	$144,369	$36,128
19		-$89,480	$0.0550	$289,080	$66,983	$199,600	$46,250	$0.0467	$245,399	$56,862	$155,919	$36,128
20		-$92,164	$0.0550	$289,080	$62,022	$196,916	$42,248	$0.0496	$260,557	$55,902	$168,392	$36,128
	-$2,193,420	-$1,412,307		$5,781,600	$2,838,230	$2,175,874	$722,566		$5,391,291	$2,838,230	$1,785,565	$722,566