# Alternative RE Approach Technical Support Document

## 1.1. Introduction

Renewable energy (RE) is a cost-effective approach for reducing carbon dioxide ($CO_2$) emissions from fossil fuel-fired electric generating units (EGUs) through the substitution of electricity generated from renewable resources. The portfolio of available RE sources encompasses a wide variety of technologies from utility-scale RE plants to smaller-scale distributed generation sited at residential, commercial, or industrial facilities. RE technologies are fueled by the sun, wind, water, organic matter, and other resources regularly replenished by physical and biological cycles. The EPA has developed an Alternative RE Approach that relies on the technical and market potential of new RE to determine how the rapidly increasing and evolving portfolio of RE can be integrated into the Best System of Emission Reduction (BSER).

Note that an accompanying excel file that contains the aggregate state level data, calculations, and proposed state RE targets is also available in the Docket for this rulemaking. The title of this document is "Alternative RE Approach Data File".

## 1.2. Alternative RE Approach Methodology

As part of its effort to evaluate the potential for incremental RE as part of BSER, EPA developed an Alternative RE Approach that is based on the technical and market potential of RE by state.

To establish a technical potential benchmark for individual states, the Alternative RE Approach compares each state's RE technical potential against its existing RE generation. For this purpose, EPA has utilized technical potential as measured by the National Renewable Energy Laboratory[1] (NREL) and existing RE generation as reported by EIA for 2012.[2] The comparison of RE technical potential to existing RE net generation yields - for each state and for each selected RE technology - a proportion of achieved renewable generation from technical potential, which can be represented as an RE development rate. For example, if a given state had 5,000 MWh of solar generation in 2012 and a solar generation technical potential of 50,000 MWh, then that state's solar RE development rate is 10%. In the Alternative

[1] Lopez et al., NREL, "U.S. Renewable Energy Technical Potentials: A GIS-Based Analysis," (July 2012). Available at http://www.nrel.gov/gis/re_potential.html.

[2] Net Generation by State by Type of Producer by Energy Source (forms EIA-906, EIA-920, and EIA-923). Available at http://www.eia.gov/electricity/data/state/.

RE Approach, the average development rate of the top third (16) of states is designated a benchmark RE development rate for each technology type. The benchmark rate is then applied to each state's technical potential to calculate the benchmark generation for each technology type.

While the benchmark RE development rate offers a useful metric to quantify the proportion of RE generation consistent with what has been demonstrably achieved in practice by the top third of states, EPA recognizes that a metric based solely on technical potential has limitations. For example, technical potential data is typically unconstrained by grid limitations, costs associated with development, quality of resource, and may overstate electricity production potential because a given site cannot produce RE simultaneously from multiple technology types. In order to address these limitations, the Alternative RE Approach pairs the benchmark RE development rates described above with Integrated Planning Model (IPM) runs of RE deployment that reduces the cost of new renewable builds.[3] The cost reduction in new RE is intended to represent the avoided cost of other actions that could be taken instead to reduce power sector $CO_2$, and to reflect continued reductions in RE technology costs. The state-level modeling results for this approach show RE deployment levels associated with a cost reduction of up to $30 per MWh, which is consistent with the estimated cost of the proposed approach (up to $40 per metric ton of $CO_2$).[4]

The RE generation projections considered from this IPM scenario are supported by analysis from a recent NREL study using the Regional Energy Deployment System (ReEDS) model, a capacity expansion and dispatch model with detailed assumptions regarding renewable technologies and associated power infrastructure. NREL modeled RE generation potential under lower cost assumptions for renewable technologies, based on DOE's RE cost and performance targets. Under the respective assumptions for each model, the IPM model run projects more RE generation in 2020 (582 TWh in IPM versus 484 TWh in ReEDS), while the ReEDS modeling projects more RE generation than IPM in 2030 (821 TWh in IPM versus 923 TWh in ReEDS). The regional distribution of generation across the two model scenarios are comparable (regional RE generation projections are within 7% of each other). Overall, both sets of modeling projections indicate a broad range of market potential for RE generation that can be developed in each state.[5]

Under the Alternative RE Approach, EPA would quantify target generation for most RE technologies as the lesser of that technology's benchmark rate multiplied by in-state technical potential,

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[3] IPM is EPA's multi-regional, dynamic, deterministic linear programming model of the U.S. electric power sector. Refer to RIA Chapter 3 for additional detail on the IPM platform. Full documentation of IPM, including cost and performance assumptions for new generating resources can be accessed at http://www.epa.gov/powersectormodeling/.

[4] For further discussion on the cost of RE, refer to Chapter 4 of the GHG Abatement Measures TSD. Full IPM run results for this scenario – the 'RE Market Potential Scenario' - can be found on the docket.

[5] NREL, ReEDS Modeling of the President's 2020 RE Generation Goal, NREL/PR-6A20-62077, http://www.nrel.gov/docs/fy14osti/62077.pdf, May 2014.

or the IPM-projected market potential for that specific technology at a reduced cost of up to $30/MWh. For example, if the benchmark RE development rate for solar generation is determined to be 10%, and this state possesses solar generation technical potential of 5,000 MWh, then the benchmark RE development level of generation for that state would be 500 MWh. If the IPM-projected market potential for solar generation at a cost reduction of up to $30/MWh in that state were 750 MWh, then this approach would quantify target generation for solar as the benchmark RE development level (500 MWh) because it is the lesser amount of those two measures.

The methodology for quantifying target generation levels by technology type under the Alternative RE Approach is presented in Section 1.3 below.

### 1.3. RE Target Generation Methodology by Technology Type

This section describes the methodology employed to produce target generation levels for each state by technology type. The RE technology types that contribute to each state's target generation level are utility-scale solar, onshore wind, conventional geothermal (hydrothermal), hydropower, and select existing biopower capacity types.[6] EPA notes that RE target generation levels are used solely to inform each state's goal calculation and are not prescriptive of any RE compliance outcome – either in sum or by technology type.[7] Consequently, whether or not any particular RE technology is considered in this Alternative RE Approach does not have any bearing on what types of RE generation a state may consider in developing its state plan for complying with its state goal. In selecting the technology types that contribute to the RE target generation level, EPA considered the availability of 2012 net generation data, technical potential estimates, and the ability to project economic deployment within the IPM modeling framework. For example, distributed generation RE technologies were omitted from the RE Alternative Approach because their market potential cannot be tested in the current IPM framework. Similarly, offshore wind was not considered under this methodology because there are currently no operational offshore wind facilities in the United States from which to calculate a benchmark development rate.

[6] Existing dedicated biomass and landfill gas facilities contribute to RE target generation levels. The analysis in this TSD does not consider biomass renewables in its evaluation of renewable development potential for BSER, but the preamble discusses the possibility of a path for states to consider it in their plans.
[7] Refer to the Goal Computation TSD for additional detail.

*Solar*

The solar development rate for each state was calculated utilizing EIA 2012 total electric power industry net generation for the solar thermal and photovoltaic energy source and NREL's technical potential estimates for urban utility-scale PV, rural utility-scale PV, and concentrated solar power (CSP). The average 2012 development rate for the top 16 states was 0.009%. The benchmark generation is defined as the greater of each state's reported 2012 solar generation or the benchmark rate of 0.009% multiplied by in-state technical potential. Total benchmark generation for the states affected by the Alternative RE Approach is 33,981 GWh, compared to 2012 net generation of 4,317 GWh.[8]

As part of the modeling that reduced the cost of new RE technologies by up to $30/MWh, IPM projected total solar generation (utility-scale PV and CSP) of 20,153 GWh in 2020, increasing to 23,635 and 27,531 by 2025 and 2030, respectively.

The solar target generation for each state is the lesser of the benchmark solar generation or IPM-projected solar generation. This methodology produced a total solar generation target across all affected states of 8,477 GWh in 2020, 8,493 GWh in 2025, and 8,722 GWh in 2030.

*Wind*

The wind development rate for each state was calculated utilizing EIA 2012 total electric power industry net generation for the wind energy source and NREL's technical potential estimates for onshore wind. The average 2012 development rate for the top 16 states was 9%. The benchmark generation is defined as the greater of each state's reported 2012 wind generation or the benchmark rate of 9% multiplied by in-state technical potential. Total benchmark generation for the states affected by the Alternative RE Approach is 2,841,650 GWh, compared to 2012 net generation of 140,229 GWh.

As part of the modeling that reduced the cost of new RE technologies by up to $30/MWh, IPM projected total onshore wind generation of 220,593 GWh in 2020, increasing to 296,720 and 442,417 by 2025 and 2030, respectively.

The wind target generation for each state is the lesser of the benchmark wind generation or IPM-projected onshore wind generation. This methodology produced a total wind generation target across all affected states of 189,687 GWh in 2020, 259,534 GWh in 2025, and 384,826 GWh in 2030.

[8] Vermont is not subject to any RE requirement under BSER.

*Geothermal*

The geothermal development rate for each state was calculated utilizing EIA 2012 total electric power industry net generation for the geothermal energy source and NREL's technical potential estimates for geothermal (hydrothermal). The average 2012 development rate for all 5 states with reported geothermal generation for 2012 was 3.6%. The benchmark generation is defined as the greater of each state's reported 2012 geothermal generation or the benchmark rate of 3.6% multiplied by in-state technical potential. Total benchmark generation for the states affected by the Alternative RE Approach is 18,054 GWh, compared to 2012 net generation of 15,301 GWh.

As part of the modeling that reduced the cost of new RE technologies by up to $30/MWh, IPM projected total geothermal generation of 32,609 GWh in 2020, increasing to 40,429 and 42,640 by 2025 and 2030, respectively.

The geothermal target generation for each state is the lesser of the benchmark geothermal generation or IPM-projected geothermal generation. This methodology produced a total geothermal generation target across all affected states of 16,516 GWh in all years.

*Hydropower*

Due to the unique nature of the hydropower technical potential data, EPA has used a different procedure for quantifying hydropower target generation under this alternative RE approach. In contrast with other RE technology types, the study that formed the basis of NREL's hydropower technical potential estimate applied a full set of feasibility criteria to the development opportunities for new low power and small hydroelectric plants.[9] The feasibility criteria include site accessibility, load or transmission proximity, and environmental concerns that may hinder development efforts. EPA believes that the application of feasibility criteria represent a refinement to the technical potential data and thus obviates the need for EPA to identify a benchmark development rate for hydropower generation. Therefore, the benchmark hydropower generation for each state is defined as the greater of each state's reported 2012 conventional hydroelectric generation, or the feasible hydropower development potential

[9] Paper available at http://www1.eere.energy.gov/water/pdfs/doewater-11263.pdf. NREL's technical potential estimate for hydropower also includes non-powered dams from the National Hydropower Asset Assessment Program.

identified by NREL.  Total benchmark generation for the states affected by the Alternative RE Approach is 354,119 GWh, compared to 2012 conventional hydroelectric net generation of 273,441 GWh.

IPM is not currently configured to project the economic deployment of new hydropower resources in the United States.  Therefore, the hydropower target generation for each state is the greater of the benchmark hydropower generation or the IPM-projected generation from existing hydropower resources in that state.  This methodology produced a total hydropower generation target across all affected states of 358,665 GWh in all years.

*Total Target Generation*

The total RE target generation level for each state is simply the sum of all of the technology-specific target levels, which are inclusive of existing generation. The total RE target generation level informs the calculation of each state's goal.[10]  State-level results for RE target generation levels are provided in Section 1.4.

*Alaska and Hawaii*

In order to quantify technical and market potential for RE generation in Alaska and Hawaii (which are often not included in power sector capacity expansion models like IPM), the Alternative RE Approach adopts annual growth factors for each state based on the difference between each state's 2002 and 2012 RE generation.  These annual growth factors are calculated as 11.4% for Alaska and 7.9% for Hawaii.[11]  Based on the application of these annual growth factors, EPA has derived a 2020 RE target level for Alaska of 1,637 GWh in 2020, increasing to 1,681 GWh and 1,738 GWh in 2025 and 2030, respectively.  2012 RE net generation in Alaska was 1,615 GWh.  EPA has derived a 2020 RE target level for Hawaii of 1,368 GWh, increasing to 1,948 GWh and 2,600 GWh in 2025 and 2030, respectively.  2012 RE net generation in Hawaii was 1,039 GWh.

[10] Refer to Goal Computation TSD.
[11] Refer to Chapter 4 of the GHG Abatement Measures TSD for further detail on the calculation of RE growth factors for Alaska and Hawaii.

### 1.4. Potential Alternative Method Using Technical and Economic Potential

This section specifies a potential alternative approach to quantification of renewable generation that also relies on a state-by-state assessment of RE technical and economic potential. This approach would compare the estimated cost of new renewable energy to the avoided cost of energy from implementing clean energy generation, by comparing the total cost of generation for each renewable energy technology by region to the estimated fuel, operating, and capital costs avoided by adding that generation. This calculation can be carried out at a high level of granularity when data is available, and then aggregated to the state or regional level. This general economic potential approach can be summarized in three steps:

Step 1: Use best available regional information (with areas excluded due to physical features and other possible criteria) and data on current technology costs and regional construction cost differences to estimate a total cost of clean energy for each location. Note this can include an adder for potential new transmission or pipeline needs. The result of this is a clean energy supply curve at many locations, with the cost and available generation for that region.

Step 2: Estimate the avoided energy cost. This is calculated based on the particular generation mix by region, providing information about the generation that would be displaced by the clean energy technology. This is composed of avoided fuel and operating costs, avoided capital costs, and a range of costs for avoided environmental externalities.

Step 3: For each resource area, compare the cost of new clean generation (found in step 1) to the avoided costs (found in step 2). If the costs are lower than avoided cost, include the generation and capacity available in this region in the "cost-effective potential". Sum the supply curve for each state and region to estimate cost-effective potential at those scales.

### 1.5. State-Level Results

This section contains state-level RE target generation levels for 2020, 2025, and 2030. Interim generation targets for Option 1 are the average target generation levels from 2020-2029; interim generation targets for Option 2 are the average from 2020-2024. Final targets for Option 1 are represented by the 2030 target generation levels; final targets for Option 2 are equivalent to the 2025 levels.[12] Results are presented both with existing hydropower included as part of RE (Tables 1.1 and 1.2) and without (Tables 1.3 and 1.4). RE target generation levels for Alaska and Hawaii are presented both with and without existing hydropower in Tables 1.5 and 1.6, respectively. IPM projections, technical resource estimates, and 2012 net generation levels are available in the Appendix to this TSD.

Under this alternative RE approach, states would not be required to achieve the absolute levels of target generation quantified below; instead, the target generation presented below would be incorporated into the denominator of the state goals as demonstrated in the Goal Computation TSD. States will have the flexibility to consider the extent to which RE is used in their state plans as a compliance measure.

Table 1.1. State-Level Target Generation Levels Under the Alternative RE Approach (Gigawatt-hours)

| State | 2012 RE* | **RE Alternate Methodology Target Generation (GWh)** | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2020 | 2024 | 2029 | Option 1 Interim | Option 1 Final | Option 2 Interim | Option 2 Final |
| AL | 10,212 | 8,117 | 8,117 | 8,117 | 8,117 | 8,117 | 8,117 | 8,117 |
| AZ | 8,415 | 10,034 | 10,034 | 10,035 | 10,034 | 10,035 | 10,034 | 10,034 |
| AR | 3,859 | 6,246 | 6,247 | 6,255 | 6,248 | 6,255 | 6,246 | 6,247 |
| CA | 56,804 | 57,776 | 59,027 | 57,821 | 58,410 | 57,821 | 58,276 | 59,027 |
| CO | 7,689 | 16,499 | 17,116 | 19,136 | 17,335 | 19,136 | 16,746 | 17,116 |
| CT | 979 | 950 | 950 | 950 | 950 | 950 | 950 | 950 |
| DE | 131 | 111 | 111 | 111 | 111 | 111 | 111 | 111 |
| FL | 4,674 | 2,700 | 2,701 | 2,690 | 2,698 | 2,690 | 2,700 | 2,701 |
| GA | 5,515 | 3,759 | 3,780 | 3,783 | 3,774 | 3,783 | 3,767 | 3,780 |
| ID | 13,455 | 21,492 | 21,513 | 21,551 | 21,514 | 21,551 | 21,500 | 21,513 |
| IL | 8,484 | 18,447 | 23,485 | 23,817 | 22,040 | 23,817 | 20,462 | 23,485 |
| IN | 3,980 | 13,285 | 22,384 | 22,384 | 19,654 | 22,384 | 16,924 | 22,384 |
| IA | 14,950 | 16,644 | 21,378 | 30,806 | 21,844 | 30,806 | 18,538 | 21,378 |
| KS | 5,263 | 11,271 | 22,486 | 50,905 | 24,805 | 50,905 | 15,757 | 22,486 |
| KY | 2,695 | 4,392 | 4,395 | 4,395 | 4,394 | 4,395 | 4,393 | 4,395 |
| LA | 3,110 | 2,503 | 2,503 | 2,503 | 2,503 | 2,503 | 2,503 | 2,503 |
| ME | 7,831 | 8,356 | 8,356 | 8,210 | 8,327 | 8,210 | 8,356 | 8,356 |
| MD | 2,555 | 2,446 | 2,446 | 2,446 | 2,446 | 2,446 | 2,446 | 2,446 |
| MA | 2,756 | 1,767 | 1,767 | 1,723 | 1,758 | 1,723 | 1,767 | 1,767 |
| MI | 5,000 | 11,340 | 11,864 | 12,077 | 11,749 | 12,077 | 11,550 | 11,864 |
| MN | 10,015 | 12,498 | 15,585 | 19,208 | 15,384 | 19,208 | 13,733 | 15,585 |

[12] It is typical for power sector models to group calendar years into a single run year to reduce model size. In the IPM runs that support the Alternative RE Approach, the relevant model run years are 2020 (2019 – 2022), 2025 (2023-2027), and 2030 (2029 – 2033). The 2024 and 2029 results presented above are taken from IPM projections for the 2025 and 2030 run years, respectively. For further detail on the use of model run years in IPM, please refer to http://www.epa.gov/powersectormodeling/.

| State | 2012 RE* | RE Alternate Methodology Target Generation (GWh) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2020 | 2024 | 2029 | Option 1 Interim | Option 1 Final | Option 2 Interim | Option 2 Final |
| MS | 1,509 | 2,506 | 2,506 | 2,506 | 2,506 | 2,506 | 2,506 | 2,506 |
| MO | 2,013 | 12,789 | 12,789 | 12,789 | 12,789 | 12,789 | 12,789 | 12,789 |
| MT | 12,545 | 16,516 | 17,285 | 21,489 | 17,895 | 21,489 | 16,824 | 17,285 |
| NE | 2,604 | 4,791 | 9,632 | 22,431 | 10,740 | 22,431 | 6,727 | 9,632 |
| NV | 5,409 | 6,087 | 6,092 | 6,297 | 6,132 | 6,297 | 6,089 | 6,092 |
| NH | 2,671 | 2,931 | 2,951 | 2,904 | 2,935 | 2,904 | 2,939 | 2,951 |
| NJ | 1,291 | 1,372 | 1,372 | 1,372 | 1,372 | 1,372 | 1,372 | 1,372 |
| NM | 2,797 | 4,735 | 7,058 | 16,664 | 8,282 | 16,664 | 5,664 | 7,058 |
| NY | 29,845 | 31,433 | 31,970 | 31,970 | 31,809 | 31,970 | 31,648 | 31,970 |
| NC | 6,432 | 6,211 | 6,211 | 6,211 | 6,211 | 6,211 | 6,211 | 6,211 |
| ND | 7,757 | 8,729 | 11,257 | 17,339 | 11,715 | 17,339 | 9,740 | 11,257 |
| OH | 2,153 | 10,372 | 15,200 | 15,200 | 13,752 | 15,200 | 12,303 | 15,200 |
| OK | 9,666 | 13,432 | 16,705 | 25,404 | 17,463 | 25,404 | 14,741 | 16,705 |
| OR | 46,617 | 47,512 | 47,606 | 47,606 | 47,578 | 47,606 | 47,550 | 47,606 |
| PA | 6,701 | 11,892 | 11,892 | 11,892 | 11,892 | 11,892 | 11,892 | 11,892 |
| RI | 106 | 441 | 441 | 441 | 441 | 441 | 441 | 441 |
| SC | 3,564 | 2,825 | 2,825 | 2,825 | 2,825 | 2,825 | 2,825 | 2,825 |
| SD | 8,896 | 9,394 | 13,154 | 25,137 | 14,423 | 25,137 | 10,898 | 13,154 |
| TN | 9,132 | 8,420 | 8,423 | 8,423 | 8,422 | 8,423 | 8,421 | 8,423 |
| TX | 34,601 | 39,527 | 51,965 | 79,022 | 53,645 | 79,022 | 44,502 | 51,965 |
| UT | 1,848 | 4,728 | 4,729 | 4,731 | 4,729 | 4,731 | 4,728 | 4,729 |
| VA | 3,402 | 6,731 | 6,731 | 6,541 | 6,693 | 6,541 | 6,731 | 6,731 |
| WA | 97,679 | 97,500 | 97,512 | 97,512 | 97,508 | 97,512 | 97,505 | 97,512 |
| WV | 2,728 | 5,705 | 5,705 | 5,705 | 5,705 | 5,705 | 5,705 | 5,705 |
| WI | 4,745 | 6,899 | 6,974 | 7,476 | 7,052 | 7,476 | 6,929 | 6,974 |
| WY | 5,263 | 8,570 | 8,570 | 8,695 | 8,595 | 8,695 | 8,570 | 8,570 |
| **Total** | **490,344** | **602,680** | **673,799** | **797,506** | **677,205** | **797,506** | **631,128** | **673,799** |

*Total electric power industry net generation for energy sources geothermal, hydroelectric conventional, other biomass, wood and wood derived fuels, solar thermal and photovoltaic, and wind.

Table 1.2. State-Level Target Generation Levels Under the Alternative RE Approach (Percent of 2012 Generation)

| State | 2012 RE* | RE Alternate Methodology Target Generation (% of 2012 Generation)[13,14] | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2020 | 2024 | 2029 | Option 1 Interim | Option 1 Final | Option 2 Interim | Option 2 Final |
| AL | 7% | 5% | 5% | 5% | 5% | 5% | 5% | 5% |
| AZ | 9% | 11% | 11% | 11% | 11% | 11% | 11% | 11% |
| AR | 6% | 10% | 10% | 10% | 10% | 10% | 10% | 10% |
| CA | 28% | 29% | 30% | 29% | 29% | 29% | 29% | 30% |
| CO | 15% | 31% | 33% | 36% | 33% | 36% | 32% | 33% |
| CT | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| DE | 2% | 1% | 1% | 1% | 1% | 1% | 1% | 1% |
| FL | 2% | 1% | 1% | 1% | 1% | 1% | 1% | 1% |
| GA | 5% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| ID | 87% | 139% | 139% | 139% | 139% | 139% | 139% | 139% |
| IL | 4% | 9% | 12% | 12% | 11% | 12% | 10% | 12% |
| IN | 3% | 12% | 20% | 20% | 17% | 20% | 15% | 20% |
| IA | 26% | 29% | 38% | 54% | 39% | 54% | 33% | 38% |
| KS | 12% | 25% | 51% | 115% | 56% | 115% | 35% | 51% |
| KY | 3% | 5% | 5% | 5% | 5% | 5% | 5% | 5% |
| LA | 3% | 2% | 2% | 2% | 2% | 2% | 2% | 2% |
| ME | 54% | 58% | 58% | 57% | 58% | 57% | 58% | 58% |
| MD | 7% | 6% | 6% | 6% | 6% | 6% | 6% | 6% |
| MA | 8% | 5% | 5% | 5% | 5% | 5% | 5% | 5% |
| MI | 5% | 10% | 11% | 11% | 11% | 11% | 11% | 11% |
| MN | 19% | 24% | 30% | 37% | 29% | 37% | 26% | 30% |
| MS | 3% | 5% | 5% | 5% | 5% | 5% | 5% | 5% |
| MO | 2% | 14% | 14% | 14% | 14% | 14% | 14% | 14% |
| MT | 45% | 59% | 62% | 77% | 64% | 77% | 61% | 62% |
| NE | 8% | 14% | 28% | 66% | 31% | 66% | 20% | 28% |
| NV | 15% | 17% | 17% | 18% | 17% | 18% | 17% | 17% |
| NH | 14% | 15% | 15% | 15% | 15% | 15% | 15% | 15% |
| NJ | 2% | 2% | 2% | 2% | 2% | 2% | 2% | 2% |
| NM | 12% | 21% | 31% | 73% | 36% | 73% | 25% | 31% |
| NY | 22% | 23% | 24% | 24% | 23% | 24% | 23% | 24% |
| NC | 6% | 5% | 5% | 5% | 5% | 5% | 5% | 5% |
| ND | 21% | 24% | 31% | 48% | 32% | 48% | 27% | 31% |
| OH | 2% | 8% | 12% | 12% | 11% | 12% | 9% | 12% |
| OK | 12% | 17% | 21% | 33% | 22% | 33% | 19% | 21% |

[13] This alternative approach may yield, at the individual state level, increases in RE generation that exceed the amount of generation reported in that state in 2012. EPA has invited comment on this topic in the preamble, focusing on whether this approach should be modified such that the difference between the RE target and the state's 2012 level of corresponding RE generation does not exceed the amount of fossil fuel-fired generation reported for that state in 2012.

[14] Values greater than 100% are possible, as these percentages represent increased deployment of future RE generation (which may exceed a state's historic generation) divided by 2012 total in-state generation.

| State | 2012 RE* | **RE Alternate Methodology Target Generation (% of 2012 Generation)[13,14]** | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2020 | 2024 | 2029 | Option 1 Interim | Option 1 Final | Option 2 Interim | Option 2 Final |
| OR | 77% | 78% | 78% | 78% | 78% | 78% | 78% | 78% |
| PA | 3% | 5% | 5% | 5% | 5% | 5% | 5% | 5% |
| RI | 1% | 5% | 5% | 5% | 5% | 5% | 5% | 5% |
| SC | 4% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| SD | 74% | 78% | 109% | 209% | 120% | 209% | 91% | 109% |
| TN | 12% | 11% | 11% | 11% | 11% | 11% | 11% | 11% |
| TX | 8% | 9% | 12% | 18% | 12% | 18% | 10% | 12% |
| UT | 5% | 13% | 13% | 13% | 13% | 13% | 13% | 13% |
| VA | 5% | 10% | 10% | 9% | 9% | 9% | 10% | 10% |
| WA | 84% | 83% | 83% | 83% | 83% | 83% | 83% | 83% |
| WV | 4% | 8% | 8% | 8% | 8% | 8% | 8% | 8% |
| WI | 7% | 11% | 11% | 12% | 11% | 12% | 11% | 11% |
| WY | 11% | 17% | 17% | 18% | 17% | 18% | 17% | 17% |
| **Total** | **12%** | **15%** | **17%** | **20%** | **17%** | **20%** | **16%** | **17%** |

*Total electric power industry net generation for energy sources geothermal, hydroelectric conventional, other biomass, wood and wood derived fuels, solar thermal and photovoltaic, and wind.

Table 1.3. State-Level Target Generation Levels under the Alternative RE Approach, Excluding Existing Hydropower (Gigawatt-hours)

| State | 2012 RE* | **RE Alternate Methodology Target Generation, Excluding Existing Hydropower (GWh)** | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2020 | 2024 | 2029 | Option 1 Interim | Option 1 Final | Option 2 Interim | Option 2 Final |
| AL | 2,777 | 682 | 682 | 682 | 682 | 682 | 682 | 682 |
| AZ | 1,698 | 3,317 | 3,317 | 3,318 | 3,317 | 3,318 | 3,317 | 3,317 |
| AR | 1,660 | 4,047 | 4,049 | 4,057 | 4,050 | 4,057 | 4,048 | 4,049 |
| CA | 29,967 | 30,938 | 32,189 | 30,983 | 31,573 | 30,983 | 31,439 | 32,189 |
| CO | 6,192 | 15,002 | 15,618 | 17,639 | 15,838 | 17,639 | 15,249 | 15,618 |
| CT | 667 | 637 | 637 | 637 | 637 | 637 | 637 | 637 |
| DE | 131 | 111 | 111 | 111 | 111 | 111 | 111 | 111 |
| FL | 4,524 | 2,549 | 2,550 | 2,540 | 2,548 | 2,540 | 2,549 | 2,550 |
| GA | 3,279 | 1,522 | 1,544 | 1,547 | 1,538 | 1,547 | 1,531 | 1,544 |
| ID | 2,515 | 10,552 | 10,572 | 10,611 | 10,574 | 10,611 | 10,560 | 10,572 |
| IL | 8,373 | 18,335 | 23,374 | 23,706 | 21,929 | 23,706 | 20,351 | 23,374 |
| IN | 3,546 | 12,851 | 21,951 | 21,951 | 19,221 | 21,951 | 16,491 | 21,951 |
| IA | 14,183 | 15,878 | 20,612 | 30,040 | 21,077 | 30,040 | 17,772 | 20,612 |
| KS | 5,253 | 11,261 | 22,475 | 50,895 | 24,795 | 50,895 | 15,747 | 22,475 |
| KY | 333 | 2,030 | 2,033 | 2,033 | 2,032 | 2,033 | 2,031 | 2,033 |
| LA | 2,430 | 1,823 | 1,823 | 1,823 | 1,823 | 1,823 | 1,823 | 1,823 |
| ME | 4,099 | 4,624 | 4,624 | 4,477 | 4,594 | 4,477 | 4,624 | 4,624 |

| State | 2012 RE* | RE Alternate Methodology Target Generation, Excluding Existing Hydropower (GWh) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2020 | 2024 | 2029 | Option 1 Interim | Option 1 Final | Option 2 Interim | Option 2 Final |
| MD | 898 | 790 | 790 | 790 | 790 | 790 | 790 | 790 |
| MA | 1,843 | 855 | 855 | 810 | 846 | 810 | 855 | 855 |
| MI | 3,785 | 10,126 | 10,649 | 10,862 | 10,535 | 10,862 | 10,335 | 10,649 |
| MN | 9,454 | 11,937 | 15,024 | 18,647 | 14,823 | 18,647 | 13,172 | 15,024 |
| MS | 1,509 | 2,506 | 2,506 | 2,506 | 2,506 | 2,506 | 2,506 | 2,506 |
| MO | 1,299 | 12,075 | 12,075 | 12,075 | 12,075 | 12,075 | 12,075 | 12,075 |
| MT | 1,262 | 5,233 | 6,001 | 10,206 | 6,612 | 10,206 | 5,540 | 6,001 |
| NE | 1,347 | 3,534 | 8,375 | 21,174 | 9,482 | 21,174 | 5,470 | 8,375 |
| NV | 2,969 | 3,646 | 3,652 | 3,856 | 3,691 | 3,856 | 3,649 | 3,652 |
| NH | 1,381 | 1,641 | 1,661 | 1,615 | 1,646 | 1,615 | 1,649 | 1,661 |
| NJ | 1,281 | 1,361 | 1,361 | 1,361 | 1,361 | 1,361 | 1,361 | 1,361 |
| NM | 2,574 | 4,512 | 6,835 | 16,441 | 8,059 | 16,441 | 5,441 | 6,835 |
| NY | 5,192 | 6,781 | 7,317 | 7,317 | 7,156 | 7,317 | 6,995 | 7,317 |
| NC | 2,704 | 2,483 | 2,483 | 2,483 | 2,483 | 2,483 | 2,483 | 2,483 |
| ND | 5,280 | 6,251 | 8,779 | 14,862 | 9,237 | 14,862 | 7,263 | 8,779 |
| OH | 1,739 | 9,958 | 14,786 | 14,786 | 13,338 | 14,786 | 11,889 | 14,786 |
| OK | 8,521 | 12,287 | 15,560 | 24,259 | 16,317 | 24,259 | 13,596 | 15,560 |
| OR | 7,207 | 8,102 | 8,196 | 8,196 | 8,168 | 8,196 | 8,139 | 8,196 |
| PA | 4,459 | 9,650 | 9,650 | 9,650 | 9,650 | 9,650 | 9,650 | 9,650 |
| RI | 102 | 437 | 437 | 437 | 437 | 437 | 437 | 437 |
| SC | 2,143 | 1,405 | 1,405 | 1,405 | 1,405 | 1,405 | 1,405 | 1,405 |
| SD | 2,915 | 3,413 | 7,173 | 19,156 | 8,442 | 19,156 | 4,917 | 7,173 |
| TN | 836 | 124 | 128 | 128 | 127 | 128 | 126 | 128 |
| TX | 34,017 | 38,942 | 51,380 | 78,438 | 53,060 | 78,438 | 43,917 | 51,380 |
| UT | 1,100 | 3,980 | 3,981 | 3,983 | 3,981 | 3,983 | 3,981 | 3,981 |
| VA | 2,358 | 5,687 | 5,687 | 5,497 | 5,649 | 5,497 | 5,687 | 5,687 |
| WA | 8,214 | 8,036 | 8,047 | 8,047 | 8,044 | 8,047 | 8,040 | 8,047 |
| WV | 1,297 | 4,274 | 4,274 | 4,274 | 4,274 | 4,274 | 4,274 | 4,274 |
| WI | 3,223 | 5,377 | 5,452 | 5,954 | 5,530 | 5,954 | 5,407 | 5,452 |
| WY | 4,369 | 7,677 | 7,677 | 7,801 | 7,702 | 7,801 | 7,677 | 7,677 |
| **Total** | 216,903 | 329,238 | 400,358 | 524,065 | 403,763 | 524,065 | 357,686 | 400,358 |

*Total electric power industry net generation for energy sources geothermal, other biomass, wood and wood derived fuels, solar thermal and photovoltaic, and wind.

Table 1.4. State-Level Target Generation Levels under the Alternative RE Approach, Excluding Existing Hydropower (Percent of 2012 Generation)

| State | 2012 RE* | Target Generation, Excluding Existing Hydropower (% of 2012 Generation) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2020 | 2024 | 2029 | Option 1 Interim | Option 1 Final | Option 2 Interim | Option 2 Final |
| AL | 2% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| AZ | 2% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| AR | 3% | 6% | 6% | 6% | 6% | 6% | 6% | 6% |
| CA | 15% | 16% | 16% | 16% | 16% | 16% | 16% | 16% |
| CO | 12% | 29% | 30% | 34% | 30% | 34% | 29% | 30% |
| CT | 2% | 2% | 2% | 2% | 2% | 2% | 2% | 2% |
| DE | 2% | 1% | 1% | 1% | 1% | 1% | 1% | 1% |
| FL | 2% | 1% | 1% | 1% | 1% | 1% | 1% | 1% |
| GA | 3% | 1% | 1% | 1% | 1% | 1% | 1% | 1% |
| ID | 16% | 68% | 68% | 68% | 68% | 68% | 68% | 68% |
| IL | 4% | 9% | 12% | 12% | 11% | 12% | 10% | 12% |
| IN | 3% | 11% | 19% | 19% | 17% | 19% | 14% | 19% |
| IA | 25% | 28% | 36% | 53% | 37% | 53% | 31% | 36% |
| KS | 12% | 25% | 51% | 115% | 56% | 115% | 35% | 51% |
| KY | 0% | 2% | 2% | 2% | 2% | 2% | 2% | 2% |
| LA | 2% | 2% | 2% | 2% | 2% | 2% | 2% | 2% |
| ME | 28% | 32% | 32% | 31% | 32% | 31% | 32% | 32% |
| MD | 2% | 2% | 2% | 2% | 2% | 2% | 2% | 2% |
| MA | 5% | 2% | 2% | 2% | 2% | 2% | 2% | 2% |
| MI | 3% | 9% | 10% | 10% | 10% | 10% | 10% | 10% |
| MN | 18% | 23% | 29% | 36% | 28% | 36% | 25% | 29% |
| MS | 3% | 5% | 5% | 5% | 5% | 5% | 5% | 5% |
| MO | 1% | 13% | 13% | 13% | 13% | 13% | 13% | 13% |
| MT | 5% | 19% | 22% | 37% | 24% | 37% | 20% | 22% |
| NE | 4% | 10% | 24% | 62% | 28% | 62% | 16% | 24% |
| NV | 8% | 10% | 10% | 11% | 10% | 11% | 10% | 10% |
| NH | 7% | 9% | 9% | 8% | 9% | 8% | 9% | 9% |
| NJ | 2% | 2% | 2% | 2% | 2% | 2% | 2% | 2% |
| NM | 11% | 20% | 30% | 72% | 35% | 72% | 24% | 30% |
| NY | 4% | 5% | 5% | 5% | 5% | 5% | 5% | 5% |
| NC | 2% | 2% | 2% | 2% | 2% | 2% | 2% | 2% |
| ND | 15% | 17% | 24% | 41% | 26% | 41% | 20% | 24% |
| OH | 1% | 8% | 11% | 11% | 10% | 11% | 9% | 11% |
| OK | 11% | 16% | 20% | 31% | 21% | 31% | 17% | 20% |
| OR | 12% | 13% | 13% | 13% | 13% | 13% | 13% | 13% |
| PA | 2% | 4% | 4% | 4% | 4% | 4% | 4% | 4% |
| RI | 1% | 5% | 5% | 5% | 5% | 5% | 5% | 5% |
| SC | 2% | 1% | 1% | 1% | 1% | 1% | 1% | 1% |
| SD | 24% | 28% | 60% | 159% | 70% | 159% | 41% | 60% |
| TN | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| TX | 8% | 9% | 12% | 18% | 12% | 18% | 10% | 12% |

| State | 2012 RE* | Target Generation, Excluding Existing Hydropower (% of 2012 Generation) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2020 | 2024 | 2029 | Option 1 Interim | Option 1 Final | Option 2 Interim | Option 2 Final |
| UT | 3% | 11% | 11% | 11% | 11% | 11% | 11% | 11% |
| VA | 3% | 8% | 8% | 8% | 8% | 8% | 8% | 8% |
| WA | 7% | 7% | 7% | 7% | 7% | 7% | 7% | 7% |
| WV | 2% | 6% | 6% | 6% | 6% | 6% | 6% | 6% |
| WI | 5% | 8% | 9% | 9% | 9% | 9% | 8% | 9% |
| WY | 9% | 15% | 15% | 16% | 16% | 16% | 15% | 15% |
| **Total** | **5%** | **8%** | **10%** | **13%** | **10%** | **13%** | **9%** | **10%** |

*Total electric power industry net generation for energy sources geothermal, hydroelectric conventional, other biomass, wood and wood derived fuels, solar thermal and photovoltaic, and wind.

Table 1.5. Alaska and Hawaii Target Generation Levels under the Alternative RE Approach

| State | 2012 RE | RE Target Generation (GWh) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2020 | 2025 | 2030 | Option 1 Interim | Option 1 Final | Option 2 Interim | Option 2 Final |
| Alaska | 1,615 | 1,637 | 1,681 | 1,738 | 1,680 | 1,738 | 1,652 | 1,670 |
| Hawaii | 1,039 | 1,368 | 1,948 | 2,600 | 1,922 | 2,600 | 1,582 | 1,814 |
| **RE Target Generation (% of 2012 Generation)** | | | | | | | | |
| Alaska | 23% | 24% | 24% | 25% | 24% | 25% | 24% | 24% |
| Hawaii | 10% | 13% | 19% | 25% | 18% | 25% | 15% | 17% |

Table 1.6. Alaska and Hawaii Target Generation Levels under the Alternative RE Approach, Excluding Existing Hydropower

| State | 2012 RE | RE Target Generation (GWh) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2020 | 2024 | 2029 | Option 1 Interim | Option 1 Final | Option 2 Interim | Option 2 Final |
| Alaska | 40 | 62 | 106 | 163 | 105 | 163 | 77 | 95 |
| Hawaii | 925 | 1,254 | 1,833 | 2,303 | 1,807 | 2,485 | 1,468 | 1,699 |
| **RE Target Generation (% of 2012 Generation)** | | | | | | | | |
| Alaska | 1% | 1% | 2% | 2% | 2% | 2% | 1% | 1% |
| Hawaii | 9% | 12% | 18% | 22% | 17% | 24% | 14% | 16% |

## Appendix

Table 1.7. IPM-Projected RE Power Sector Generation from $30/MWh Reduced Cost Run, 2020 (Gigawatt-hours)

| State | IPM-Projected RE Power Sector Generation from $30/MWh Reduced Cost Run, 2020 (GWh) | | | | | |
|---|---|---|---|---|---|---|
| | Solar | Wind | Biomass (Existing)* | Geothermal | Hydropower | **Total** |
| AL | - | - | 304 | - | 7,814 | 8,117 |
| AR | - | 0 | 152 | - | 3,815 | 3,967 |
| AZ | 2,217 | 456 | 240 | - | 7,221 | 10,135 |
| CA | 8,124 | 15,147 | 2,883 | 25,178 | 31,102 | 82,433 |
| CO | 283 | 8,361 | 67 | - | 1,891 | 10,601 |
| CT | - | 17 | 22 | - | 475 | 514 |
| DE | 48 | 24 | 52 | - | - | 125 |
| FL | 276 | - | 1,741 | - | 186 | 2,203 |
| GA | 7 | - | 1,016 | - | 2,736 | 3,759 |
| IA | - | 13,716 | 110 | - | 925 | 14,751 |
| ID | 19 | 2,438 | 207 | 70 | 10,318 | 13,053 |
| IL | 50 | 12,271 | 1,243 | - | 141 | 13,705 |
| IN | 36 | 10,510 | 344 | - | 422 | 11,313 |
| KS | - | 8,719 | 44 | - | 35 | 8,799 |
| KY | 4 | - | 133 | - | 3,269 | 3,405 |
| LA | - | - | 79 | - | 1,056 | 1,135 |
| MA | 58 | 1,673 | 285 | - | 1,068 | 3,084 |
| MD | 1,205 | 2,779 | 120 | - | 1,946 | 6,049 |
| ME | - | 5,921 | 1,844 | - | 3,846 | 11,611 |
| MI | 2 | 8,211 | 1,820 | - | 1,308 | 11,340 |
| MN | 1,132 | 9,573 | 737 | - | 699 | 12,141 |
| MO | 500 | 4,939 | 188 | - | 1,558 | 7,186 |
| MS | - | - | 295 | - | - | 295 |
| MT | - | 1,911 | 58 | - | 10,192 | 12,161 |
| NC | 2,845 | 1,343 | 1,430 | - | 4,226 | 9,843 |
| ND | 0 | 6,251 | - | 145 | 1,731 | 8,128 |
| NE | - | 1,598 | 50 | - | 570 | 2,218 |
| NH | 47 | 2,349 | 669 | - | 1,526 | 4,592 |
| NJ | 611 | 418 | 489 | - | 27 | 1,546 |
| NM | 439 | 2,470 | - | 835 | 264 | 4,008 |
| NV | 809 | 408 | 82 | 3,369 | 2,116 | 6,785 |
| NY | 143 | 3,835 | 1,607 | - | 25,858 | 31,443 |
| OH | 54 | 6,838 | 434 | - | 427 | 7,754 |
| OK | - | 10,416 | - | - | 2,949 | 13,365 |
| OR | 4 | 10,943 | 1,103 | 2,000 | 34,676 | 48,726 |
| PA | 102 | 7,717 | 1,342 | - | 2,822 | 11,983 |

| State | IPM-Projected RE Power Sector Generation from $30/MWh Reduced Cost Run, 2020 (GWh) | | | | | |
|---|---|---|---|---|---|---|
| | Solar | Wind | Biomass (Existing)* | Geothermal | Hydropower | **Total** |
| RI | - | 102 | 370 | - | 9 | 481 |
| SC | 889 | 384 | 657 | - | 1,788 | 3,718 |
| SD | - | 3,413 | - | - | 4,506 | 7,919 |
| TN | 23 | 66 | 35 | - | 7,702 | 7,827 |
| TX | 217 | 34,552 | 1,752 | - | 1,148 | 37,669 |
| UT | 8 | 671 | 56 | 1,012 | 794 | 2,541 |
| VA | 0 | 3,795 | 2,660 | - | 1,366 | 7,821 |
| WA | 0 | 7,107 | 1,436 | - | 78,087 | 86,630 |
| WI | - | 3,444 | 1,168 | - | 1,683 | 6,295 |
| WV | - | 1,680 | 11 | - | 1,520 | 3,211 |
| WY | - | 4,125 | - | - | 965 | 5,090 |

*Dedicated biomass and landfill gas facilities.

Table 1.8. IPM-Projected RE Power Sector Generation from $30/MWh Reduced Cost Run, 2025 (Gigawatt-hours)

| State | IPM-Projected RE Power Sector Generation from $30/MWh Reduced Cost Run, 2025 (GWh) | | | | | |
|---|---|---|---|---|---|---|
| | Solar | Wind | Biomass (Existing)* | Geothermal | Hydropower | **Total** |
| AL | - | - | 304 | - | 7,814 | 8,117 |
| AR | - | 2 | 152 | - | 3,815 | 3,968 |
| AZ | 2,217 | 456 | 240 | - | 7,221 | 10,135 |
| CA | 9,033 | 19,049 | 4,134 | 30,566 | 31,102 | 93,884 |
| CO | 283 | 8,977 | 67 | - | 1,891 | 11,217 |
| CT | - | 17 | 22 | - | 475 | 514 |
| DE | 48 | 24 | 52 | - | - | 125 |
| FL | 276 | - | 1,742 | - | 186 | 2,204 |
| GA | 7 | 3 | 1,034 | - | 2,736 | 3,780 |
| IA | - | 18,450 | 110 | - | 925 | 19,485 |
| ID | 19 | 2,443 | 222 | 70 | 10,318 | 13,073 |
| IL | 50 | 17,309 | 1,243 | - | 141 | 18,743 |
| IN | 36 | 19,610 | 344 | - | 422 | 20,412 |
| KS | - | 19,934 | 44 | - | 35 | 20,013 |
| KY | 4 | 3 | 133 | - | 3,269 | 3,409 |
| LA | - | - | 79 | - | 1,056 | 1,135 |
| MA | 58 | 1,673 | 285 | - | 1,068 | 3,084 |
| MD | 1,205 | 2,779 | 120 | - | 1,946 | 6,049 |
| ME | - | 7,080 | 1,844 | - | 3,846 | 12,770 |
| MI | 2 | 8,720 | 1,834 | - | 1,308 | 11,864 |
| MN | 1,169 | 12,705 | 691 | - | 699 | 15,265 |

| State | IPM-Projected RE Power Sector Generation from $30/MWh Reduced Cost Run, 2025 (GWh) | | | | | |
|---|---|---|---|---|---|---|
| | Solar | Wind | Biomass (Existing)* | Geothermal | Hydropower | **Total** |
| MO | 755 | 4,939 | 188 | - | 1,558 | 7,441 |
| MS | - | - | 295 | - | - | 295 |
| MT | - | 2,680 | 58 | - | 10,192 | 12,930 |
| NC | 5,109 | 1,373 | 1,430 | - | 4,226 | 12,137 |
| ND | 0 | 8,779 | - | 145 | 1,731 | 10,656 |
| NE | - | 6,439 | 50 | - | 570 | 7,059 |
| NH | 47 | 2,349 | 689 | - | 1,526 | 4,612 |
| NJ | 611 | 418 | 489 | - | 27 | 1,546 |
| NM | 451 | 4,782 | - | 1,482 | 264 | 6,979 |
| NV | 814 | 409 | 82 | 4,581 | 2,116 | 8,002 |
| NY | 143 | 4,371 | 1,607 | - | 25,858 | 31,979 |
| OH | 54 | 12,817 | 437 | - | 427 | 13,736 |
| OK | - | 13,689 | - | - | 2,949 | 16,638 |
| OR | 4 | 10,962 | 1,197 | 2,000 | 34,676 | 48,839 |
| PA | 102 | 7,717 | 1,342 | - | 2,822 | 11,983 |
| RI | - | 102 | 370 | - | 9 | 481 |
| SC | 889 | 384 | 657 | - | 1,788 | 3,718 |
| SD | - | 7,173 | - | - | 4,506 | 11,679 |
| TN | 23 | 73 | 35 | - | 7,702 | 7,833 |
| TX | 217 | 47,053 | 1,688 | - | 1,148 | 50,107 |
| UT | 8 | 672 | 56 | 1,583 | 794 | 3,113 |
| VA | 0 | 3,795 | 2,660 | - | 1,366 | 7,821 |
| WA | 0 | 7,119 | 1,447 | - | 78,087 | 86,654 |
| WI | - | 3,583 | 1,104 | - | 1,683 | 6,370 |
| WV | - | 1,680 | 11 | - | 1,520 | 3,211 |
| WY | - | 4,125 | - | - | 965 | 5,090 |

*Dedicated biomass and landfill gas facilities.

Table 1.9. IPM-Projected RE Power Sector Generation from $30/MWh Reduced Cost Run, 2030 (Gigawatt-hours)

| State | IPM-Projected RE Power Sector Generation from $30/MWh Reduced Cost Run, 2030 (GWh) | | | | | |
|---|---|---|---|---|---|---|
| | Solar | Wind | Biomass (Existing)* | Geothermal | Hydropower | **Total** |
| AL | - | - | 304 | - | 7,814 | 8,117 |
| AR | - | 10 | 152 | - | 3,815 | 3,976 |
| AZ | 2,217 | 457 | 240 | - | 7,221 | 10,136 |
| CA | 10,608 | 37,296 | 2,928 | 31,619 | 31,102 | 113,553 |

| State | IPM-Projected RE Power Sector Generation from $30/MWh Reduced Cost Run, 2030 (GWh) | | | | | |
|---|---|---|---|---|---|---|
| | Solar | Wind | Biomass (Existing)* | Geothermal | Hydropower | **Total** |
| CO | 283 | 10,997 | 67 | - | 1,891 | 13,237 |
| CT | - | 17 | 22 | - | 475 | 514 |
| DE | 48 | 24 | 52 | - | - | 125 |
| FL | 276 | - | 1,732 | - | 186 | 2,194 |
| GA | 7 | 6 | 1,034 | - | 2,736 | 3,783 |
| IA | - | 27,878 | 110 | - | 925 | 28,913 |
| ID | 19 | 2,482 | 222 | 70 | 10,318 | 13,112 |
| IL | 50 | 17,641 | 1,243 | - | 141 | 19,075 |
| IN | 36 | 19,610 | 344 | - | 422 | 20,412 |
| KS | - | 48,353 | 44 | - | 35 | 48,432 |
| KY | 4 | 3 | 133 | - | 3,269 | 3,409 |
| LA | - | - | 79 | - | 1,056 | 1,135 |
| MA | 58 | 1,673 | 241 | - | 1,068 | 3,040 |
| MD | 1,205 | 2,779 | 120 | - | 1,946 | 6,049 |
| ME | - | 7,437 | 1,697 | - | 3,846 | 12,980 |
| MI | 2 | 9,137 | 1,630 | - | 1,308 | 12,077 |
| MN | 1,203 | 16,480 | 540 | - | 699 | 18,922 |
| MO | 814 | 4,939 | 188 | - | 1,558 | 7,500 |
| MS | - | - | 295 | - | - | 295 |
| MT | - | 6,884 | 58 | - | 10,192 | 17,134 |
| NC | 7,107 | 1,398 | 1,430 | - | 4,226 | 14,161 |
| ND | 0 | 14,862 | - | 145 | 1,731 | 16,738 |
| NE | - | 19,239 | 50 | - | 570 | 19,859 |
| NH | 48 | 2,349 | 643 | - | 1,526 | 4,566 |
| NJ | 611 | 418 | 489 | - | 27 | 1,546 |
| NM | 478 | 14,360 | - | 1,482 | 264 | 16,584 |
| NV | 1,015 | 412 | 82 | 5,740 | 2,116 | 9,365 |
| NY | 143 | 4,371 | 1,607 | - | 25,858 | 31,979 |
| OH | 54 | 14,327 | 437 | - | 427 | 15,246 |
| OK | - | 22,388 | - | - | 2,949 | 25,337 |
| OR | 4 | 11,071 | 1,197 | 2,000 | 34,676 | 48,948 |
| PA | 102 | 7,717 | 1,342 | - | 2,822 | 11,983 |
| RI | - | 102 | 370 | - | 9 | 481 |
| SC | 889 | 384 | 657 | - | 1,788 | 3,718 |
| SD | - | 19,156 | - | - | 4,506 | 23,662 |
| TN | 23 | 75 | 35 | - | 7,702 | 7,836 |
| TX | 217 | 74,034 | 1,765 | - | 1,148 | 77,164 |
| UT | 8 | 674 | 56 | 1,583 | 794 | 3,115 |
| VA | 0 | 3,795 | 2,470 | - | 1,366 | 7,631 |
| WA | 0 | 7,273 | 1,447 | - | 78,087 | 86,808 |
| WI | - | 3,977 | 1,212 | - | 1,683 | 6,872 |
| WV | - | 1,680 | 11 | - | 1,520 | 3,211 |
| WY | - | 4,250 | - | - | 965 | 5,214 |

*Dedicated biomass and landfill gas facilities.

Table 1.10. NREL Renewable Energy Technical Potential by Selected Technology Type (Gigawatt-hours)[15]

| State | NREL Renewable Energy Technical Potential by Selected Technology Type (GWh) | | | |
|---|---|---|---|---|
| | Utility-Scale Solar (PV and CSP) | Onshore Wind | Geothermal (Hydrothermal) | Hydropower |
| AL | 3,742,689 | 283 | - | 4,103 |
| AZ | 24,533,333 | 26,036 | 8,330 | 1,303 |
| AR | 5,015,349 | 22,892 | - | 6,093 |
| CA | 17,592,841 | 89,862 | 130,921 | 30,024 |
| CO | 19,436,079 | 1,096,036 | 8,954 | 7,789 |
| CT | 27,344 | 62 | - | 922 |
| DE | 287,189 | 22 | - | 31 |
| FL | 5,210,493 | 1 | - | 682 |
| GA | 5,535,350 | 323 | - | 1,988 |
| ID | 7,462,920 | 44,320 | 17,205 | 18,758 |
| IL | 8,194,537 | 649,468 | - | 4,883 |
| IN | 4,975,001 | 377,604 | - | 2,394 |
| IA | 7,021,251 | 1,723,588 | - | 2,818 |
| KS | 22,506,111 | 3,101,576 | - | 2,508 |
| KY | 1,850,491 | 147 | - | 4,255 |
| LA | 4,170,275 | 935 | - | 2,423 |
| ME | 1,103,543 | 28,743 | - | 3,916 |
| MD | 614,500 | 3,632 | - | 814 |
| MA | 99,674 | 2,827 | - | 1,197 |
| MI | 5,266,485 | 143,908 | - | 1,181 |
| MN | 10,826,184 | 1,428,525 | - | 1,255 |
| MS | 5,007,619 | - | - | 2,211 |
| MO | 5,365,818 | 689,519 | - | 7,198 |
| MT | 9,739,000 | 2,746,272 | 6,548 | 14,547 |
| NE | 14,126,640 | 3,011,253 | - | 3,142 |
| NV | 16,935,101 | 17,709 | 45,321 | 846 |
| NH | 61,154 | 5,706 | - | 1,741 |
| NJ | 484,081 | 317 | - | 549 |
| NM | 33,202,248 | 1,399,157 | 12,933 | 1,363 |
| NY | 1,545,369 | 63,566 | - | 6,711 |
| NC | 4,301,136 | 2,037 | - | 3,037 |
| ND | 9,775,369 | 2,537,825 | - | 347 |
| OH | 3,712,677 | 129,143 | - | 3,046 |
| OK | 14,459,998 | 1,521,652 | - | 3,016 |

[15] Please refer to data file at http://www.nrel.gov/gis/re_potential.html.

| State | NREL Renewable Energy Technical Potential by Selected Technology Type (GWh) | | | |
|---|---|---|---|---|
| | Utility-Scale Solar (PV and CSP) | Onshore Wind | Geothermal (Hydrothermal) | Hydropower |
| OR | 6,578,388 | 68,767 | 18,200 | 18,184 |
| PA | 609,518 | 8,231 | - | 8,368 |
| RI | 15,424 | 130 | - | 59 |
| SC | 2,788,808 | 428 | - | 1,889 |
| SD | 11,643,106 | 2,901,858 | - | 1,047 |
| TN | 2,276,233 | 766 | - | 5,745 |
| TX | 62,075,015 | 5,552,400 | - | 3,006 |
| UT | 10,282,917 | 31,552 | 12,982 | 3,528 |
| VA | 1,909,919 | 4,589 | - | 3,657 |
| WA | 1,933,554 | 47,250 | 2,547 | 27,249 |
| WV | 55,718 | 4,952 | - | 4,408 |
| WI | 5,097,198 | 255,266 | - | 2,287 |
| WY | 11,140,864 | 1,653,857 | 1,373 | 4,445 |
| Total | 390,594,517 | 31,394,989 | 265,313 | 230,965 |

Table 1.11. EIA 2012 Net Generation by RE Capacity Type (Gigawatt-hours)[16]

| State | EIA 2012 Net Generation by RE Capacity Type (GWh) | | | |
|---|---|---|---|---|
| | Solar Thermal and Photovoltaic | Wind | Geothermal | Hydroelectric Conventional |
| AL | - | - | - | 7,435 |
| AZ | 955 | 532 | - | 6,717 |
| AR | - | - | - | 2,198 |
| CA | 1,382 | 9,754 | 12,519 | 26,837 |
| CO | 165 | 5,969 | - | 1,497 |
| CT | - | - | - | 312 |
| DE | 23 | 4 | - | - |
| FL | 194 | - | - | 151 |
| GA | 3 | - | - | 2,236 |
| ID | - | 1,891 | 75 | 10,940 |
| IL | 31 | 7,727 | - | 111 |
| IN | 0 | 3,210 | - | 434 |
| IA | - | 14,032 | - | 766 |
| KS | - | 5,195 | - | 10 |
| KY | - | - | - | 2,362 |

[16] Please refer to data file at http://www.eia.gov/electricity/data/state/.

| State | EIA 2012 Net Generation by RE Capacity Type (GWh) | | | |
|---|---|---|---|---|
| | Solar Thermal and Photovoltaic | Wind | Geothermal | Hydroelectric Conventional |
| LA | - | - | - | 680 |
| ME | - | 887 | - | 3,733 |
| MD | 22 | 322 | - | 1,657 |
| MA | 30 | 90 | - | 912 |
| MI | - | 1,132 | - | 1,215 |
| MN | - | 7,615 | - | 561 |
| MS | - | - | - | - |
| MO | - | 1,245 | - | 714 |
| MT | - | 1,262 | - | 11,283 |
| NE | - | 1,284 | - | 1,257 |
| NV | 473 | 129 | 2,347 | 2,440 |
| NH | - | 209 | - | 1,289 |
| NJ | 304 | 12 | - | 11 |
| NM | 334 | 2,226 | - | 223 |
| NY | 53 | 2,992 | - | 24,652 |
| NC | 139 | - | - | 3,728 |
| ND | - | 5,275 | - | 2,477 |
| OH | 37 | 985 | - | 414 |
| OK | - | 8,158 | - | 1,146 |
| OR | 6 | 6,343 | 26 | 39,410 |
| PA | 32 | 2,129 | - | 2,242 |
| RI | - | 1 | - | 4 |
| SC | - | - | - | 1,420 |
| SD | - | 2,915 | - | 5,981 |
| TN | 12 | 47 | - | 8,296 |
| TX | 118 | 32,214 | - | 584 |
| UT | 2 | 704 | 335 | 748 |
| VA | - | - | - | 1,044 |
| WA | 1 | 6,600 | - | 89,464 |
| WV | - | 1,286 | - | 1,431 |
| WI | - | 1,558 | - | 1,522 |
| WY | - | 4,369 | - | 893 |