Synapse
Energy Economics, Inc.

Potential Impacts of a Renewable and Energy Efficiency Portfolio Standard in Kentucky

Prepared for the Mountain Association for Community Economic Development & the Kentucky Sustainable Energy Alliance

January 12, 2012

AUTHORS

Rick Hornby, Dr. David White, Dr. Tommy Vitolo, Tyler Comings, and Kenji Takahashi

485 Massachusetts Ave.
Suite 2
Cambridge, MA 02139

617.661.3248
www.synapse-energy.com

1. Executive Summary

Legislation being introduced in the Kentucky General Assembly proposes to establish a Renewable and Energy Efficiency Portfolio Standard (REPS) for utilities in the state. The Mountain Association for Community Economic Development (MACED) and the Kentucky Sustainable Energy Alliance (KySEA) retained Synapse Energy Economics, Inc. (Synapse) to estimate the potential impacts of establishing such a standard. The study estimates the impacts of a REPS on Kentucky's portfolio of electricity resources, on average electric bills, and on the state's economy.

Proposed REPS. The study assumes the goals of the REPS would be to promote energy independence and security by diversifying the state's generating mix, stabilizing long-term energy prices, and creating high-quality jobs and business opportunities. It assumes the REPS would require all utilities in the state to meet specific portions of their retail load through energy efficiency (EE) and from renewable energy (RE) respectively. The assumed required cumulative reductions from EE begin at 0.25 percent in 2014 and increase to 10.25 percent of aggregate retail load by 2022. The assumed required cumulative portions of retail load to be met from RE begin at 2.25 percent in 2014 and increase to 12.5 percent by 2022.

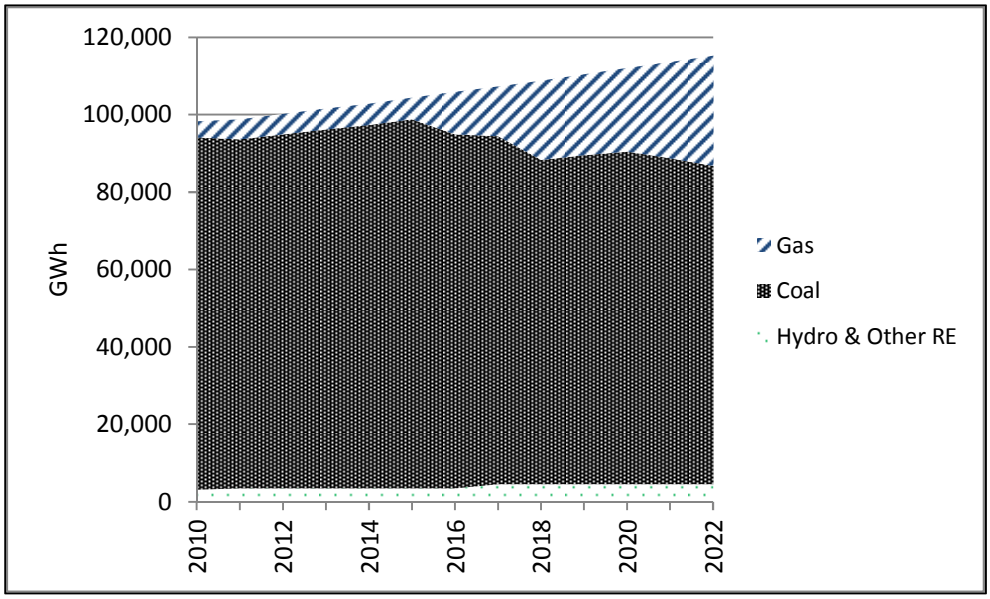
Study Methodology. The study estimates various impacts of the proposed REPS over the ten year period 2013 – 2022 using a scenario approach. It then projects supply mix and average electric bills under a Business-as-Usual (BAU) scenario, i.e., a future without a REPS, and under a REPS scenario. The study develops the REPS scenario by estimating the cost of achieving the EE reductions and of acquiring the RE resources required under the REPS legislation. Finally, the study calculates the incremental impacts of the REPS scenario relative to the BAU scenario in terms of the state's electricity supply portfolio, average electric bills, and economic activity. All values are expressed in constant 2010$ unless noted otherwise.

The BAU scenario and the REPS scenario are based on a number of common assumptions. Both scenarios are based on the same projection of retail electric requirements excluding the effects of EE, which is an average annual rate of growth of 1.5% over the study period. Second, both are based on the same projections of electricity resource capital and operating costs, including projected long-term prices for coal and natural gas. Third, both scenarios assume Kentucky utilities will comply with new, more stringent regulations of various air emissions that are currently scheduled to take effect in 2016. Finally, both scenarios assume that carbon emissions from all generating units, both existing and new, will be subject to regulation beginning in 2018 at a cost per ton of $15 (2010$). Given the uncertainty regarding the timing and magnitude of future regulation of carbon, Appendix C of the study presents an estimate of the summary impacts of a REPS assuming no regulation of carbon in Kentucky until after 2022.

BAU scenario. Historically almost all of Kentucky's annual supply of electric energy has been coal-fired generation. For example, in 2010 Kentucky met over 92% of its annual retail electric requirements from coal-fired generation. The BAU scenario projects that coal-fired generation would decline but would continue to supply the majority of the state's annual electric energy requirements, as indicated in Figure 1-1. For example, the study projects that generation from coal would account for approximately 71% of the state's supply in 2022. The decline in coal-fired generation is due to generation from new gas-fired units projected to replace older coal units scheduled to retire starting 2016 and to meet load growth. Under the BAU scenario Kentucky

utilities are projected to meet less than 5% of annual retail electric requirements from resources other than coal and natural gas.

Figure 1-1. BAU scenario annual electricity requirements and sources

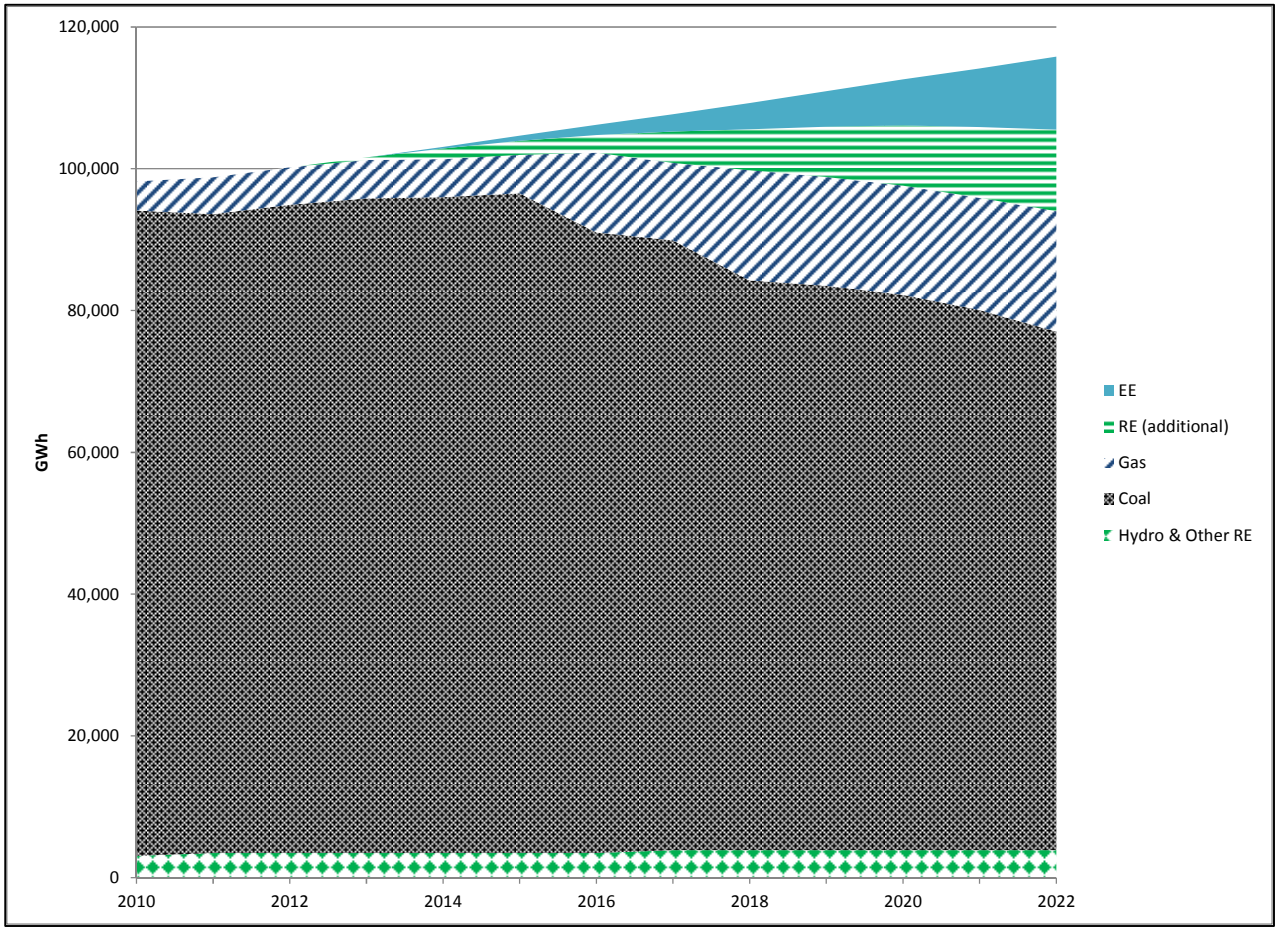


Average electricity prices and average electric bills are projected to increase substantially under the BAU, primarily due to the capacity costs of new gas-fired units and the higher costs of generation from those units (i.e., production costs). For example, the BAU scenario projects state-wide average residential bills would increase approximately 47 percent, in constant dollars, between 2010 and 2022.

The marginal, or avoided, cost of electricity under the BAU scenario is projected to double over the study period, from less than 4 cents/kWh in 2012 to approximately 9 cents/kWh by 2022. This increase is again attributable to the projected costs of adding and dispatching new gas-fired capacity as well as to the projected cost of complying with carbon regulation from 2018 onward.

REPS Scenario. The REPS scenario estimates the impacts of meeting total annual retail electricity requirements using greater levels of EE and RE than under the BAU scenario. The additional quantities of EE and RE would displace some of the generation from natural gas and coal projected under the BAU scenario. Under the REPS scenario, Kentucky would have a more diverse electricity resource portfolio, as illustrated in Figure 1-2. For example, the state's dependence on coal would decrease to approximately 63% of total annual requirements by 2022. This diversification of the state's generating mix has the potential to produce a number of benefits beyond those examined in this report, including mitigation of operational and financial risks.

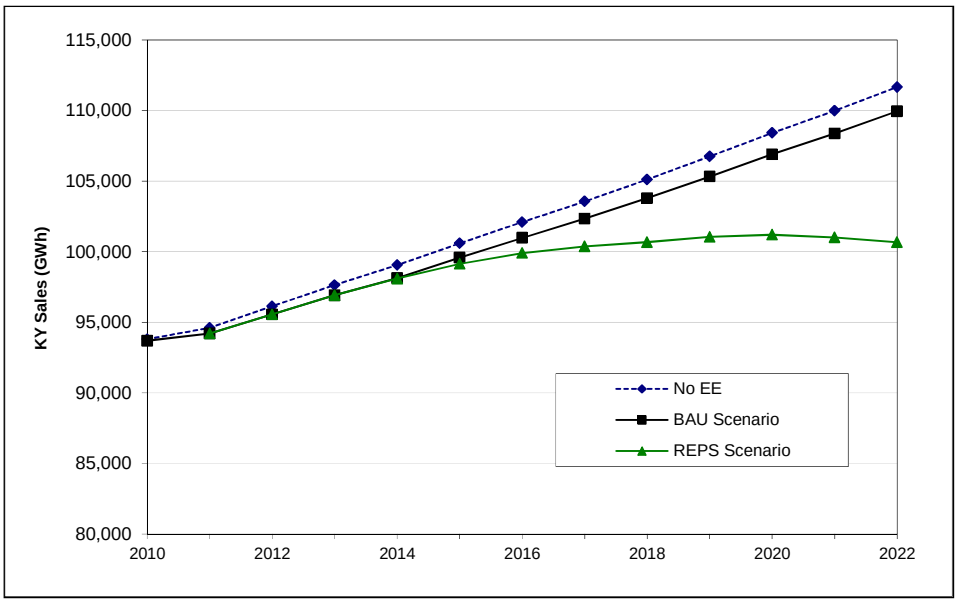
Figure 1-2. REPS scenario annual electricity requirements and sources



Additional EE reductions under REPS scenario. Our analyses project that, by 2015, cumulative reductions from EE required under a REPS would be large enough to offset incremental growth in annual electric sales. The potential for EE to flatten annual sales after 2015 is illustrated in Figure 1-3 (below).

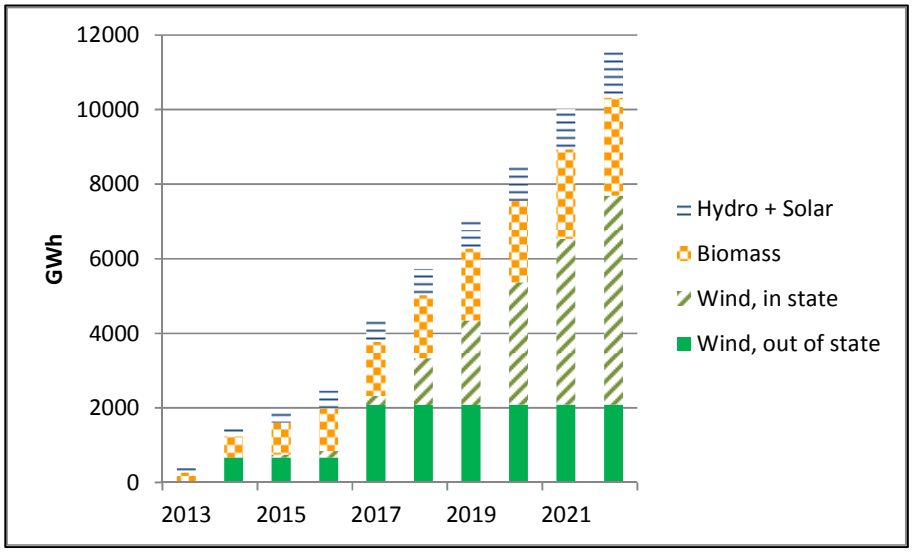
By capping annual retail sales, those EE reductions would reduce the quantity of new peaking capacity needed over the study period as well as reduce the quantity of annual generation required from new gas-fired plants. The study estimates these EE reductions could be achieved at levelized costs ranging between 3 cents/kWh and 4 cents/kWh, considerably less than the avoided costs projected under the BAU scenario.

Figure 1-3. Total annual sales without EE, BAU scenario, and REPS scenario



Additional RE generation under REPS scenario. The study projects that Kentucky could eventually acquire the majority of the additional RE generation required under the REPS scenario from in-state resources, primarily biomass and wind. The study projects that Kentucky utilities would acquire a portion of their required RE as wind energy imported from out-of-state, particularly during the initial years when in-state resources are being developed. The study assumes utilities would satisfy the solar RE requirement through a combination of solar water heating installations at customer sites and large-scale photovoltaic (PV) projects. Figure 1-4 illustrates the mix of projected additional RE sources.

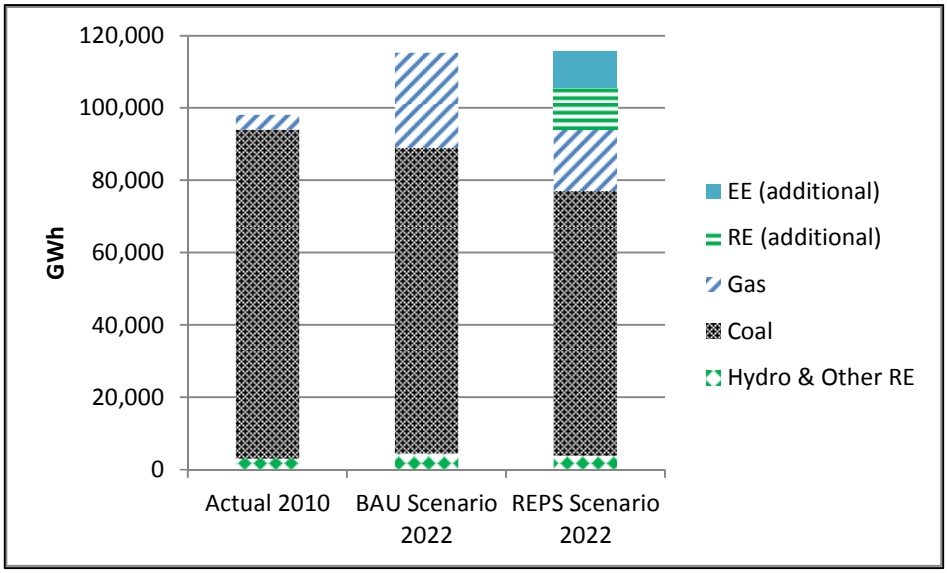
Figure 1-4. Mix of additional RE under REPS scenario



The cost of electricity from RE varies by RE resource and project scale. The study projects that the total cost of generation from new RE projects, i.e. capital plus variable production, will become increasingly competitive with generation from new natural gas units and existing coal units over time due to increases in the costs of carbon emissions and decreases in the costs of RE technologies.

Impact of REPS on Kentucky electricity resource portfolio. The study projects that the REPS would lead to a more diverse electricity resource portfolio. For example, by 2022 the state's utilities would be achieving reductions from EE equivalent to 10.2 percent of annual retail sales and acquiring generation from RE equivalent to 12.5 percent of annual sales. Those quantities of EE and RE would enable the state to reduce its dependence on generation from coal and natural gas for its total annual energy requirements in 2022 from 71 percent and 25 percent under the BAU scenario to 63 percent and 15 percent under the REPS scenario, as indicated in Figure 1-5. Kentucky would have 15% less emissions of carbon dioxide under the REPS scenario than under the BAU scenario as a result of these increased quantities of EE and RE.

Figure 1-5. Annual electricity requirements and sources in 2022 - REPS versus BAU



Impact of REPS on electric bills. The study indicates that the REPS would lead to lower electric bills over time. If one assumes no regulation of carbon in Kentucky until after 2022, our analyses indicate that a REPS would still lead to lower electric bills, although the savings would be less.

The study projects electric bills will increase under the REPS scenario, but by lesser amounts than under the BAU scenario. For example, the study projects annual bills will be approximately 8 to 10 percent lower under the REPS scenario in 2022 than under the BAU scenario, as indicated in Table 1-1. The lower average bills in that year are primarily due to the fact that, under the REPS scenario, retail customers are projected to use approximately 8 percent less electricity on average than under the BAU scenario due to reductions from EE. After 2022 the study projects that average bills would continue to be less under the REPS scenario, as the cost of electricity from

RE is projected to continue declining relative to the cost of electricity from coal-fired and natural gas generation.

Table 1-1. Annual electricity bills in 2022 - REPS versus BAU

Average Electric Rates ($/kWh) (2010$)	2010	BAU Scenario 2022	REPS Scenario 2022	REPS Scenario vs BAU Scenario
Total (All Sectors)	$0.067	$0.101	$0.102	1%
Residential	$0.086	$0.120	$0.121	1%
Commercial	$0.079	$0.113	$0.114	1%
Industrial	$0.051	$0.085	$0.085	0%
Average Electric Bills ($) (2010$)	**2010**	**BAU Scenario 2022**	**REPS Scenario 2022**	**REPS Scenario vs BAU Scenario**
Residential	$1,249	$1,834	$1,657	-10%
Commercial	$5,198	$7,658	$7,067	-8%
Industrial	$325,409	$557,989	$513,178	-8%

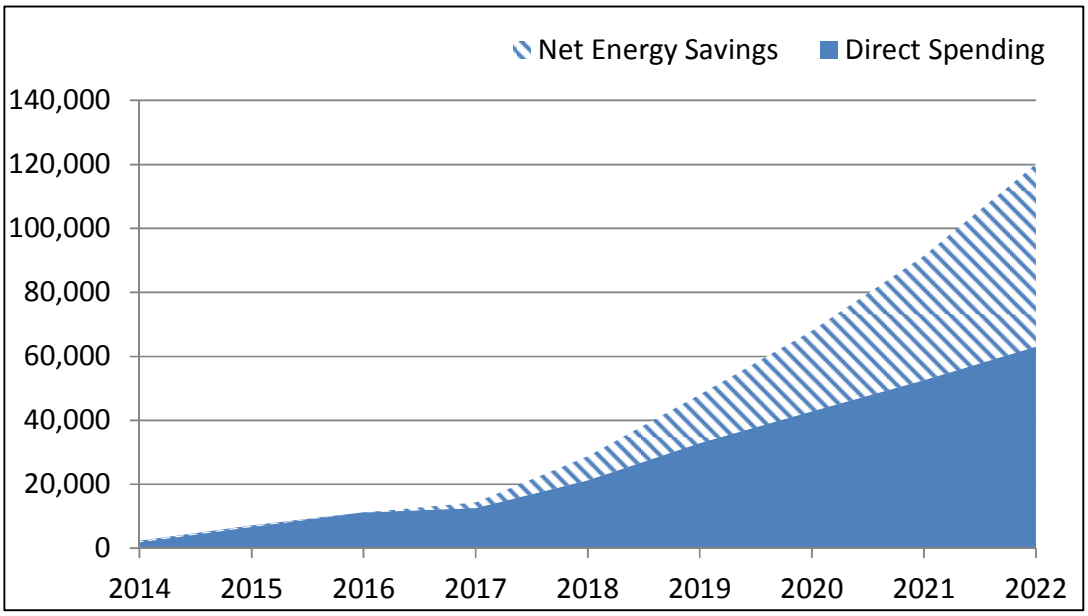
Impact of REPS on Kentucky economy. The study estimates that a REPS would lead to a net increase in employment and business opportunities in Kentucky. In other words the expenditures on additional reductions from EE and additional RE generation required under a REPS would create more economic activity and employment in Kentucky than the electric generation from coal and natural gas that the additional EE and RE would displace. If one assumes no regulation of carbon in Kentucky until after 2022, our analyses indicate that a REPS would still lead to a net increase in employment and business opportunities in Kentucky, although those net increases would be somewhat smaller.

Complying with the EE targets will require expenditures on materials and equipment to improve the efficiency of residences, businesses, and factories, while complying with the RE targets will require expenditures on construction and operation of RE projects. The net positive impact of these expenditures is attributable to three major factors. First, the portion of total expenditures that would remain in Kentucky is projected to be higher for EE and RE than for generation from coal and natural gas. Second, the EE and RE projects are expected to be more labor-intensive than generation from coal and natural gas, and thus are projected to create more jobs per dollar spent. Finally, the additional quantities of EE and RE are projected to result in lower electric bills over time, leaving Kentuckians with more discretionary income available to spend on other goods and services, which in turn would produce additional economic impacts.

The study projects a REPS would create over 28,000 net additional job-years in Kentucky by 2022. (Employment impacts are in job-years since the duration of some jobs is limited, e.g. a RE construction project, while the duration of other jobs is longer-term, e.g. programs to install EE measures). The major sources of these incremental job-years are capital and operating expenditures on EE measures and RE facilities ($159 million in 2022) as well as electric customer spending of the amounts they saved on their electric bills, i.e., spending of their net energy

savings from energy efficiency ($970 million in 2022). Figure 1-6 presents the projected cumulative net job-year impacts in Kentucky.

Figure 1-6. Cumulative net job-year impacts in Kentucky from a REPS



The study projects the net incremental impacts of a REPS on Kentucky by 2022 would include an increase in personal income of nearly $1 billion and an increase in Gross State Product of $1.5 billion. Those projections are reported in Table 1-2.

Table 1-2. Annual net economic impacts in Kentucky from a REPS

Economic Impacts	2017	2020	2022	Cumulative Total
Job-years	3,190	19,958	28,539	***120,140***
Personal Income (2010$ millions)	$119	$765	$1,088	***$4,634***
Gross State Product (2010$ millions)	$118	$1,004	$1,474	***$6,038***