National Renewable Energy Laboratory
Innovation for Our Energy Future

A national laboratory of the U.S. Department of Energy
Office of Energy Efficiency & Renewable Energy

Interaction between Carbon Markets and Renewable Energy Markets

BACKGROUND/OVERVIEW

A number of states and regions in the United States (such as California and the states participating in the Regional Greenhouse Gas Initiative "RGGI" in New England) have begun to regulate carbon emissions and are considering cap-and-trade programs. Nearly half of U.S. states are implementing renewable portfolio standards (RPS) to increase the use of renewable energy. There is also a robust voluntary market for renewable energy. These programs and markets are being defined through separate and evolving policy debates; however, the way each is structured directly impacts the others because of overlapping goals with respect to reducing carbon dioxide emissions. The goal of this research is to understand the interaction of these markets and determine how these policies could be implemented to maximize societal benefits.

RENEWABLE ENERGY MARKETS AND RENEWABLE ENERGY CREDITS "REC"

Renewable energy credits (RECs) were created to help support renewable energy, and represent the benefits associated with renewable energy as compared to more conventional fossil fuels. One REC represents the contract right to the environmental and other nonelectrical value associated with 1 megawatt hour ("MWh") of electricity generated from renewable energy. The value of a REC can include emissions reductions, regulatory compliance value, and the right to claim that you're generating or purchasing renewable energy. RECs are tradable and can be sold along with the electricity produced, or as a separate product (see **Figure 1**.)

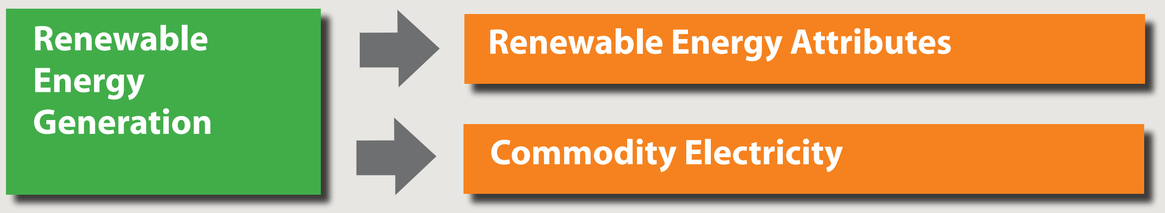

Figure 1. Products of Renewable Energy Generation

Table 2. Comparison Chart of Renewable Energy Credits and Carbon Credits

	RECs	CCs
Purpose	Support Renewable Energy	Reduce anthropogenic CO2 emissions
Market-based	yes	yes
Tradable	yes	yes
Used in Mandatory and Voluntary Markets	yes	yes
Allocated	No (depends how you define allocated)	yes

EMERGING CARBON MARKETS AND CARBON CREDITS "CC"

Carbon credits ("CCs") were created as a tool to help reduce anthropogenic-caused CO_2 and other greenhouse gas ("GHG") emissions (e.g., methane, nitrous oxide, and tropospheric ozone), and therefore reduce the human impact on climate change. One carbon credit represents the right to emit, or the reduction of, 1 metric ton of CO_2 equivalent. CCs are tradable, and governments can allocate or auction them off. They can also be generated by emissions reductions projects, e.g., increasing efficiency, using more efficient technology, using cleaner technologies, or by creating carbon sinks. By allowing trading of these instruments, a country or entity can choose the cheapest option for reducing emissions and meeting mandates. **Table 2** compares CCs to RECs.

EMERGING CARBON REGULATION IN THE UNITED STATES

Although there is no federal regulation of greenhouse gases currently in the United States, there are mandatory cap-and-trade systems for other pollutants, including SO2 at a national level and NOx at a regional level. Additionally, the Regional Greenhouse Gas Initiative ("RGGI") is under way in New England to regulate carbon under a cap-and-trade system. And California is developing carbon regulation as well. There are also voluntary cap-and-trade systems for CO2, such as the Chicago Climate Exchange ("CCX"). Participants in the CCX (such as IBM, the City of Boulder, and Tufts University), join voluntarily; however, their commitments to reducing GHG emissions become legally binding once they become CCX members. **Table 3** compares carbon trading schemes in Europe and in the United States.

Table 3. Carbon Emission Trading Schemes

Exchange	Scope	Date Started	Focus	Participants	Funding	Results
European Union Emissions Trading System (EU-ETS)	EU-wide	2005	CO2	12,000+ installations (all exceeding 20MW) accounting for 55+% of the EU's overall emissions.	Fees charged to member companies, auction revenues	TBD
Chicago Climate Exchange (CCX)	USA-wide	2003	CO2, CH4, N20, HFC's, PFC's, and SF6	60 members, 30 industrials	Initiated with grant funding	- Price discovery ($1.87/ton as of 11/25/04) - Creating processes to monitor and reduce CO2 emissions
Regional Greenhouse Gas Initiative	Regional	2003	CO2 initially	9 northeast U.S. states to design regional cap-and-trade system	TBD	TBD

RELATIONSHIP BETWEEN RENEWABLE ENERGY AND CARBON MARKETS

The REC and CC programs and markets are being defined through separate and evolving policy debates. However, the way each is structured directly impacts the others because of overlapping goals with respect to reducing carbon dioxide emissions (see **Figure 2**). State-level policy makers are defining RECs state by state through the RPS policy processes, and there is not yet a consistent approach for defining what attributes a REC should include. Simultaneously, the international community involved in Kyoto and, in the United States, nascent regional policies such as RGGI are defining CCs. Without a better understanding of the roles, limitations, and interactions of these markets and, specifically, renewable energy credits (RECs) and carbon credits (CCs) – the two policy tools they employ – the larger environmental and economic societal goals that these markets and tools are meant to achieve may not be fully realized.

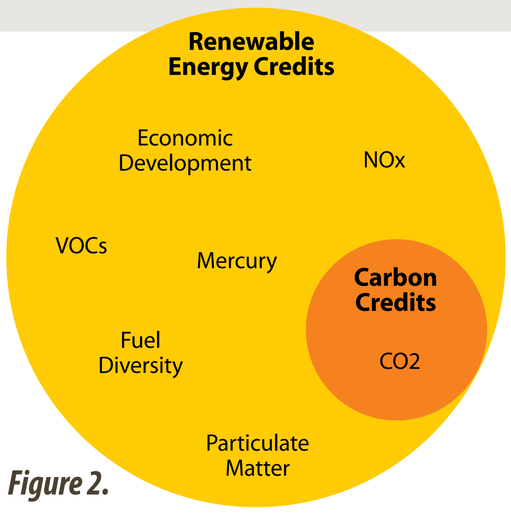

Figure 2.

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SEAC Strategic Energy Analysis Center

CU Energy Initiative/NREL Symposium
University of Colorado, Boulder
October 3, 2006
NREL/PO-640-40671