

New York State Energy Research and Development Authority

Energy Efficiency and Renewable Energy Potential Study of New York State

Volume 5: Renewable Energy Technical Appendices

Final Report

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Report Number 14-19



NYSERDA's Promise to New Yorkers:

NYSERDA provides resources, expertise, and objective information so New Yorkers can make confident, informed energy decisions.

Mission Statement:

Advance innovative energy solutions in ways that improve New York's economy and environment.

Vision Statement:

Serve as a catalyst—advancing energy innovation and technology, transforming New York's economy, empowering people to choose clean and efficient energy as part of their everyday lives.

Core Values:

Objectivity, integrity, public service, partnership, and innovation.

Portfolios

NYSERDA programs are organized into five portfolios, each representing a complementary group of offerings with common areas of energy-related focus and objectives.

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Helping New York State to achieve its aggressive energy efficiency and renewable energy goals – including programs to motivate increased efficiency in energy consumption by consumers (residential, commercial, municipal, institutional, industrial, and transportation), to increase production by renewable power suppliers, to support market transformation, and to provide financing.

Energy Technology Innovation and Business Development

Helping to stimulate a vibrant innovation ecosystem and a clean-energy economy in New York State – including programs to support product research, development, and demonstrations; clean-energy business development; and the knowledge-based community at the Saratoga Technology + Energy Park® (STEP®).

Energy Education and Workforce Development

Helping to build a generation of New Yorkers ready to lead and work in a clean energy economy – including consumer behavior, youth education, workforce development, and training programs for existing and emerging technologies.

Energy and the Environment

Helping to assess and mitigate the environmental impacts of energy production and use in New York State – including environmental research and development, regional initiatives to improve environmental sustainability, and West Valley Site Management.

Energy Data, Planning, and Policy

Helping to ensure that New York State policymakers and consumers have objective and reliable information to make informed energy decisions – including State Energy Planning, policy analysis to support the Regional Greenhouse Gas Initiative and other energy initiatives, emergency preparedness, and a range of energy data reporting.

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Volume 5: Renewable Energy Technical Appendices

Final Report

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Abstract

This study presents the potential for increased adoption of energy efficiency and renewable energy technologies in New York State. It focuses on the long-term potential using a twenty-year study period, 2013–2032. Efficiency potential results are presented in terms of “achievable potential” and “economic potential” (the cost-effective energy savings). The report presents these results statewide as well as separately for each of four regional zones (Long Island, New York City, Hudson Valley, and Upstate). The efficiency portion of the study includes electricity, natural gas, and petroleum fuels in the building and industrial sectors, but excludes transportation energy use. For renewable energy, the study analyzes the economic potential and the “bounded technical potential,” a measurement of what theoretically would be possible if cost were not a factor. These figures are for renewable resources serving the energy needs of buildings and electric generation. The major renewable resource categories include biomass, hydro, solar, and wind. The study also assesses alternative allocations between various renewable technology options. Overall, the study finds that large amounts of energy efficiency and renewable energy potential exist through the study period. Pursuing additional cost-effective clean energy potential in the State is anticipated to result in long-term net benefits to New York citizens.

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Structure of the Full Report

The full report is presented in six parts:

- Summary
- Volume 1: Study Overview
 - Background and Purpose of Study
 - Study Scope and General Approach
 - High-Level Results
- Volume 2: Energy Efficiency Methodology and Detailed Results
 - Study Scope
 - Portfolio-Level Results
 - Residential /Commercial / Industrial Efficiency (methodology and detailed results by sector)
- Volume 3: Renewable Energy Methodology and Detailed Results
 - Overview and Approach
 - Biomass / Hydro / Solar / Wind (methodology and detailed results by technology)
- Volume 4: Energy Efficiency Technical Appendices
- Volume 5: Renewable Energy Technical Appendices

Appendix A: Summary of Inputs for the Renewable Energy Analysis

**Biomass
Electric**

	Input	Value(s)	References and Notes:
Biomass Co-firing	Scale Analyzed:	5% co-fire	5% by energy, not weight or volume. USDA, 2012, Cofiring Biomass and Coal for Fossil Fuel Reduction and Other Benefits and IRENA, 2013, Biomass Co-Firing Technology Brief
	Unit For Tool:	per MW of Co-fire capacity	
	Measure Life:	20 years	
	First Year Installed Cost:	\$500/kW	IRENA, 2013, Biomass Co-Firing Technology Brief
	Changes Installed Costs:	None	
	O&M:	3%	IRENA, 2013, Biomass Co-Firing Technology Brief
	First Year Energy Production/Saved:	-58,531 MMBtu coal + 58,531 MMBtu biomass	1 for 1 fuel switch
	Changes in Energy Production/Saved:	None	
	Peak Coincidence:	None	No incremental generation or capacity – fuel switch
	Incentives:	PTC	NPV of 6 years of 1.1¢/kWh PTC
	Incentive Changes:	Phase Out	2013-2019+: 100%, 100%, 80%, 70%, 60%, 60%, 0%
	Limiting Factors for BTP:	5% of capacity of Syracuse and Huntley	Based on estimated ramp down and projected retirement trends in 2013 NY ISO Goldbook
	Allocation by Zones:	100% UP	Plants not scheduled for retirement are upstate
	Years Deployed:	2014-2019	
Growth Rates for BTP:	Phased in gradually	Based on estimated ramp down and projected retirement trends in 2013 NY ISO Goldbook	
Biomass Direct-fired plants	Scale Analyzed:	45 MW Plant	
	Unit For Tool:	per MW capacity	
	Measure Life:	50 years	
	First Year Installed Cost:	\$3,378/kW	National Academies, 2009, Electricity from Renewable Resources

**Biomass
Electric**

	Input	Value(s)	References and Notes:
	Changes Installed Costs:	None	
	O&M:	\$110/kW-yr	National Academies, 2009, Electricity from Renewable Resources
	First Year Energy Production/Saved:	6,136 MWh	70% capacity factor
	Changes in Energy Production/Saved:	0.4%/yr	Improved heat rate from 14.5 to 13.5 MMBtu/MWh over 20 years NREL, 2012, "Renewable Electricity Futures Study Vol. 1," Figure 6-14.
	Peak Coincidence:	98% summer 99% Winter	Screening tool load shapes
	Incentives:	PTC	NPV of 10 years of 1.1¢/kWh PTC
	Incentive Changes:	Phase Out	2013-2019+: 100%, 100%, 80%, 70%, 60%, 60%, 0%
	Limiting Factors for BTP:	Resource	
	Allocation by Zones:	73% UP, 27% HV	Proximity to resource – limited to UP and HV; divided between UP and HV by population
	Years Deployed:	2013-2030	
	Growth Rates for BTP:	Flat	BTP capacity assigned equally to 20 year horizon
Commercial Scale CHP/District Heat	Scale Analyzed:	2 MW Plant	87% heat, 13% electric output
	Unit For Tool:	per MW capacity	
	Measure Life:	20 years	
	First Year Installed Cost:	\$4,535/kW	Average installations at WJ Cowee, NY; City of Auburn, NY; Griffiss Utility Services Corp, NY, Middlebury College, VT
	Changes Installed Costs:	None	
	O&M:	\$0.04/kWh	EPA, Combined Heat and Power Level 1 Feasibility Analysis ,Table 6
	First Year Energy Production/Saved:	2,500 MWh 89,026 MMBtu biomass -57,286 MMBtu petro	2500 hours of operation 80% heating efficiency 24% electrical efficiency
	Changes in Energy Production/Saved:	None	

**Biomass
Electric**

	Input	Value(s)	References and Notes:
	Peak Coincidence:	89% Summer 88% Winter	Other electric miscellaneous C/I load shape. Assume thermal load following, but continuous (not seasonal) load for high value applications
	Incentives:	ITC	10% of installed cost
	Incentive Changes:	10% 9% 8% 7% 6% 5%	2013-2016 2017 2018 2019 2020 2021 - 2030
	Limiting Factors for BTP:	Resource	
	Allocation by Zones:	73% UP, 27% HV	Proximity to resource; divided between UP and HV by population
	Years Deployed:	2013-2030	
	Growth Rates for BTP:	Flat	BTP capacity assigned equally to 20 year horizon
Landfill Gas	Scale Analyzed:	3 MW system	
	Unit For Tool:	per MW capacity	
	Measure Life:	30 years	
	First Year Installed Cost:	\$3,883/kW	Preliminary Results from the 2013 RPS Main Tier Program Review Cost Study
	Changes Installed Costs:	None	
	O&M:	\$118/kW-yr	Preliminary Results from the 2013 RPS Main Tier Program Review Cost Study
	First Year Energy Production/Saved:	7,889 MWh	90% capacity factor
	Changes in Energy Production/Saved:	None	
	Peak Coincidence:	98% summer 99% Winter	Screening Tool Load Shapes – developed for 2003 Potential Study
	Incentives:	PTC	NPV of 10 years of 1.1¢/kWh PTC

**Biomass
Electric**

	Input	Value(s)	References and Notes:
	Incentive Changes:	Phase Out	2013-2019+: 100%, 100%, 80%, 70%, 60%, 60%, 0%
	Limiting Factors for BTP:	Resource	
	Allocation by Zones:	49% UP, 31% HV, 20% LI	Resource distribution
	Years Deployed:	2013-2030	
	Growth Rates for BTP:	Steady	Nearly flat with peak installations in 2024
Anaerobic Digesters	Scale Analyzed:	300 kW system	
	Unit For Tool:	per MW capacity	
	Measure Life:	30 years	
	First Year Installed Cost:	\$7,200/kW	Average from NYS Operational Anaerobic Digester Specifications and 2009 Dairy Power NY Summit briefing
	Changes Installed Costs:	None	
	O&M:	5% of installed cost per year	EPA Fair Oaks Dairy Digester 2 and William Lazarus, University of Minnesota, 2009 Anaerobic Digester Technology
	First Year Energy Production/Saved:	6,136 MWh	70% capacity factor
	Changes in Energy Production/Saved:	None	
	Peak Coincidence:	98% summer 99% Winter	Screening Tool Load Shapes – developed for 2003 Potential Study
	Incentives:	ITC	30% off installed cost
	Incentive Changes:	30% 27% 24% 21% 18% 15%	2013-2016 2017 2018 2019 2020 2021-2030
	Limiting Factors for BTP:	Resource	

**Biomass
Electric**

	Input	Value(s)	References and Notes:
	Allocation by Zones:	42% NYC, 32% UP, 15% LI, 13%, HV	According to population
	Years Deployed:	2014-2030	
	Growth Rates for BTP:	Flat	BTP capacity assigned equally to 20 year horizon

**Biomass
Thermal**

	Input	Value(s)	References and Notes:
Res. stove, boilers, furnace	Scale Analyzed:	40 kBtu/h	
	Unit For Tool:	per MMBtu/h capacity	Equivalent to 25 average systems
	Measure Life:	23 years	
	First Year Installed Cost:	\$225,776/MMBtu/h	Preliminary analysis for the New York State Biomass Thermal Energy Roadmap and with experience from Biomass Energy Resource Center
	Changes Installed Costs:	\$234,760/MMBtu/h	From 2024 on
	O&M:	\$1,406/MMBtu/h·yr	Interviews conducted by Efficiency Vermont
	First Year Energy Production/Saved:	1,474 MMBtu biomass -1,511 MMBtu petroleum	1,209 hours adapted from 2010 NY TRM, 82% efficiency Same hours, 80% efficiency
	Changes in Energy Production/Saved:		Weighted Average Efficiency improves from 80% to 84% during study horizon
	Incentives:	None	
	Incentive Changes:	N/A	
	Allocation by Zones:	73% UP, 27% HV	Proximity to resource; divided between UP and HV by population
	Years Deployed:	2013-2030	
	Growth Rates for BTP:	Flat	BTP capacity assigned equally to 20 year horizon
	Limiting Factors for BTP:	Resource	

**Biomass
Thermal**

	Input	Value(s)	References and Notes:
Comm. stove, boilers, furnace	Scale Analyzed:	1 MMBtu/h	
	Unit For Tool:	per MMBtu/h capacity	Equivalent to ~1 average system
	Measure Life:	30 years	
	First Year Installed Cost:	\$311,176/MMBtu/h	Preliminary analysis for the New York State Biomass Thermal Energy Roadmap and with experience from Biomass Energy Resource Center
	Changes Installed Costs:	\$308,531/MMBtu/h	From 2024 on
	O&M:	\$2,031/MMBtu/h-yr	Vermont schools installation data
	First Year Energy Production/Saved:	1,277 MMBtu biomass -1,348 MMBtu petroleum	1,078 hours adapted from 2010 NY TRM, 84% efficiency Same hours, 80% efficiency
	Changes in Energy Production/Saved:	None	Weighted Average Efficiency improves from 78% to 90% over study horizon
	Incentives:	None	
	Incentive Changes:	N/A	
	Allocation by Zones:	73% UP, 27% HV	Proximity to resource; divided between UP and HV by population
	Years Deployed:	2013-2030	
	Growth Rates for BTP:	Flat	BTP capacity assigned equally to 20 year horizon
	Limiting Factors for BTP:	Resource	
Biodiesel B5 Fuel Oil Blend (Residential and Commercial)	Scale Analyzed:	5% biodiesel	
	Unit For Tool:	All available biodiesel	
	Measure Life:	1 year	
	First Year Installed Cost:	\$0.58/MMBtu premium	\$1.50/gallon premium, EIA, 2013, Workshop on Biofuels Projections in the Annual Energy Outlook
	Changes Installed Costs:	Linear change to \$0.04/MMBtu premium in 2030	\$0.10/gallon premium in 2030 [for E100] Anselm Eisentraut, Bioenergy Analyst, IEA, http://www.eco-business.com/news/the-future-for-biofuels-iea-insight/
	O&M:	None	
	First Year Energy	3.5 TBtu biodiesel	All available biodiesel

**Biomass
Thermal**

Input	Value(s)	References and Notes:
Production/Saved:	-3.5 TBtu petroleum	
Changes in Energy Production/Saved:	None	
Incentives:	None	
Incentive Changes:	N/A	
Allocation by Zones:	42% NYC, 32% UP, 15% LI, 13%, HV	55% commercial, 45% residential, and by zone according to population
Years Deployed:	2013-2030	
Growth Rates for BTP:	Flat	
Limiting Factors for BTP:	Resource	

Hydro

	Input	Value(s)	References and Notes:
Run of River	Scale Analyzed:	100 kW-30 MW	
	Unit For Tool:	per MW capacity	
	Measure Life:	50 years	
	First Year Installed Cost:	\$3,850/kW	Preliminary Results from the 2013 RPS Main Tier Program Review Cost Study and Black and Veatch, 2012, Cost and Performance Data for Power Generation Technologies
	Changes Installed Costs:	None	
	O&M:	\$6/MWh \$15,000/MW	Black and Veatch, 2012, Cost and Performance Data for Power Generation Technologies
	First Year Energy Production/Saved:	3,504 MWh	40% capacity factor
	Changes in Energy Production/Saved:	None	
	Peak Coincidence:	36% Summer 47% Winter	Screening Tool Load Shapes – developed for 2003 Potential Study
	Incentives:	PTC	NPV of 10 years of 1.1¢/kWh PTC
	Incentive Changes:	Phase Out	2013-2019+: 100%, 100%, 80%, 70%, 60%, 60%, 0%
	Allocation by Zones:	85% UP, 12% HV, 3% LI	
	Years Deployed:	2017-2030	Slow ramp up reflects licensing time
	Growth Rates for BTP:	Flat	BTP capacity assigned equally to 20 year horizon
Limiting Factors for BTP:	Resource		
New Dams – Undeveloped Sites	Scale Analyzed:	100+ kW	
	Unit For Tool:	per MW capacity	
	Measure Life:	50 years	
	First Year Installed Cost:	\$5,000/kW	Preliminary Results from the 2013 RPS Main Tier Program Review Cost Study and Black and Veatch, 2012, Cost and Performance Data for Power Generation Technologies
	Changes Installed Costs:	None	

Hydro

	Input	Value(s)	References and Notes:
	O&M:	\$6/MWh \$15,000/MW	Black and Veatch, 2012, Cost and Performance Data for Power Generation Technologies
	First Year Energy Production/Saved:	4,511 MWh	52% capacity factor
	Changes in Energy Production/Saved:	None	
	Peak Coincidence:	36% Summer 47% Winter	Screening Tool Load Shapes – developed for 2003 Potential Study
	Incentives:	PTC	NPV of 10 years of 1.1¢/kWh PTC
	Incentive Changes:	Phase Out	2013-2019+: 100%, 100%, 80%, 70%, 60%, 60%, 0%
	Allocation by Zones:	85% UP, 15% HV	
	Years Deployed:	2017-2030	Slow ramp up reflects licensing time
	Growth Rates for BTP:	Flat	BTP capacity assigned equally to 20 year horizon
	Limiting Factors for BTP:	Resource	
	Non-Powered Dams	Scale Analyzed:	1+ MW
Unit For Tool:		per MW capacity	
Measure Life:		50 years	
First Year Installed Cost:		\$4,200/kW	Preliminary Results from the 2013 RPS Main Tier Program Review Cost Study and Black and Veatch, 2012, Cost and Performance Data for Power Generation Technologies
Changes Installed Costs:		None	
O&M:		\$6/MWh \$15,000/MW	Black and Veatch, 2012, Cost and Performance Data for Power Generation Technologies
First Year Energy Production/Saved:		4,511 MWh	52% capacity factor
Changes in Energy Production/Saved:		None	
Peak Coincidence:		36% Summer 47% Winter	Screening Tool Load Shapes – developed for 2003 Potential Study

Hydro

	Input	Value(s)	References and Notes:
	Incentives:	PTC	NPV of 10 years of 1.1¢/kWh PTC
	Incentive Changes:	Phase Out	2013-2019+: 100%, 100%, 80%, 70%, 60%, 60%, 0%
	Allocation by Zones:	85% UP, 15% HV	
	Years Deployed:	2017-2030	Slow ramp up reflects licensing time
	Growth Rates for BTP:	Flat	BTP capacity assigned equally to 20 year horizon
	Limiting Factors for BTP:	Resource	
Repowering and Upgrades to Existing facilities	Scale Analyzed:	100+ kW	
	Unit For Tool:	per MW new capacity	
	Measure Life:	50 years	
	First Year Installed Cost:	\$2,000/kW	Preliminary Results from the 2013 RPS Main Tier Program Review Cost Study and Black and Veatch, 2012, Cost and Performance Data for Power Generation Technologies
	Changes Installed Costs:	None	
	O&M:	\$6/MWh \$15,000/MW	Black and Veatch, 2012, Cost and Performance Data for Power Generation Technologies
	First Year Energy Production/Saved:	4,511 MWh	52% capacity factor
	Changes in Energy Production/Saved:	None	
	Peak Coincidence:	36% Summer 47% Winter	Screening Tool Load Shapes – developed for 2003 Potential Study
	Incentives:	PTC	NPV of 10 years of 1.1¢/kWh PTC
	Incentive Changes:	Phase Out	2013-2019+: 100%, 100%, 80%, 70%, 60%, 60%, 0%
		Allocation by Zones:	85% UP, 15% HV
	Years Deployed:	2017-2030	Slow ramp up reflects licensing time
	Growth Rates for BTP:	Flat	BTP capacity assigned equally to 20 year horizon
	Limiting Factors for BTP:	Resource	
Tidal Energy	Scale Analyzed:	30+ kW	

Hydro

	Input	Value(s)	References and Notes:
	Unit For Tool:	per MW capacity	
	Measure Life:	20 years	
	First Year Installed Cost:	\$5,574/kW	Black and Veatch, 2012, Cost and Performance Data for Power Generation Technologies
	Changes Installed Costs:	-5.2%/yr, -4.1%/yr, -1.3%/yr	2013-2017 2018-2022 2023-2030
	O&M:	\$95,855/MW	EPRI, North American Tidal In Stream Feasibility Study
	First Year Energy Production/Saved:	3,332 MWh	EPRI, North American Tidal In Stream Feasibility Study
	Changes in Energy Production/Saved:	None	
	Peak Coincidence:	36% Summer 47% Winter	Screening Tool Load Shapes – developed for 2003 Potential Study
	Incentives:	PTC	NPV of 10 years of 1.1¢/kWh PTC
	Incentive Changes:	Phase Out	2013-2019+: 100%, 100%, 80%, 70%, 60%, 60%, 0%
	Allocation by Zones:	97% LI, 3% NYC	
	Years Deployed:	2017-2030	Slow ramp up reflects licensing time
	Growth Rates for BTP:	Flat	BTP capacity assigned equally to 20 year horizon
	Limiting Factors for BTP:	Resource	
Wave Energy	Scale Analyzed:	10+ kW	
	Unit For Tool:	per MW capacity	
	Measure Life:	20 years	
	First Year Installed Cost:	\$9,240/kW	Black and Veatch, 2012, Cost and Performance Data for Power Generation Technologies
	Changes Installed Costs:	-4.9%/yr -3.6%/yr -3.4%/yr -3.3%/yr	2013-2017 2018-2022 2023-2027 2028-2030

Hydro

	Input	Value(s)	References and Notes:
	O&M:	\$110,450/MW	EPRI, Offshore Wave Power Demonstration Project
	First Year Energy Production/Saved:	2,562 MWh	EPRI, Offshore Wave Power Demonstration Project
	Changes in Energy Production/Saved:	None	
	Peak Coincidence:	36% Summer 47% Winter	Screening Tool Load Shapes – developed for 2003 Potential Study
	Incentives:	PTC	NPV of 10 years of 1.1¢/kWh PTC
	Incentive Changes:	Phase Out	2013-2019+: 100%, 100%, 80%, 70%, 60%, 60%, 0%
	Allocation by Zones:	100% LI	
	Years Deployed:	None deployed	
	Growth Rates for BTP:	N/A	
	Limiting Factors for BTP:	N/A	

Solar PV

	Input	Value(s)	References and Notes:
Residential PV	Scale Analyzed:	3-7 kW	New York Solar Study
	Unit For Tool:	per MW of capacity	
	Measure Life:	25 years	
	First Year Installed Cost:	\$4,626/kW \$5,899/kW (NYC)	New York Solar Study 2013 Update, average of B&V and Sunshot
	Changes Installed Costs:		Projected costs changes based on analysis of historic data and trends, from LBNL Tracking the Sun report and Solar Electric Industries Association Quarterly Updates. Forecast projections consistent with New York State Solar Study 2013 Update.
		-8%/yr	2014-2016
		-5%/yr	2017-2018
	-4%/yr	2019-2020	
	-2%/yr	2021-2023	
	-1.5%/yr	2024-2030	

Solar PV

	Input	Value(s)	References and Notes:
	O&M:	\$2,200/MW	New York Solar Study
	First Year Energy Production/Saved:	1,211 MWh	NREL, PVWatts, New York Solar Study
	Changes in Energy Production/Saved:	-0.5%/yr	New York Solar Study
	Peak Coincidence:	37%	New York Solar Study 2013 Update
	Incentives:	ITC	30% off installed cost
	Incentive Changes:	30%	2013-2016
		27%	2017
		24%	2018
		21%	2019
		18%	2020
		15%	2021
		12%	2022
		9%	2023
		6%	2024
		3%	2025
		0%	2026-2030
	Allocation by Zones:	42% HV, 28% LI, 20% UP, 10% NYC	By share of electricity consumption, adjusted for space and electric rates
	Years Deployed:	2013-2030	
	Growth Rates for BTP:	Sigmoidal	Starts with market growth, flattens at end near limit
	Limiting Factors for BTP:	Initially growth rate, then penetration	NREL, 2012, Grid Modeling for the SunShot Vision Study showed 27% solar energy on the grid was possible. This was taken as the penetration limit.
Small Commercial PV	Scale Analyzed:	30-50 kW	New York Solar Study
	Unit For Tool:	per MW of capacity	
	Measure Life:	25 years	
	First Year Installed Cost:	\$4,496/kW \$5,690/kW (NYC)	New York Solar Study 2013 Update, average of B&V and Sunshot

Solar PV

Input	Value(s)	References and Notes:
Changes Installed Costs:		Projected costs changes based on analysis of historic data and trends, from LBNL Tracking the Sun report and Solar Electric Industries Association Quarterly Updates. Forecast projections consistent with New York State Solar Study 2013 Update.
	-8%/yr	2014-2016
	-5%/yr	2017-2018
	-4%/yr	2019-2020
	-2%/yr	2021-2023
	-1.5%/yr	2024-2030
O&M:	\$2,200/MW	New York Solar Study
First Year Energy Production/Saved:	1,189 MWh	NREL, PVWatts, New York Solar Study
Changes in Energy Production/Saved:	-0.5%/yr	New York Solar Study
Peak Coincidence:	37%	New York Solar Study 2013 Update
Incentives:	ITC	30% off installed cost
Incentive Changes:	30%	2013-2016
	27%	2017
	24%	2018
	21%	2019
	18%	2020
	15%	2021
	12%	2022
	9%	2023
	6%	2024
	3%	2025
	0%	2026-2030
Allocation by Zones:	42% HV, 28% LI, 20% UP, 10% NYC	By share of electricity consumption, adjusted for space and electric rates
Years Deployed:	2013-2030	
Growth Rates for BTP:	Sigmoidal	Starts with market growth, flattens at end near limit

Solar PV

	Input	Value(s)	References and Notes:
	Limiting Factors for BTP:	Initially growth rate, then penetration	NREL, 2012, Grid Modeling for the SunShot Vision Study showed 27% solar energy on the grid was possible. This was taken as the penetration limit.
Large Commercial PV	Scale Analyzed:	50+ kW	New York Solar Study
	Unit For Tool:	per MW of capacity	
	Measure Life:	25 years	
	First Year Installed Cost:	\$3,406/kW \$4,311/kW (NYC)	New York Solar Study 2013 Update, average of B&V and Sunshot
	Changes Installed Costs:		Projected costs changes based on analysis of historic data and trends, from LBNL Tracking the Sun report and Solar Electric Industries Association Quarterly Updates. Forecast projections consistent with New York State Solar Study 2013 Update.
		-8%/yr	2014-2016
		-5%/yr	2017-2018
		-4%/yr	2019-2020
		-2%/yr	2021-2023
		-1.5%/yr	2024-2030
	O&M:	\$2,200/MW	New York Solar Study
	First Year Energy Production/Saved:	1,204 MWh	NREL, PVWatts, New York Solar Study
	Changes in Energy Production/Saved:	-0.5%/yr	New York Solar Study
	Peak Coincidence:	37%	New York Solar Study 2013 Update
	Incentives:	ITC	30% off installed cost

Solar PV

	Input	Value(s)	References and Notes:
	Incentive Changes:	30% 27% 24% 21% 18% 15% 12% 9% 6% 3% 0%	2013-2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026-2030
	Allocation by Zones:	42% HV, 28% LI, 20% UP, 10% NYC	By share of electricity consumption, adjusted for space and electric rates
	Years Deployed:	2013-2030	
	Growth Rates for BTP:	Sigmoidal	Starts with market growth, flattens at end near limit
	Limiting Factors for BTP:	Initially growth rate, then penetration	NREL, 2012, Grid Modeling for the SunShot Vision Study showed 27% solar energy on the grid was possible. This was taken as the penetration limit.
Grid Supply – MW Scale PV	Scale Analyzed:	1+ MW	New York Solar Study
	Unit For Tool:	per MW of capacity	
	Measure Life:	25 years	
	First Year Installed Cost:	\$3,140/kW \$3,975/kW (NYC)	New York Solar Study 2013 Update, average of B&V and Sunshot

Solar PV

Input	Value(s)	References and Notes:
Changes Installed Costs:		Projected costs changes based on analysis of historic data and trends, from LBNL Tracking the Sun report and Solar Electric Industries Association Quarterly Updates. Forecast projections consistent with New York State Solar Study 2013 Update.
	-8%/yr	2014-2016
	-5%/yr	2017-2018
	-4%/yr	2019-2020
	-2%/yr	2021-2023
	-1.5%/yr	2024-2030
O&M:	\$2,400/MW	New York Solar Study
First Year Energy Production/Saved:	1,298 MWh	NREL, PVWatts, New York Solar Study
Changes in Energy Production/Saved:	-0.5%/yr	New York Solar Study
Peak Coincidence:	37%	New York Solar Study 2013 Update
Incentives:	ITC	30% off installed cost
Incentive Changes:	30%	2013-2016
	27%	2017
	24%	2018
	21%	2019
	18%	2020
	15%	2021
	12%	2022
	9%	2023
	6%	2024
	3%	2025
	0%	2026-2030
Allocation by Zones:	42% HV, 28% LI, 20% UP, 10% NYC	By share of electricity consumption, adjusted for space and electric rates
Years Deployed:	2013-2030	
Growth Rates for BTP:	Sigmoidal	Starts with market growth, flattens at end near limit

Solar PV

Input	Value(s)	References and Notes:
Limiting Factors for BTP:	Initially growth rate, then penetration	NREL, 2012, Grid Modeling for the SunShot Vision Study showed 27% solar energy on the grid was possible. This was taken as the penetration limit.

Solar Thermal

	Input	Value(s)	References and Notes:
Residential	Scale Analyzed:	80 GPD (3.8 kW _{th})	Average home 2 panel system
	Unit For Tool:	per MW _{th} capacity	
	Measure Life:	20 years	Ean Jones and Robert Mowris, Verified, Inc , 2010, California’s Solar Water Heating Program: Scaling Up to Install 200,000 Systems by 2020, Figure 1
	First Year Installed Cost:	\$2,134/kW	New York Solar Thermal Roadmap, 2012 Vermont Small Scale Renewable Energy Incentive Program Data
	Changes Installed Costs:	Flat for 3 years, then -3%/yr	Conservative adaptation of New York Solar Thermal Roadmap
	O&M:	0.95%/yr	NREL, 2012, Distributed Generation Renewable Energy Estimate of Costs, http://www.nrel.gov/analysis/pdfs/2012_dg_icoe_data.pdf
	First Year Energy Production/Saved:	1,754 MW electricity, or 9,637 MMBtu natural Gas, or 10,807 MMBtu oil	Average of recent installations and average efficiency of water heating systems
	Changes in Energy Production/Saved:	None	
	Incentives:	ITC	30% off installed cost
	Incentive Changes:	30% 27% 24% 21% 18% 15%	2013-2016 2017 2018 2019 2020 2021 - 2030

Solar Thermal

	Input	Value(s)	References and Notes:
	Allocation by Zones:	42% HV, 28% LI, 20% UP, 10% NYC	By share of electricity consumption, adjusted for space and electric rates
	Years Deployed:	2013-2030	
	Growth Rates for BTP:	Sigmoidal	Starts with market growth, flattens at end near limit
	Limiting Factors for BTP:	Initially growth rate, then saturation	Saturation limit based on residential hot water consumption, 60% solar fraction, and 50% buildings suitable
Commercial	Scale Analyzed:	240 GPD (11.4 kW _{th})	6 panel system
	Unit For Tool:	per MW _{th} capacity	
	Measure Life:	30 years	Ean Jones and Robert Mowris, Verified, Inc , 2010, California’s Solar Water Heating Program: Scaling Up to Install 200,000 Systems by 2020, Figure 1
	First Year Installed Cost:	\$1,538/kW	New York Solar Thermal Roadmap, 2012 Vermont Small Scale Renewable Energy Incentive Program Data
	Changes Installed Costs:	Flat for 3 years, then -3%/yr	Conservative adaptation of New York Solar Thermal Roadmap
	O&M:	0.5%/yr	NREL, 2012, Distributed Generation Renewable Energy Estimate of Costs, http://www.nrel.gov/analysis/pdfs/2012_dg_icoe_data.pdf
	First Year Energy Production/Saved:	1,754 MW electricity, or 9,637 MMBtu natural Gas, or 10,807 MMBtu oil	Average of recent installations and average efficiency of water heating systems
	Changes in Energy Production/Saved:	None	
	Incentives:	ITC	30% off installed cost
	Incentive Changes:	30%	2013-2016
		27%	2017
		24%	2018
		21%	2019
		18%	2020
		15%	2021 - 2030

Solar Thermal

	Input	Value(s)	References and Notes:
	Allocation by Zones:	42% HV, 28% LI, 20% UP, 10% NYC	By share of electricity consumption, adjusted for space and electric rates
	Years Deployed:	2013-2030	
	Growth Rates for BTP:	Sigmoidal	Starts with market growth, flattens at end near limit
	Limiting Factors for BTP:	Initially growth rate, then saturation	Saturation limit based on commercial hot water consumption, 60% solar fraction, and 50% buildings suitable

Wind

	Input	Value(s)	References and Notes:
Residential	Scale Analyzed:	10 kW	
	Unit For Tool:	per MW capacity	
	Measure Life:	20 years	
	First Year Installed Cost:	\$7,121/kW	2011-2012 Vermont Small Scale Renewable Energy Incentive Program Data
	Changes Installed Costs:	None	
	O&M:	\$50/kW-yr	Sustainable Energy Developments, The Real Cost of O&M Presentation
	First Year Energy Production/Saved:	1,694 MWh	18-20% capacity factor
	Changes in Energy Production/Saved:	None	
	Peak Coincidence:	Summer 19% Winter 45%	Screening Tool Load Shapes – developed for 2003 Potential Study
	Incentives:	ITC	30% off installed cost
	Incentive Changes:	30% 27% 24% 21% 18% 15%	2013-2016 2017 2018 2019 2020 2021 - 2030
	Allocation by Zones:	38% UP, 31% LI, 31% HV	
	Years Deployed:	2013-2030	

Wind

	Input	Value(s)	References and Notes:	
	Growth Rates for BTP:	Flat	BTP capacity assigned equally to 20 year horizon	
	Limiting Factors for BTP:	Limited sites and interest		
Commercial – customer sited	Scale Analyzed:	3 kW - 1 MW		
	Unit For Tool:	per MW capacity		
	Measure Life:	20 years		
	First Year Installed Cost:	\$3,224/kW	LBNL, 2013, Wind Technologies Market Report, Figure 22 Data LBNL, 2009, The Cost of Transmission for Wind Energy: A Review of Transmission Planning Studies (transmission adder)	
	Changes Installed Costs:	None		
	O&M:	\$40/kW·yr	Sustainable Energy Developments, The Real Cost of O&M Presentation	
	First Year Energy Production/Saved:	2,511 MWh	26-30% capacity factor	
	Changes in Energy Production/Saved:	21% over 20 years	Minimum from NREL, 2012, Renewable Electricity Futures Study Vol. 2, Table 11-2. Expected is 45%.	
	Peak Coincidence:	Summer 19% Winter 45%	Screening Tool Load Shapes – developed for 2003 Potential Study	
	Incentives:	PTC	NPV of 10 years of 2.2¢/kWh PTC	
	Incentive Changes:	Phase Out	2013-2019+: 100%, 100%, 80%, 70%, 60%, 60%, 0%	
	Allocation by Zones:	33% UP, 33% LI, 33% HV		
	Years Deployed:	2013-2030		
		Growth Rates for BTP:	Flat	BTP capacity assigned equally to 20 year horizon
		Limiting Factors for BTP:	Grid and Transmission	NYISO, 2010, Growing Wind
Cluster	Scale Analyzed:	1-30 MW	Plant size 1-30 MW using 1MW to 3 MW turbines.	
	Unit For Tool:	per MW capacity		
	Measure Life:	20 years		

Wind

	Input	Value(s)	References and Notes:
	First Year Installed Cost:	\$3,138/kW	Preliminary Results from the 2013 RPS Main Tier Program Review Cost Study LBNL, 2009, The Cost of Transmission for Wind Energy: A Review of Transmission Planning Studies (transmission adder)
	Changes Installed Costs:	None	
	O&M:	\$70/kW/yr \$0.00057/kWh	Preliminary Results from the 2013 RPS Main Tier Program Review Cost Study
	First Year Energy Production/Saved:	2,862 MWh	28-35% capacity factor
	Changes in Energy Production/Saved:	21% over 20 years	Minimum from NREL, 2012, Renewable Electricity Futures Study Vol. 2, Table 11-2. Expected is 45%.
	Peak Coincidence:	Summer 19% Winter 45%	Screening Tool Load Shapes – developed for 2003 Potential Study
	Incentives:	PTC	NPV of 10 years of 2.2¢/kWh PTC
	Incentive Changes:	Phase Out	2013-2019+: 100%, 100%, 80%, 70%, 60%, 60%, 0%
	Allocation by Zones:	51% UP, 31% LI, 18% HV	
	Years Deployed:	2013-2030	
	Growth Rates for BTP:	0.06% per year	
	Limiting Factors for BTP:	Grid and Transmission	NYISO, 2010, Growing Wind
Onshore Wind Farm	Scale Analyzed:	2-5 MW	Plant size >30 MW based on 2 MW to 5 MW turbines.
	Unit For Tool:	per MW capacity	
	Measure Life:	20 years	
	First Year Installed Cost:	\$2,381/kW	Preliminary Results from the 2013 RPS Main Tier Program Review Cost Study LBNL, 2009, The Cost of Transmission for Wind Energy: A Review of Transmission Planning Studies (transmission adder)
	Changes Installed Costs:	None	
	O&M:	\$66/kW·yr \$0.00057/kWh	Preliminary Results from the 2013 RPS Main Tier Program Review Cost Study

Wind

	Input	Value(s)	References and Notes:
	First Year Energy Production/Saved:	2,920 MWh	30-35% capacity factor
	Changes in Energy Production/Saved:	21% over 20 years	Minimum from NREL, 2012, Renewable Electricity Futures Study Vol. 2, Table 11-2. Expected is 45%.
	Peak Coincidence:	Summer 19% Winter 45%	Screening Tool Load Shapes – developed for 2003 Potential Study
	Incentives:	PTC	NPV of 10 years of 2.2¢/kWh PTC
	Incentive Changes:	Phase Out	2013-2019+: 100%, 100%, 80%, 70%, 60%, 60%, 0%
	Allocation by Zones:	69% UP, 26% LI, 6% HV	
	Years Deployed:	2013-2030	
	Growth Rates for BTP:	0.27% per year	
	Limiting Factors for BTP:	Grid and Transmission	NYISO, 2010, Growing Wind
Offshore Wind Farm	Scale Analyzed:	2-5 MW	Plant size 300 MW based on turbines 2+ MW
	Unit For Tool:	per MW capacity	
	Measure Life:	25 years	
	First Year Installed Cost:	\$4,339/kW in 2019	Year 1 turbine and balance of plant costs from Draft NYS Offshore Wind Study plus transmission adders from Atlantic Wind Connection, 2012 Report by IHC, “Assessment of the Economic Benefits of Offshore Wind in the Mid-Atlantic”
	Changes Installed Costs:	-0.9%/yr	-2%/yr from 2013 RPS Main tier Program Cost Study reduced to not apply to transmission portion because that cost already assumes are fully built out offshore transmission backbone.
	O&M:	\$173/kW-yr	Year 1 block from the 2013 RPS Main Tier Program Review Cost Study
	First Year Energy Production/Saved:	3,416 MWh	39% capacity factor
	Changes in Energy Production/Saved:	Annual capacity factor improves from 39% to 47% over study horizon	NREL, 2012, Renewable Electricity Futures Study Vol. 2, Table 11-2.

Wind

Input	Value(s)	References and Notes:
Peak Coincidence:	Summer 19% Winter 45%	Screening Tool Load Shapes – developed for 2003 Potential Study
Incentives:	PTC	NPV of 10 years of 2.2¢/kWh PTC
Incentive Changes:	Phase Out	2013-2019+: 100%, 100%, 80%, 70%, 60%, 60%, 0%
Allocation by Zones:	100% NYC	Atlantic Wind Connection transmission backbone could link to more southern and profitable electricity market
Years Deployed:	2019-2030	
Growth Rates for BTP:	Averages 24%/yr	Quick growth at start, slowing after 5 years
Limiting Factors for BTP:	Siting, permitting, transmission	Discussion with NYSERDA, Carl Mas email 8/15

Appendix B: Renewable Economic Potential: Incremental Measures by Year

The tables below present renewable measure penetrations for each technology, for the economic potential, in MW for electric measures, MMBtu/hr for thermal measures, or as a percent of statewide consumption for B5 biodiesel.

Measure Name	Measure ID3 Zone	Measure ID1 Sector	2,013.0	2,014.0	2,015.0	2,016.0	2,017.0	2,018.0	2,019.0	2,020.0	2,021.0	2,022.0	2,023.0	2,024.0	2,025.0	2,026.0	2,027.0	2,028.0	2,029.0	2,030.0
Residential PV	LI	CST-RE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Residential PV	NYC	CST-RE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Residential PV	HV	CST-RE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Residential PV	UP	CST-RE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Small Commercial PV	LI	CST-RE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Small Commercial PV	NYC	CST-RE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Small Commercial PV	HV	CST-RE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Small Commercial PV	UP	CST-RE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Large Commercial PV	LI	CST-RE	0.0	0.0	0.0	275.4	275.4	275.4	275.4	275.4	334.2	393.1	451.9	510.7	451.9	393.1	334.2	275.4	226.6	177.8
Large Commercial PV	NYC	CST-RE	0.0	0.0	0.0	98.4	98.4	98.4	98.4	98.4	119.4	140.4	161.4	182.4	161.4	140.4	119.4	98.4	80.9	63.5
Large Commercial PV	HV	CST-RE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	413.2	339.9	266.7
Large Commercial PV	UP	CST-RE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Utility Scale PV	LI	Grid-RE	0.0	0.0	0.0	152.2	122.4	122.4	122.4	122.4	148.6	174.7	200.8	227.0	200.8	174.7	148.6	122.4	100.7	79.0
Utility Scale PV	NYC	Grid-RE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.0	28.2
Utility Scale PV	HV	Grid-RE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Utility Scale PV	UP	Grid-RE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Commercial and industrial boilers , furnaces, and kilns (per MMBTU/h for a 1 MMBTU/h system)	LI	CST-RE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Commercial and industrial boilers , furnaces, and kilns (per MMBTU/h for a 1 MMBTU/h system)	NYC	CST-RE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Commercial and industrial boilers , furnaces, and kilns (per MMBTU/h for a 1 MMBTU/h system)	HV	CST-RE	591.4	591.4	591.4	591.4	591.4	591.4	591.4	591.4	591.4	591.4	591.4	591.4	591.4	591.4	591.4	591.4	591.4	591.4
Commercial and industrial boilers , furnaces, and kilns (per MMBTU/h for a 1 MMBTU/h system)	UP	CST-RE	1,578.6	1,578.6	1,578.6	1,578.6	1,578.6	1,578.6	1,578.6	1,578.6	1,578.6	1,578.6	1,578.6	1,578.6	1,578.6	1,578.6	1,578.6	1,578.6	1,578.6	1,578.6
Residential stove, boiler, furnace (per MMBTU/h for a 0.04 MMBTU/h system)	LI	CST-RE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Residential stove, boiler, furnace (per MMBTU/h for a 0.04 MMBTU/h system)	NYC	CST-RE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Residential stove, boiler, furnace (per MMBTU/h for a 0.04 MMBTU/h system)	HV	CST-RE	0.0	0.0	0.0	346.0	403.7	461.3	519.0	576.7	576.7	576.7	576.7	576.7	576.7	576.7	576.7	576.7	576.7	576.7
Residential stove, boiler, furnace (per MMBTU/h for a 0.04 MMBTU/h system)	UP	CST-RE	0.0	0.0	0.0	1,125.2	1,312.7	1,500.3	1,687.8	1,875.3	1,875.3	1,875.3	1,875.3	1,875.3	1,875.3	1,875.3	1,875.3	1,875.3	1,875.3	1,875.3
Cofiring 5% biomass per cofired MW	HV	Grid-RE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cofiring 5% biomass per cofired MW	UP	Grid-RE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Direct-fired stand alone power plants (per MW for a 45 MW plant)	HV	Grid-RE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Direct-fired stand alone power plants (per MW for a 45 MW plant)	UP	Grid-RE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHP/ District heat (institutional, district) (per MW for a 2 MWe thermal led plant)	LI	CST-RE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHP/ District heat (institutional, district) (per MW for a 2 MWe thermal led plant)	NYC	CST-RE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHP/ District heat (institutional, district) (per MW for a 2 MWe thermal led plant)	HV	CST-RE	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9
CHP/ District heat (institutional, district) (per MW for a 2 MWe thermal led plant)	UP	CST-RE	13.1	13.1	13.1	13.1	13.1	13.1	13.1	13.1	13.1	13.1	13.1	13.1	13.1	13.1	13.1	13.1	13.1	13.1

Energy Efficiency and Renewable Energy Potential Study of New York State

Measure Name	Primary Fuel	Include in Calc's	Measure ID3 Zone	Measure ID1 Sector	Measure ID4 (e.g., Bldg type)	Measure ID5 (e.g., Electric End Use)	Measure ID6 (e.g., Market)	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
C&I B5 blend for statewide use	0	P	LI	CST-RE	0	Heat and Process	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01
C&I B5 blend for statewide use	0	P	NYC	CST-RE	0	Heat and Process	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.02	0.02	0.02
C&I B5 blend for statewide use	0	P	HV	CST-RE	0	Heat and Process	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01
C&I B5 blend for statewide use	0	P	UP	CST-RE	0	Heat and Process	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.02	0.02	0.02
Res B5 blend for statewide use	0	P	LI	CST-RE	0	Thermal Comfort	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
Res B5 blend for statewide use	0	P	NYC	CST-RE	0	Thermal Comfort	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.02	0.02	0.02	0.02
Res B5 blend for statewide use	0	P	HV	CST-RE	0	Thermal Comfort	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01
Res B5 blend for statewide use	0	P	UP	CST-RE	0	Thermal Comfort	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.02	0.02	0.02	0.02
Grid-tied Bio-liquids to power co-firing in boilers (soy biodiesel, or other biodiesel)(per MMBTU/h)	0	P	LI	Grid-RE	0	Elec Total	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grid-tied Bio-liquids to power co-firing in boilers (soy biodiesel, or other biodiesel)(per MMBTU/h)	0	P	NYC	Grid-RE	0	Elec Total	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grid-tied Bio-liquids to power co-firing in boilers (soy biodiesel, or other biodiesel)(per MMBTU/h)	0	P	HV	Grid-RE	0	Elec Total	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grid-tied Bio-liquids to power co-firing in boilers (soy biodiesel, or other biodiesel)(per MMBTU/h)	0	P	UP	Grid-RE	0	Elec Total	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Landfill gas (per MW for a 3MW system)	0	P	LI	Grid-RE	0	Elec Total	0	0.17	0.33	0.50	0.67	0.78	0.90	1.02	1.14	1.20	1.26	1.32	1.38	1.39	1.40	1.41	1.43	1.43	1.43
Landfill gas (per MW for a 3MW system)	0	P	NYC	Grid-RE	0	Elec Total	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Landfill gas (per MW for a 3MW system)	0	P	HV	Grid-RE	0	Elec Total	0	0.26	0.52	0.77	1.03	1.22	1.40	1.58	1.77	1.86	1.95	2.04	2.14	2.16	2.17	2.19	2.21	2.21	2.21
Landfill gas (per MW for a 3MW system)	0	P	UP	Grid-RE	0	Elec Total	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Farm waste, food waste, and wastewater digesters (per MW for a 0.3 MW system)	0	P	LI	CST-RE	0	Elec Total	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Farm waste, food waste, and wastewater digesters (per MW for a 0.3 MW system)	0	P	NYC	CST-RE	0	Elec Total	0	0.00	0.00	1.62	1.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.62	1.62	1.62	1.62	1.62	1.62
Farm waste, food waste, and wastewater digesters (per MW for a 0.3 MW system)	0	P	HV	CST-RE	0	Elec Total	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Farm waste, food waste, and wastewater digesters (per MW for a 0.3 MW system)	0	P	UP	CST-RE	0	Elec Total	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Residential SWH - Elec	0	P	LI	CST-RE	0	DHW	0	0.51	0.95	1.40	1.85	2.51	3.18	3.85	4.51	5.64	6.77	7.90	9.03	8.90	8.78	8.65	8.53	7.40	6.27
Residential SWH - Elec	0	P	NYC	CST-RE	0	DHW	0	0.18	0.34	0.50	0.66	0.90	1.14	1.37	1.61	2.01	2.42	2.82	3.22	3.18	3.13	3.09	3.04	2.64	2.24
Residential SWH - Elec	0	P	HV	CST-RE	0	DHW	0	0.76	1.43	2.10	2.77	3.77	4.77	5.77	6.77	8.46	10.16	11.85	13.54	13.35	13.16	12.98	12.79	11.10	9.40
Residential SWH - Elec	0	P	UP	CST-RE	0	DHW	0	0.36	0.68	1.00	1.32	1.79	2.27	2.75	3.22	4.03	4.84	5.64	6.45	6.36	6.27	6.18	6.09	5.28	4.48
Residential SWH - NG	0	P	LI	CST-RE	0	DHW	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Residential SWH - NG	0	P	NYC	CST-RE	0	DHW	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Residential SWH - NG	0	P	HV	CST-RE	0	DHW	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Residential SWH - NG	0	P	UP	CST-RE	0	DHW	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Residential SWH - Petro	0	P	LI	CST-RE	0	DHW	0	1.33	2.50	3.67	4.84	6.60	8.35	10.10	11.85	14.81	17.77	20.73	23.70	23.37	23.04	22.71	22.38	19.42	16.46
Residential SWH - Petro	0	P	NYC	CST-RE	0	DHW	0	0.47	0.89	1.31	1.73	2.36	2.98	3.61	4.23	5.29	6.35	7.40	8.46	8.35	8.23	8.11	7.99	6.93	5.88
Residential SWH - Petro	0	P	HV	CST-RE	0	DHW	0	1.99	3.75	5.51	7.27	9.89	12.52	15.15	17.77	22.21	26.66	31.10	35.54	35.05	34.56	34.06	33.57	29.13	24.68
Residential SWH - Petro	0	P	UP	CST-RE	0	DHW	0	0.95	1.79	2.62	3.46	4.71	5.96	7.21	8.46	10.58	12.69	14.81	16.93	16.69	16.46	16.22	15.99	13.87	11.75
Commercial SWH - Elec	0	P	LI	CST-RE	0	DHW	0	0.25	0.47	0.69	0.91	1.24	1.57	1.90	2.22	2.78	3.34	3.89	4.45	4.39	4.33	4.26	4.20	3.65	3.09
Commercial SWH - Elec	0	P	NYC	CST-RE	0	DHW	0	0.09	0.17	0.25	0.32	0.44	0.56	0.68	0.79	0.99	1.19	1.39	1.59	1.57	1.54	1.52	1.50	1.30	1.10
Commercial SWH - Elec	0	P	HV	CST-RE	0	DHW	0	0.37	0.70	1.03	1.36	1.86	2.35	2.84	3.34	4.17	5.01	5.84	6.67	6.58	6.49	6.40	6.30	5.47	4.63
Commercial SWH - Elec	0	P	UP	CST-RE	0	DHW	0	0.18	0.34	0.49	0.65	0.88	1.12	1.35	1.59	1.99	2.38	2.78	3.18	3.13	3.09	3.05	3.00	2.60	2.21
Commercial SWH - NG	0	P	LI	CST-RE	0	DHW	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	74.75	89.70	104.65	119.59	117.93	116.27	114.61	112.95	98.00	83.05
Commercial SWH - NG	0	P	NYC	CST-RE	0	DHW	0	2.40	4.51	6.62	8.73	11.89	15.04	18.20	21.36	26.70	32.03	37.37	42.71	42.12	41.53	40.93	40.34	35.00	29.66
Commercial SWH - NG	0	P	UP	CST-RE	0	DHW	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	64.07	74.75	85.42	84.24	83.05	81.87	80.68	70.00	59.32
Commercial SWH - Petro	0	P	LI	CST-RE	0	DHW	0	2.94	5.53	8.12	10.70	14.57	18.44	22.31	26.18	32.72	39.27	45.81	52.36	51.63	50.90	50.17	49.45	42.90	36.36
Commercial SWH - Petro	0	P	NYC	CST-RE	0	DHW	0	1.05	1.97	2.90	3.82	5.20	6.59	7.97	9.35	11.69	14.02	16.36	18.70	18.44	18.18	17.92	17.66	15.32	12.99
Commercial SWH - Petro	0	P	HV	CST-RE	0	DHW	0	4.41	8.29	12.17	16.06	21.86	27.66	33.46	39.27	49.08	58.90	68.72	78.53	77.44	76.35	75.26	74.17	64.35	54.54

Energy Efficiency and Renewable Energy Potential Study of New York State

Measure Name	Primary Fuel	Include in Calc's	Measure ID3 Zone	Measure ID1 Sector	Measure ID4 (e.g., Bldg type)	Measure ID5 (e.g., Electric End Use)	Measure ID6 (e.g., Market)	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Residential Wind (1-10 kW)	0	P	LI	CST-RE	0	Elec Total	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Residential Wind (1-10 kW)	0	P	HV	CST-RE	0	Elec Total	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Residential Wind (1-10 kW)	0	P	UP	CST-RE	0	Elec Total	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Commercial Wind (3kW-1 MW)	0	P	LI	CST-RE	0	Elec Total	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.25	0.25	0.25	0.25	0.25	0.25	
Commercial Wind (3kW-1 MW)	0	P	HV	CST-RE	0	Elec Total	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Commercial Wind (3kW-1 MW)	0	P	UP	CST-RE	0	Elec Total	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Community Scale Wind (1-3MW)	0	P	LI	Grid-RE	0	Elec Total	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.49	9.49	9.49	9.50	
Community Scale Wind (1-3MW)	0	P	HV	Grid-RE	0	Elec Total	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Community Scale Wind (1-3MW)	0	P	UP	Grid-RE	0	Elec Total	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Windfarm (2-5 MW)	0	P	LI	Grid-RE	0	Elec Total	0	52.61	53.32	54.04	54.75	55.50	56.25	57.01	57.76	58.55	59.35	60.14	60.94	61.77	62.61	63.45	64.29	65.17	
Windfarm (2-5 MW)	0	P	HV	Grid-RE	0	Elec Total	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14.33	14.52	14.72	
Windfarm (2-5 MW)	0	P	UP	Grid-RE	0	Elec Total	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	190.51	195.05	199.58	204.57	
Offshore Wind (2-5 MW)	0	P	LI	Grid-RE	0	Elec Total	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Offshore Wind (2-5 MW)	0	P	NYC	Grid-RE	0	Elec Total	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	630.00	
Run of the River Low Power 10kW-1MW	0	P	UP	Grid-RE	0	Elec Total	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	62.72	62.72	62.72	62.72	62.72	62.72	62.72	
Run of the River Low Power 10kW-1MW	0	P	HV	Grid-RE	0	Elec Total	0	0.00	0.00	0.00	0.00	1.84	3.69	5.53	7.38	7.38	7.38	7.38	7.38	7.38	7.38	7.38	7.38	7.38	
Run of the River Low Power 10kW-1MW	0	P	LI	Grid-RE	0	Elec Total	0	0.00	0.00	0.00	0.00	0.92	1.84	2.77	3.69	3.69	3.69	3.69	3.69	3.69	3.69	3.69	3.69	3.69	
Run of the River High Power 1-30 MW	0	P	UP	Grid-RE	0	Elec Total	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	48.22	48.22	48.22	48.22	48.22	48.22	48.22	
Run of the River High Power 1-30 MW	0	P	HV	Grid-RE	0	Elec Total	0	0.00	0.00	0.00	0.00	2.13	4.25	6.38	8.51	8.51	8.51	8.51	8.51	8.51	8.51	8.51	8.51	8.51	
Run of the River High Power 1-30 MW	0	P	UP	Grid-RE	0	Elec Total	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	38.20	38.20	38.20	38.20	38.20	38.20	38.20	
Undeveloped Sites 100+ kW	0	P	HV	Grid-RE	0	Elec Total	0	0.00	0.00	0.00	0.00	1.69	3.37	5.06	6.74	6.74	6.74	6.74	6.74	6.74	6.74	6.74	6.74	6.74	
Non-Powered Dams 1+ MW	0	P	UP	Grid-RE	0	Elec Total	0	0.00	0.00	0.00	0.00	3.50	7.00	10.50	13.99	13.99	13.99	13.99	13.99	13.99	13.99	13.99	13.99	13.99	
Non-Powered Dams 1+ MW	0	P	HV	Grid-RE	0	Elec Total	0	0.00	0.00	0.00	0.00	0.62	1.23	1.85	2.47	2.47	2.47	2.47	2.47	2.47	2.47	2.47	2.47	2.47	
Re-Powered Dams 100+ kW	0	P	UP	Grid-RE	0	Elec Total	0	0.00	0.00	0.00	0.00	2.37	4.74	7.10	9.47	9.47	9.47	9.47	9.47	9.47	9.47	9.47	9.47	9.47	
Re-Powered Dams 100+ kW	0	P	HV	Grid-RE	0	Elec Total	0	0.00	0.00	0.00	0.00	0.42	0.84	1.25	1.67	1.67	1.67	1.67	1.67	1.67	1.67	1.67	1.67	1.67	
Wave Energy 10 kW+	0	P	LI	Grid-RE	0	Elec Total	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Tidal Energy 30 kW+	0	P	LI	Grid-RE	0	Elec Total	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Tidal Energy 30 kW+	0	P	NYC	Grid-RE	0	Elec Total	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	

Appendix C: Renewable Economic Potential: Net Benefits by Measure and Year

Dollar values are in 2012 real dollars.

Measure Name	Measure ID3 Zone	Measure ID1 Sector	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Residential PV	LI	CST-RE																		
Residential PV	NYC	CST-RE																		
Residential PV	HV	CST-RE																		
Residential PV	UP	CST-RE																		
Small Commercial PV	LI	CST-RE																		
Small Commercial PV	NYC	CST-RE																		
Small Commercial PV	HV	CST-RE																		
Small Commercial PV	UP	CST-RE																		
Large Commercial PV	LI	CST-RE				\$124,728	\$150,797	\$176,404	\$188,190	\$200,448	\$189,721	\$179,492	\$169,640	\$154,933	\$140,816	\$127,209	\$141,447	\$153,613	\$163,895	\$172,468
Large Commercial PV	NYC	CST-RE				\$112,815	\$136,966	\$162,775	\$173,129	\$185,932	\$171,316	\$159,572	\$150,324	\$136,744	\$125,538	\$116,431	\$142,738	\$166,556	\$188,092	\$207,538
Large Commercial PV	HV	CST-RE																\$1,328	\$17,779	\$32,321
Large Commercial PV	UP	CST-RE																		
Utility Scale PV	LI	Grid-RE		\$47,180	\$75,749	\$103,628	\$118,516	\$133,605	\$127,279	\$121,121	\$115,039	\$104,227	\$93,723	\$83,471	\$98,750	\$111,983	\$123,352	\$133,027		
Utility Scale PV	NYC	Grid-RE																\$7,869	\$35,190	
Utility Scale PV	HV	Grid-RE																		
Utility Scale PV	UP	Grid-RE																		
Commercial and industrial boilers , furnaces, and kilns (per MMBTU/h for a 1 MMBTU/h system)	LI	CST-RE	\$97,635	\$97,850	\$96,707	\$94,496	\$91,961	\$89,113	\$86,297	\$83,497	\$80,698	\$77,857	\$75,026	\$73,603	\$70,731	\$67,833	\$65,008	\$62,210	\$59,448	\$56,753
Commercial and industrial boilers , furnaces, and kilns (per MMBTU/h for a 1 MMBTU/h system)	NYC	CST-RE	\$26,568	\$34,459	\$40,751	\$45,660	\$49,744	\$53,021	\$55,770	\$58,000	\$59,719	\$60,911	\$61,629	\$63,290	\$63,051	\$62,349	\$61,281	\$59,811	\$57,952	\$55,736
Commercial and industrial boilers , furnaces, and kilns (per MMBTU/h for a 1 MMBTU/h system)	HV	CST-RE	\$49,637	\$51,839	\$52,701	\$52,491	\$51,878	\$50,890	\$49,851	\$48,750	\$47,582	\$46,306	\$44,986	\$45,011	\$43,525	\$41,960	\$40,408	\$38,828	\$37,234	\$35,654
Commercial and industrial boilers , furnaces, and kilns (per MMBTU/h for a 1 MMBTU/h system)	UP	CST-RE	\$48,465	\$50,715	\$51,626	\$51,465	\$50,899	\$49,957	\$48,962	\$47,902	\$46,774	\$45,536	\$44,253	\$44,313	\$42,861	\$41,329	\$39,808	\$38,258	\$36,692	\$35,140
Residential stove, boiler, furnace (per MMBTU/h for a 0.04 MMBTU/h system)	LI	CST-RE	\$22,876	\$27,768	\$30,971	\$32,788	\$34,019	\$34,688	\$35,175	\$35,473	\$35,575	\$35,446	\$35,152	\$29,986	\$29,651	\$29,123	\$28,519	\$27,798	\$26,977	\$26,099
Residential stove, boiler, furnace (per MMBTU/h for a 0.04 MMBTU/h system)	NYC	CST-RE	\$27,055	\$31,781	\$34,813	\$36,459	\$37,523	\$38,029	\$38,361	\$38,510	\$38,470	\$38,204	\$37,779	\$32,488	\$32,032	\$31,389	\$30,674	\$29,847	\$28,925	\$27,950
Residential stove, boiler, furnace (per MMBTU/h for a 0.04 MMBTU/h system)	HV	CST-RE	\$3,850	\$9,501	\$13,479	\$16,079	\$18,070	\$19,479	\$20,672	\$21,646	\$22,396	\$22,889	\$23,191	\$18,596	\$18,809	\$18,809	\$18,708	\$18,470	\$18,112	\$17,677
Residential stove, boiler, furnace (per MMBTU/h for a 0.04 MMBTU/h system)	UP	CST-RE					\$2,215	\$4,360	\$6,256	\$7,901	\$9,295	\$10,406	\$11,302	\$7,275	\$8,032	\$8,556	\$8,956	\$9,197	\$9,300	\$9,304
Cofiring 5% biomass per cofired MW	HV	Grid-RE																		
Cofiring 5% biomass per cofired MW	UP	Grid-RE																		
Direct-fired stand alone power plants (per MW for a 45 MW plant)	HV	Grid-RE																		
Direct-fired stand alone power plants (per MW for a 45 MW plant)	UP	Grid-RE																		
CHP/ District heat (institutional, district) (per MW for a 2 MWe thermal led plant)	LI	CST-RE	\$12,954,983	\$12,424,501	\$11,753,420	\$11,294,881	\$10,795,118	\$10,304,186	\$9,833,754	\$9,382,236	\$8,948,206	\$8,554,715	\$8,173,674	\$7,804,878	\$7,447,739	\$7,100,212	\$6,767,114	\$6,446,165	\$6,137,186	\$5,840,804
CHP/ District heat (institutional, district) (per MW for a 2 MWe thermal led plant)	NYC	CST-RE	\$10,910,961	\$10,756,676	\$10,551,384	\$10,312,010	\$10,030,969	\$9,743,669	\$9,458,387	\$9,174,266	\$8,890,437	\$8,630,643	\$8,366,488	\$8,098,292	\$7,825,755	\$7,547,255	\$7,265,477	\$6,978,611	\$6,686,560	\$6,389,935
CHP/ District heat (institutional, district) (per MW for a 2 MWe thermal led plant)	HV	CST-RE	\$10,289,783	\$9,978,746	\$9,631,836	\$9,263,705	\$8,843,054	\$8,431,575	\$8,039,660	\$7,665,707	\$7,308,408	\$6,989,343	\$6,680,779	\$6,382,034	\$6,092,614	\$5,810,740	\$5,540,421	\$5,279,679	\$5,028,430	\$4,787,251
CHP/ District heat (institutional, district) (per MW for a 2 MWe thermal led plant)	UP	CST-RE	\$9,944,304	\$9,648,388	\$9,321,289	\$8,970,162	\$8,573,472	\$8,182,143	\$7,806,872	\$7,446,368	\$7,099,619	\$6,790,333	\$6,490,832	\$6,200,476	\$5,918,815	\$5,644,120	\$5,380,511	\$5,126,043	\$4,880,660	\$4,644,963

Energy Efficiency and Renewable Energy Potential Study of New York State

Measure Name	Measure ID3 Zone	Measure ID1 Sector	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
C&I B5 blend for statewide use	LI	CST-RE																		
C&I B5 blend for statewide use	NYC	CST-RE																		
C&I B5 blend for statewide use	HV	CST-RE																		
C&I B5 blend for statewide use	UP	CST-RE																		
Res B5 blend for statewide use	LI	CST-RE																		
Res B5 blend for statewide use	NYC	CST-RE																		
Res B5 blend for statewide use	HV	CST-RE																		
Res B5 blend for statewide use	UP	CST-RE																		
Grid-tied Bio-liquids to power co-firing in boilers (soy biodiesel, or other biodiesel)(per MMBTU/h)	LI	Grid-RE	\$3,007,501	\$2,713,324	\$2,092,719	\$1,983,115	\$1,861,289	\$1,779,833	\$1,676,559	\$1,644,413	\$1,609,539	\$1,570,385	\$1,527,264	\$1,480,729	\$1,431,313	\$1,379,728	\$1,329,361	\$1,280,500	\$1,233,088	\$1,186,954
Grid-tied Bio-liquids to power co-firing in boilers (soy biodiesel, or other biodiesel)(per MMBTU/h)	NYC	Grid-RE	\$2,956,286	\$2,887,645	\$2,707,487	\$2,516,771	\$2,354,608	\$2,240,600	\$2,111,844	\$2,060,637	\$2,012,526	\$1,965,024	\$1,917,971	\$1,871,479	\$1,825,683	\$1,780,918	\$1,736,408	\$1,692,521	\$1,649,279	\$1,606,579
Grid-tied Bio-liquids to power co-firing in boilers (soy biodiesel, or other biodiesel)(per MMBTU/h)	HV	Grid-RE	\$1,572,028	\$1,580,212	\$1,491,411	\$1,396,599	\$1,271,702	\$1,193,458	\$1,099,085	\$1,080,924	\$1,064,561	\$1,044,718	\$1,021,582	\$995,582	\$967,138	\$936,850	\$907,027	\$877,967	\$849,637	\$821,892
Grid-tied Bio-liquids to power co-firing in boilers (soy biodiesel, or other biodiesel)(per MMBTU/h)	UP	Grid-RE	\$892,748	\$932,087	\$884,399	\$824,193	\$749,302	\$712,618	\$652,157	\$660,940	\$665,186	\$664,310	\$658,621	\$648,653	\$634,926	\$618,124	\$600,842	\$583,428	\$565,913	\$548,210
Landfill gas (per MW for a 3MW system)	LI	Grid-RE	\$4,725,795	\$4,332,608	\$3,509,098	\$3,339,677	\$3,155,746	\$3,021,761	\$2,860,288	\$2,790,704	\$2,717,939	\$2,640,100	\$2,557,912	\$2,472,042	\$2,383,097	\$2,291,630	\$2,202,598	\$2,115,997	\$2,031,815	\$1,950,035
Landfill gas (per MW for a 3MW system)	NYC	Grid-RE	\$4,409,984	\$4,325,790	\$4,089,177	\$3,831,906	\$3,606,869	\$3,441,132	\$3,256,400	\$3,171,251	\$3,089,874	\$3,009,157	\$2,929,254	\$2,850,298	\$2,772,408	\$2,695,687	\$2,619,654	\$2,544,446	\$2,470,183	\$2,396,972
Landfill gas (per MW for a 3MW system)	HV	Grid-RE	\$2,960,021	\$2,952,503	\$2,811,685	\$2,656,815	\$2,464,615	\$2,330,856	\$2,177,241	\$2,122,353	\$2,070,386	\$2,014,600	\$1,955,535	\$1,893,684	\$1,829,499	\$1,763,391	\$1,698,853	\$1,635,901	\$1,574,546	\$1,514,791
Landfill gas (per MW for a 3MW system)	UP	Grid-RE	\$2,136,709	\$2,165,572	\$2,074,422	\$1,961,372	\$1,830,354	\$1,747,460	\$1,635,301	\$1,613,302	\$1,586,439	\$1,553,629	\$1,515,567	\$1,472,888	\$1,426,179	\$1,375,974	\$1,326,236	\$1,277,054	\$1,228,504	\$1,180,654
Farm waste, food waste, and wastewater digesters (per MW for a 0.3 MW system)	LI	CST-RE																		
Farm waste, food waste, and wastewater digesters (per MW for a 0.3 MW system)	NYC	CST-RE			\$2,241	\$73,438									\$14,646	\$72,403	\$124,292	\$170,767	\$212,251	\$249,138
Farm waste, food waste, and wastewater digesters (per MW for a 0.3 MW system)	HV	CST-RE																		
Farm waste, food waste, and wastewater digesters (per MW for a 0.3 MW system)	UP	CST-RE																		
Residential SWH - Elec	LI	CST-RE	\$541,017	\$506,323	\$396,868	\$428,006	\$418,898	\$412,380	\$408,017	\$405,435	\$186,637	\$225,302	\$257,150	\$282,854	\$303,028	\$318,236	\$330,352	\$339,704	\$346,592	\$351,287
Residential SWH - Elec	NYC	CST-RE	\$536,242	\$538,637	\$524,494	\$504,984	\$484,035	\$468,755	\$458,412	\$452,353	\$216,516	\$258,470	\$295,019	\$326,681	\$353,933	\$377,206	\$397,495	\$415,096	\$430,282	\$443,298
Residential SWH - Elec	HV	CST-RE	\$234,554	\$277,177	\$310,848	\$340,594	\$326,185	\$316,117	\$309,801	\$306,716	\$113,601	\$150,326	\$180,836	\$205,742	\$225,600	\$240,922	\$253,430	\$263,419	\$271,159	\$276,894
Residential SWH - Elec	UP	CST-RE	\$231,592	\$271,918	\$307,127	\$336,347	\$332,458	\$328,766	\$325,113	\$321,371	\$145,690	\$174,008	\$197,284	\$216,019	\$230,673	\$241,664	\$250,184	\$256,499	\$260,850	\$263,456
Residential SWH - NG	LI	CST-RE																		
Residential SWH - NG	NYC	CST-RE																		
Residential SWH - NG	HV	CST-RE																		
Residential SWH - NG	UP	CST-RE																		
Residential SWH - Petro	LI	CST-RE	\$2,366,195	\$2,296,398	\$2,217,710	\$2,132,479	\$2,033,264	\$1,937,298	\$1,847,280	\$1,762,465	\$1,192,599	\$1,171,941	\$1,148,777	\$1,123,494	\$1,096,357	\$1,067,280	\$1,037,301	\$1,006,262	\$974,435	\$942,247
Residential SWH - Petro	NYC	CST-RE	\$2,291,826	\$2,226,266	\$2,151,509	\$2,069,933	\$1,973,331	\$1,879,962	\$1,792,528	\$1,710,267	\$1,139,624	\$1,123,513	\$1,104,514	\$1,083,044	\$1,059,398	\$1,033,513	\$1,006,456	\$978,089	\$948,707	\$918,754
Residential SWH - Petro	HV	CST-RE	\$2,362,572	\$2,291,327	\$2,211,649	\$2,125,806	\$2,027,128	\$1,931,628	\$1,841,935	\$1,757,334	\$1,202,562	\$1,178,970	\$1,153,227	\$1,125,685	\$1,096,582	\$1,065,816	\$1,034,376	\$1,002,092	\$969,216	\$936,145
Residential SWH - Petro	UP	CST-RE	\$2,479,992	\$2,400,999	\$2,314,357	\$2,222,237	\$2,119,696	\$2,020,314	\$1,926,668	\$1,838,093	\$1,294,237	\$1,261,445	\$1,227,344	\$1,192,216	\$1,156,234	\$1,119,247	\$1,082,166	\$1,044,782	\$1,007,298	\$970,063
Commercial SWH - Elec	LI	CST-RE	\$1,671,740	\$1,581,286	\$1,417,342	\$1,395,280	\$1,339,658	\$1,288,335	\$1,240,879	\$1,196,905	\$1,156,067	\$1,139,212	\$1,118,693	\$1,094,984	\$1,068,517	\$1,039,686	\$1,010,424	\$980,887	\$951,217	\$921,535
Commercial SWH - Elec	NYC	CST-RE	\$1,794,022	\$1,739,297	\$1,666,673	\$1,587,618	\$1,514,370	\$1,448,762	\$1,390,052	\$1,337,570	\$1,290,710	\$1,271,712	\$1,251,056	\$1,229,018	\$1,205,845	\$1,181,756	\$1,157,644	\$1,133,613	\$1,109,752	\$1,086,140
Commercial SWH - Elec	HV	CST-RE	\$1,253,327	\$1,245,292	\$1,229,687	\$1,211,531	\$1,155,356	\$1,105,034	\$1,059,982	\$1,019,673	\$983,632	\$969,993	\$953,029	\$933,169	\$910,802	\$886,281	\$861,381	\$836,241	\$810,981	\$785,711
Commercial SWH - Elec	UP	CST-RE	\$1,113,924	\$1,109,981	\$1,102,341	\$1,090,103	\$1,050,011	\$1,011,439	\$974,229	\$938,249	\$903,384	\$887,891	\$869,879	\$849,692	\$827,641	\$804,006	\$779,981	\$755,698	\$731,273	\$706,812
Commercial SWH - NG	LI	CST-RE										\$22,415	\$44,476	\$63,268	\$79,228	\$92,685	\$103,701	\$112,572	\$119,953	\$126,156
Commercial SWH - NG	NYC	CST-RE	\$13,447	\$21,455	\$28,909	\$35,416	\$30,928	\$28,154	\$26,579	\$26,088	\$26,673	\$52,790	\$74,785	\$93,368	\$109,005	\$122,045	\$132,541	\$140,810	\$147,561	\$153,124
Commercial SWH - NG	HV	CST-RE	\$150,225	\$150,989	\$151,577	\$151,584	\$142,235	\$134,623	\$128,261	\$123,059	\$119,024	\$137,566	\$152,610	\$164,814	\$174,591	\$182,251	\$187,812	\$191,551	\$194,139	\$195,874
Commercial SWH - NG	UP	CST-RE										\$2,424	\$20,577	\$36,120	\$49,397	\$60,670	\$69,990	\$77,592	\$83,986	\$89,417
Commercial SWH - Petro	LI	CST-RE	\$3,227,007	\$3,110,487	\$2,986,902	\$2,858,766	\$2,722,934	\$2,591,679	\$2,467,754	\$2,350,420	\$2,239,021	\$2,156,464	\$2,075,188	\$1,995,337	\$1,916,935	\$1,839,600	\$1,764,337	\$1,690,716	\$1,618,851	\$1,549,053
Commercial SWH - Petro	NYC	CST-RE	\$2,587,205	\$2,535,884	\$2,475,376	\$2,407,606	\$2,327,358	\$2,247,719	\$2,170,872	\$2,096,281	\$2,023,460	\$1,976,938	\$1,927,522	\$1,875,536	\$1,821,130	\$1,764,068	\$1,705,341	\$1,644,631	\$1,582,090	\$1,518,048
Commercial SWH - Petro	HV	CST-RE	\$2,925,644	\$2,820,698	\$2,709,067	\$2,593,059	\$2,469,639	\$2,350,335	\$2,237,727	\$2,131,140	\$2,029,997	\$1,955,583	\$1,882,362	\$1,810,372	\$1,739,640	\$1,669,819	\$1,601,834	\$1,535,292	\$1,470,304	\$1,407,156
Commercial SWH - Petro	UP	CST-RE	\$3,082,319	\$2,969,104	\$2,849,658	\$2,726,264	\$2,597,255	\$2,472,405	\$2,354,318	\$2,242,344	\$2,135,928	\$2,053,051	\$1,972,046	\$1,892,898	\$1,815,581	\$1,739,704	\$1,666,149	\$1,594,484	\$1,524,783	\$1,457,300

Energy Efficiency and Renewable Energy Potential Study of New York State

Measure Name	Measure ID3 Zone	Measure ID1 Sector	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Residential Wind (1-10 kW)	LI	CST-RE																		
Residential Wind (1-10 kW)	HV	CST-RE																		
Residential Wind (1-10 kW)	UP	CST-RE																		
Commercial Wind (3kW-1 MW)	LI	CST-RE												\$16,960	\$63,228	\$102,767	\$138,062	\$169,431	\$197,170	\$221,556
Commercial Wind (3kW-1 MW)	HV	CST-RE																		
Commercial Wind (3kW-1 MW)	UP	CST-RE																		
Community Scale Wind (1-3MW)	LI	Grid-RE														\$4,732	\$45,770	\$82,554	\$115,398	\$144,596
Community Scale Wind (1-3MW)	HV	Grid-RE																		
Community Scale Wind (1-3MW)	UP	Grid-RE																		
Windfarm (2-5 MW)	LI	Grid-RE	\$314,237	\$285,587	\$35,626	\$35,166	\$31,905	\$60,486	\$60,962	\$126,354	\$183,000	\$231,830	\$273,413	\$308,282	\$336,936	\$359,840	\$379,523	\$396,238	\$410,222	\$421,693
Windfarm (2-5 MW)	HV	Grid-RE															\$26,297	\$55,114	\$80,967	\$104,074
Windfarm (2-5 MW)	UP	Grid-RE														\$30,091	\$61,376	\$89,200	\$113,821	\$135,478
Offshore Wind (2-5 MW)	LI	Grid-RE																		
Offshore Wind (2-5 MW)	NYC	Grid-RE																		\$5,786
Run of the River Low Power 10kW-1MW	UP	Grid-RE											\$5,840	\$21,618	\$33,664	\$42,327	\$49,615	\$55,648	\$60,537	\$64,385
Run of the River Low Power 10kW-1MW	HV	Grid-RE	\$201,377	\$259,128	\$254,717	\$240,796	\$206,008	\$194,080	\$170,422	\$187,877	\$204,057	\$216,424	\$225,333	\$231,110	\$234,058	\$234,456	\$234,036	\$232,882	\$231,073	\$228,679
Run of the River Low Power 10kW-1MW	LI	Grid-RE	\$1,071,220	\$954,027	\$644,157	\$619,994	\$585,877	\$570,780	\$540,512	\$548,282	\$552,041	\$551,543	\$547,223	\$539,479	\$528,682	\$515,169	\$501,372	\$487,356	\$473,182	\$458,904
Run of the River High Power 1-30 MW	UP	Grid-RE											\$5,840	\$21,618	\$33,664	\$42,327	\$49,615	\$55,648	\$60,537	\$64,385
Run of the River High Power 1-30 MW	HV	Grid-RE	\$201,377	\$259,128	\$254,717	\$240,796	\$206,008	\$194,080	\$170,422	\$187,877	\$204,057	\$216,424	\$225,333	\$231,110	\$234,058	\$234,456	\$234,036	\$232,882	\$231,073	\$228,679
Undeveloped Sites 100+ kW	UP	Grid-RE											\$23,942	\$43,399	\$58,098	\$68,482	\$77,136	\$84,212	\$89,852	\$94,186
Undeveloped Sites 100+ kW	HV	Grid-RE	\$287,326	\$360,218	\$353,152	\$333,914	\$287,880	\$271,342	\$239,764	\$261,176	\$281,002	\$295,972	\$306,539	\$313,121	\$316,105	\$315,848	\$314,578	\$312,402	\$309,417	\$305,714
Non-Powered Dams 1+ MW	UP	Grid-RE	\$516,442	\$574,399	\$561,556	\$533,717	\$491,537	\$474,733	\$439,187	\$453,318	\$462,903	\$467,593	\$467,871	\$464,185	\$456,947	\$446,537	\$435,482	\$423,877	\$411,809	\$399,358
Non-Powered Dams 1+ MW	HV	Grid-RE	\$1,045,620	\$1,078,980	\$1,034,443	\$979,688	\$899,987	\$851,539	\$789,714	\$782,455	\$775,106	\$764,317	\$750,468	\$733,906	\$714,953	\$693,903	\$672,924	\$652,066	\$631,374	\$610,887
Re-Powered Dams 100+ kW	UP	Grid-RE	\$2,601,750	\$2,550,994	\$2,435,106	\$2,309,594	\$2,174,832	\$2,070,274	\$1,951,548	\$1,886,835	\$1,821,688	\$1,755,540	\$1,688,674	\$1,621,344	\$1,553,780	\$1,486,190	\$1,420,935	\$1,357,955	\$1,297,192	\$1,238,583
Re-Powered Dams 100+ kW	HV	Grid-RE	\$3,130,928	\$3,055,575	\$2,907,993	\$2,755,565	\$2,583,283	\$2,447,079	\$2,302,075	\$2,215,973	\$2,133,890	\$2,052,264	\$1,971,271	\$1,891,066	\$1,811,787	\$1,733,556	\$1,658,377	\$1,586,145	\$1,516,756	\$1,450,112
Wave Energy 10 kW+	LI	Grid-RE																		
Tidal Energy 30 kW+	LI	Grid-RE																		
Tidal Energy 30 kW+	NYC	Grid-RE																		

AppendixD: Renewable Technology Benefit Cost Ratios by Measure and Year

Measure Name	Measure ID3 Zone	Measure ID1 Sector	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Residential PV	LI	CST-RE	0.64	0.69	0.72	0.81	0.82	0.84	0.86	0.87	0.87	0.87	0.86	0.86	0.85	0.84	0.86	0.88	0.90	0.92
Residential PV	NYC	CST-RE	0.59	0.65	0.71	0.78	0.79	0.81	0.82	0.83	0.82	0.82	0.82	0.81	0.81	0.81	0.83	0.85	0.88	0.90
Residential PV	HV	CST-RE	0.50	0.56	0.62	0.69	0.71	0.72	0.73	0.74	0.74	0.73	0.73	0.72	0.72	0.71	0.73	0.74	0.76	0.78
Residential PV	UP	CST-RE	0.42	0.47	0.53	0.59	0.60	0.61	0.62	0.63	0.63	0.63	0.63	0.62	0.61	0.61	0.62	0.63	0.65	0.66
Small Commercial PV	LI	CST-RE	0.64	0.70	0.73	0.81	0.83	0.85	0.86	0.88	0.87	0.87	0.87	0.86	0.86	0.85	0.87	0.89	0.91	0.93
Small Commercial PV	NYC	CST-RE	0.61	0.67	0.73	0.79	0.81	0.82	0.83	0.84	0.84	0.84	0.83	0.83	0.83	0.82	0.85	0.87	0.90	0.92
Small Commercial PV	HV	CST-RE	0.51	0.57	0.63	0.70	0.71	0.73	0.73	0.75	0.74	0.74	0.74	0.73	0.72	0.72	0.73	0.75	0.77	0.78
Small Commercial PV	UP	CST-RE	0.43	0.48	0.54	0.60	0.61	0.63	0.64	0.65	0.64	0.64	0.64	0.63	0.63	0.62	0.63	0.65	0.66	0.67
Large Commercial PV	LI	CST-RE	0.86	0.93	0.97	1.08	1.11	1.13	1.15	1.17	1.17	1.16	1.16	1.15	1.14	1.14	1.16	1.19	1.21	1.24
Large Commercial PV	NYC	CST-RE	0.81	0.89	0.97	1.06	1.08	1.10	1.11	1.12	1.12	1.12	1.11	1.11	1.10	1.10	1.13	1.16	1.19	1.23
Large Commercial PV	HV	CST-RE	0.68	0.76	0.84	0.93	0.95	0.97	0.98	1.00	0.99	0.99	0.98	0.98	0.97	0.96	0.98	1.00	1.02	1.05
Large Commercial PV	UP	CST-RE	0.58	0.64	0.72	0.80	0.82	0.84	0.85	0.86	0.86	0.85	0.85	0.84	0.84	0.83	0.85	0.86	0.88	0.90
Utility Scale PV	LI	Grid-RE	0.82	0.89	0.93	1.03	1.06	1.09	1.10	1.12	1.12	1.12	1.12	1.11	1.10	1.10	1.12	1.15	1.18	1.20
Utility Scale PV	NYC	Grid-RE	0.65	0.72	0.79	0.86	0.88	0.90	0.91	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.95	0.98	1.01	1.04
Utility Scale PV	HV	Grid-RE	0.63	0.70	0.79	0.88	0.89	0.91	0.92	0.94	0.94	0.93	0.93	0.92	0.92	0.91	0.93	0.95	0.97	0.99
Utility Scale PV	UP	Grid-RE	0.52	0.58	0.65	0.73	0.75	0.77	0.78	0.79	0.79	0.79	0.79	0.78	0.77	0.77	0.78	0.80	0.82	0.83
Commercial and industrial boilers , furnaces, and kilns (per MMBTU/h for a 1 MMBTU/h system)	LI	CST-RE	1.23	1.24	1.25	1.26	1.27	1.27	1.28	1.28	1.29	1.29	1.30	1.31	1.31	1.32	1.32	1.32	1.32	1.33
Commercial and industrial boilers , furnaces, and kilns (per MMBTU/h for a 1 MMBTU/h system)	NYC	CST-RE	1.06	1.09	1.11	1.13	1.14	1.16	1.18	1.20	1.21	1.23	1.24	1.27	1.28	1.29	1.30	1.31	1.32	1.32
Commercial and industrial boilers , furnaces, and kilns (per MMBTU/h for a 1 MMBTU/h system)	HV	CST-RE	1.12	1.13	1.14	1.14	1.15	1.15	1.16	1.16	1.17	1.17	1.18	1.19	1.19	1.20	1.20	1.20	1.20	1.21
Commercial and industrial boilers , furnaces, and kilns (per MMBTU/h for a 1 MMBTU/h system)	UP	CST-RE	1.11	1.13	1.13	1.14	1.15	1.15	1.16	1.16	1.17	1.17	1.17	1.19	1.19	1.19	1.20	1.20	1.20	1.20
Residential stove, boiler, furnace (per MMBTU/h for a 0.04 MMBTU/h system)	LI	CST-RE	1.04	1.05	1.06	1.07	1.07	1.08	1.08	1.09	1.09	1.10	1.10	1.09	1.09	1.10	1.10	1.10	1.11	1.11
Residential stove, boiler, furnace (per MMBTU/h for a 0.04 MMBTU/h system)	NYC	CST-RE	1.05	1.06	1.07	1.07	1.08	1.08	1.09	1.09	1.10	1.10	1.11	1.10	1.10	1.10	1.11	1.11	1.11	1.12
Residential stove, boiler, furnace (per MMBTU/h for a 0.04 MMBTU/h system)	HV	CST-RE	1.01	1.02	1.03	1.03	1.04	1.04	1.05	1.05	1.06	1.06	1.07	1.06	1.06	1.06	1.07	1.07	1.07	1.07
Residential stove, boiler, furnace (per MMBTU/h for a 0.04 MMBTU/h system)	UP	CST-RE	0.97	0.98	0.99	1.00	1.00	1.01	1.01	1.02	1.02	1.03	1.03	1.02	1.03	1.03	1.03	1.03	1.04	1.04
Cofiring 5% biomass per cofired MW	HV	Grid-RE	0.46	0.46	0.45	0.44	0.44	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43
Cofiring 5% biomass per cofired MW	UP	Grid-RE	0.46	0.46	0.45	0.44	0.44	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43
Direct-fired stand alone power plants (per MW for a 45 MW plant)	HV	Grid-RE	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.55	0.55	0.55	0.56	0.56	0.56	0.57	0.57	0.57	0.57
Direct-fired stand alone power plants (per MW for a 45 MW plant)	UP	Grid-RE	0.46	0.47	0.47	0.47	0.47	0.47	0.47	0.48	0.48	0.49	0.49	0.49	0.50	0.50	0.50	0.50	0.50	0.51

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Measure Name	Measure ID3 Zone	Measure ID1 Sector	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
CHP/ District heat (institutional, district) (per MW for a 2 MWe thermal led plant)	LI	CST-RE	2.00	2.00	2.00	2.01	2.01	2.01	2.01	2.01	2.01	2.02	2.02	2.03	2.03	2.04	2.04	2.04	2.05	2.05
CHP/ District heat (institutional, district) (per MW for a 2 MWe thermal led plant)	NYC	CST-RE	1.84	1.87	1.89	1.92	1.94	1.95	1.97	1.99	2.00	2.03	2.05	2.07	2.09	2.10	2.12	2.13	2.14	2.15
CHP/ District heat (institutional, district) (per MW for a 2 MWe thermal led plant)	HV	CST-RE	1.79	1.81	1.82	1.83	1.83	1.83	1.83	1.83	1.83	1.83	1.84	1.84	1.84	1.85	1.85	1.86	1.86	1.86
CHP/ District heat (institutional, district) (per MW for a 2 MWe thermal led plant)	UP	CST-RE	1.77	1.78	1.79	1.80	1.80	1.80	1.80	1.80	1.80	1.81	1.81	1.82	1.82	1.82	1.83	1.83	1.83	1.84
C&I B5 blend for statewide use	LI	CST-RE	0.98	0.98	0.98	0.98	0.98	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	1.00	1.00	1.00	1.00
C&I B5 blend for statewide use	NYC	CST-RE	0.97	0.97	0.98	0.98	0.98	0.98	0.98	0.98	0.99	0.99	0.99	0.99	0.99	0.99	1.00	1.00	1.00	1.00
C&I B5 blend for statewide use	HV	CST-RE	0.97	0.98	0.98	0.98	0.98	0.98	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	1.00	1.00	1.00	1.00
C&I B5 blend for statewide use	UP	CST-RE	0.97	0.98	0.98	0.98	0.98	0.98	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	1.00	1.00	1.00	1.00
Res B5 blend for statewide use	LI	CST-RE	0.98	0.98	0.98	0.98	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	1.00	1.00	1.00	1.00	1.00
Res B5 blend for statewide use	NYC	CST-RE	0.98	0.98	0.98	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	1.00	1.00	1.00	1.00	1.00
Res B5 blend for statewide use	HV	CST-RE	0.98	0.98	0.98	0.98	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	1.00	1.00	1.00	1.00	1.00
Res B5 blend for statewide use	UP	CST-RE	0.98	0.98	0.98	0.98	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	1.00	1.00	1.00	1.00	1.00
Grid-tied Bio-liquids to power co-firing in boilers (soy biodiesel, or other biodiesel(per MMBTU/h)	LI	Grid-RE	1.53	1.50	1.40	1.39	1.38	1.38	1.37	1.38	1.39	1.40	1.41	1.42	1.43	1.43	1.44	1.45	1.46	1.46
Grid-tied Bio-liquids to power co-firing in boilers (soy biodiesel, or other biodiesel(per MMBTU/h)	NYC	Grid-RE	1.52	1.53	1.51	1.49	1.48	1.47	1.46	1.47	1.49	1.50	1.51	1.53	1.54	1.56	1.57	1.59	1.61	1.62
Grid-tied Bio-liquids to power co-firing in boilers (soy biodiesel, or other biodiesel(per MMBTU/h)	HV	Grid-RE	1.28	1.29	1.29	1.28	1.26	1.26	1.24	1.25	1.26	1.27	1.28	1.29	1.29	1.30	1.31	1.31	1.32	1.33
Grid-tied Bio-liquids to power co-firing in boilers (soy biodiesel, or other biodiesel(per MMBTU/h)	UP	Grid-RE	1.16	1.18	1.17	1.17	1.16	1.16	1.15	1.16	1.17	1.18	1.18	1.19	1.20	1.20	1.21	1.21	1.22	1.22
Landfill gas (per MW for a 3MW system)	LI	Grid-RE	2.54	2.49	2.23	2.18	2.13	2.11	2.07	2.10	2.13	2.16	2.19	2.21	2.23	2.25	2.27	2.28	2.30	2.32
Landfill gas (per MW for a 3MW system)	NYC	Grid-RE	2.44	2.49	2.43	2.35	2.29	2.26	2.22	2.25	2.29	2.32	2.36	2.40	2.43	2.47	2.51	2.54	2.58	2.62
Landfill gas (per MW for a 3MW system)	HV	Grid-RE	1.97	2.02	1.98	1.94	1.88	1.86	1.82	1.84	1.86	1.89	1.91	1.93	1.95	1.96	1.98	1.99	2.01	2.02
Landfill gas (per MW for a 3MW system)	UP	Grid-RE	1.70	1.75	1.73	1.69	1.65	1.64	1.61	1.64	1.66	1.68	1.70	1.72	1.74	1.75	1.76	1.77	1.79	1.80
Farm waste, food waste, and wastewater digesters (per MW for a 0.3 MW system)	LI	CST-RE	0.79	0.76	0.66	0.69	0.68	0.68	0.67	0.66	0.66	0.67	0.69	0.70	0.71	0.72	0.73	0.74	0.75	0.76
Farm waste, food waste, and wastewater digesters (per MW for a 0.3 MW system)	HV	CST-RE	0.47	0.49	0.52	0.54	0.53	0.53	0.52	0.51	0.51	0.52	0.53	0.54	0.55	0.56	0.57	0.58	0.59	0.60
Farm waste, food waste, and wastewater digesters (per MW for a 0.3 MW system)	UP	CST-RE	0.32	0.34	0.37	0.40	0.40	0.40	0.40	0.40	0.40	0.41	0.42	0.43	0.44	0.45	0.45	0.46	0.47	0.47
Residential SWH - Elec	LI	CST-RE	1.36	1.36	1.29	1.34	1.34	1.35	1.36	1.38	1.18	1.24	1.30	1.36	1.42	1.48	1.54	1.60	1.67	1.73
Residential SWH - Elec	NYC	CST-RE	1.34	1.36	1.37	1.37	1.37	1.38	1.39	1.40	1.20	1.26	1.32	1.39	1.46	1.53	1.61	1.69	1.78	1.88
Residential SWH - Elec	HV	CST-RE	1.17	1.21	1.25	1.29	1.29	1.29	1.30	1.31	1.12	1.17	1.23	1.28	1.33	1.39	1.44	1.50	1.56	1.62
Residential SWH - Elec	UP	CST-RE	1.20	1.24	1.29	1.33	1.34	1.36	1.37	1.38	1.18	1.24	1.29	1.35	1.40	1.46	1.51	1.57	1.63	1.70
Residential SWH - NG	LI	CST-RE	0.44	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.37	0.39	0.40	0.42	0.43	0.45	0.46	0.48	0.50	0.51
Residential SWH - NG	NYC	CST-RE	0.47	0.47	0.47	0.48	0.48	0.47	0.47	0.48	0.39	0.41	0.42	0.44	0.45	0.47	0.49	0.50	0.52	0.54
Residential SWH - NG	HV	CST-RE	0.54	0.55	0.55	0.56	0.55	0.55	0.55	0.55	0.46	0.48	0.49	0.51	0.53	0.55	0.57	0.59	0.61	0.63
Residential SWH - NG	UP	CST-RE	0.43	0.43	0.44	0.44	0.44	0.44	0.44	0.44	0.36	0.37	0.39	0.40	0.42	0.43	0.45	0.46	0.48	0.50

Energy Efficiency and Renewable Energy Potential Study of New York State

Measure Name	Measure ID3 Zone	Measure ID1 Sector	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Residential SWH - Petro	LI	CST-RE	2.58	2.62	2.65	2.67	2.66	2.65	2.65	2.65	2.17	2.25	2.33	2.42	2.51	2.59	2.69	2.78	2.87	2.97
Residential SWH - Petro	NYC	CST-RE	2.44	2.48	2.51	2.53	2.52	2.52	2.51	2.51	2.06	2.13	2.21	2.29	2.37	2.46	2.55	2.63	2.72	2.81
Residential SWH - Petro	HV	CST-RE	2.70	2.73	2.77	2.79	2.78	2.77	2.77	2.77	2.27	2.35	2.44	2.53	2.62	2.71	2.81	2.91	3.00	3.11
Residential SWH - Petro	UP	CST-RE	3.09	3.14	3.17	3.20	3.19	3.18	3.18	3.18	2.61	2.70	2.80	2.91	3.01	3.12	3.23	3.34	3.45	3.57
Commercial SWH - Elec	LI	CST-RE	2.55	2.54	2.46	2.52	2.52	2.53	2.54	2.55	2.58	2.69	2.80	2.92	3.04	3.16	3.28	3.41	3.54	3.67
Commercial SWH - Elec	NYC	CST-RE	2.57	2.60	2.62	2.63	2.62	2.62	2.63	2.64	2.66	2.78	2.90	3.04	3.17	3.31	3.47	3.63	3.80	3.98
Commercial SWH - Elec	HV	CST-RE	2.25	2.31	2.36	2.42	2.41	2.41	2.41	2.42	2.44	2.55	2.65	2.76	2.87	2.98	3.09	3.21	3.33	3.45
Commercial SWH - Elec	UP	CST-RE	2.30	2.37	2.44	2.50	2.51	2.52	2.53	2.54	2.56	2.66	2.77	2.88	3.00	3.11	3.23	3.35	3.47	3.60
Commercial SWH - NG	LI	CST-RE	0.97	0.98	0.99	1.00	0.99	0.99	0.99	0.99	1.00	1.03	1.07	1.11	1.15	1.19	1.23	1.28	1.32	1.37
Commercial SWH - NG	NYC	CST-RE	1.01	1.02	1.03	1.04	1.03	1.03	1.03	1.03	1.03	1.07	1.11	1.15	1.20	1.24	1.28	1.33	1.37	1.42
Commercial SWH - NG	HV	CST-RE	1.15	1.16	1.17	1.18	1.17	1.17	1.17	1.17	1.17	1.22	1.26	1.31	1.36	1.41	1.46	1.51	1.56	1.61
Commercial SWH - NG	UP	CST-RE	0.95	0.95	0.96	0.97	0.97	0.96	0.96	0.97	0.97	1.00	1.04	1.08	1.12	1.16	1.20	1.24	1.28	1.33
Commercial SWH - Petro	LI	CST-RE	3.99	4.04	4.08	4.11	4.09	4.07	4.06	4.05	4.05	4.20	4.34	4.50	4.66	4.82	4.98	5.15	5.32	5.50
Commercial SWH - Petro	NYC	CST-RE	3.26	3.34	3.41	3.47	3.49	3.51	3.54	3.57	3.60	3.77	3.93	4.11	4.28	4.46	4.63	4.81	4.99	5.16
Commercial SWH - Petro	UP	CST-RE	4.61	4.67	4.72	4.75	4.73	4.71	4.69	4.68	4.68	4.85	5.02	5.20	5.38	5.56	5.75	5.95	6.15	6.35
Residential Wind (1-10 kW)	LI	CST-RE	0.28	0.27	0.25	0.26	0.25	0.25	0.24	0.24	0.24	0.24	0.24	0.25	0.25	0.25	0.25	0.26	0.26	0.26
Residential Wind (1-10 kW)	HV	CST-RE	0.18	0.19	0.20	0.20	0.20	0.19	0.19	0.19	0.18	0.19	0.19	0.19	0.19	0.20	0.20	0.20	0.20	0.20
Residential Wind (1-10 kW)	UP	CST-RE	0.17	0.18	0.19	0.19	0.19	0.19	0.18	0.18	0.18	0.18	0.18	0.19	0.19	0.19	0.19	0.19	0.20	0.20
Commercial Wind (3kW-1 MW)	LI	CST-RE	0.88	0.87	0.79	0.81	0.82	0.84	0.85	0.88	0.91	0.95	0.98	1.01	1.04	1.07	1.10	1.14	1.17	1.20
Commercial Wind (3kW-1 MW)	HV	CST-RE	0.58	0.61	0.63	0.64	0.65	0.66	0.67	0.69	0.72	0.74	0.77	0.79	0.82	0.84	0.87	0.89	0.92	0.95
Commercial Wind (3kW-1 MW)	UP	CST-RE	0.57	0.61	0.62	0.63	0.64	0.66	0.67	0.69	0.72	0.75	0.77	0.80	0.82	0.85	0.87	0.90	0.92	0.95
Community Scale Wind (1-3MW)	LI	Grid-RE	0.82	0.81	0.72	0.73	0.74	0.76	0.77	0.81	0.84	0.87	0.91	0.94	0.97	1.00	1.04	1.07	1.10	1.13
Community Scale Wind (1-3MW)	HV	Grid-RE	0.42	0.45	0.46	0.48	0.48	0.50	0.51	0.53	0.55	0.58	0.60	0.62	0.65	0.67	0.69	0.72	0.74	0.77
Community Scale Wind (1-3MW)	UP	Grid-RE	0.48	0.52	0.54	0.55	0.56	0.57	0.58	0.61	0.64	0.66	0.69	0.72	0.74	0.76	0.79	0.81	0.84	0.87
Windfarm (2-5 MW)	LI	Grid-RE	1.17	1.16	1.02	1.02	1.02	1.04	1.04	1.08	1.13	1.17	1.22	1.26	1.30	1.34	1.39	1.43	1.47	1.52
Windfarm (2-5 MW)	HV	Grid-RE	0.68	0.73	0.74	0.75	0.75	0.76	0.76	0.79	0.83	0.86	0.89	0.93	0.96	0.99	1.03	1.06	1.10	1.13
Windfarm (2-5 MW)	UP	Grid-RE	0.70	0.75	0.76	0.77	0.77	0.78	0.79	0.82	0.86	0.89	0.93	0.96	1.00	1.03	1.06	1.09	1.13	1.16
Offshore Wind (2-5 MW)	LI	Grid-RE	0.43	0.42	0.37	0.40	0.42	0.45	0.49	0.52	0.55	0.58	0.61	0.65	0.68	0.71	0.74	0.77	0.80	0.84
Offshore Wind (2-5 MW)	NYC	Grid-RE	0.37	0.40	0.43	0.45	0.48	0.51	0.54	0.58	0.61	0.65	0.69	0.73	0.77	0.82	0.86	0.91	0.96	1.00
Run of the River Low Power 10kW-1MW	UP	Grid-RE	0.94	0.96	0.96	0.96	0.96	0.96	0.96	0.97	0.98	0.99	1.00	1.01	1.02	1.02	1.03	1.03	1.04	1.04
Run of the River Low Power 10kW-1MW	HV	Grid-RE	1.06	1.08	1.08	1.08	1.07	1.07	1.06	1.07	1.09	1.10	1.11	1.11	1.12	1.13	1.14	1.14	1.15	1.16
Run of the River Low Power 10kW-1MW	LI	Grid-RE	1.32	1.30	1.21	1.21	1.20	1.21	1.20	1.22	1.23	1.24	1.26	1.27	1.28	1.28	1.29	1.30	1.31	1.31
Run of the River High Power 1-30 MW	UP	Grid-RE	0.94	0.96	0.96	0.96	0.96	0.96	0.96	0.97	0.98	0.99	1.00	1.01	1.02	1.02	1.03	1.03	1.04	1.04
Run of the River High Power 1-30 MW	HV	Grid-RE	1.06	1.08	1.08	1.08	1.07	1.07	1.06	1.07	1.09	1.10	1.11	1.11	1.12	1.13	1.14	1.14	1.15	1.16
Undeveloped Sites 100+ kW	UP	Grid-RE	0.94	0.97	0.97	0.97	0.97	0.97	0.97	0.98	0.99	1.00	1.01	1.02	1.02	1.03	1.03	1.04	1.04	1.05
Undeveloped Sites 100+ kW	HV	Grid-RE	1.07	1.09	1.09	1.09	1.08	1.08	1.07	1.08	1.09	1.10	1.11	1.12	1.13	1.13	1.14	1.15	1.15	1.16
Non-Powered Dams 1+ MW	UP	Grid-RE	1.14	1.17	1.17	1.17	1.16	1.16	1.15	1.17	1.18	1.19	1.20	1.21	1.22	1.22	1.23	1.24	1.24	1.25
Non-Powered Dams 1+ MW	HV	Grid-RE	1.29	1.31	1.31	1.30	1.29	1.28	1.27	1.29	1.30	1.31	1.32	1.33	1.34	1.35	1.36	1.37	1.37	1.38
Re-Powered Dams 100+ kW	UP	Grid-RE	2.69	2.75	2.68	2.60	2.52	2.48	2.42	2.45	2.47	2.50	2.52	2.54	2.56	2.57	2.59	2.60	2.61	2.62
Re-Powered Dams 100+ kW	HV	Grid-RE	3.03	3.09	3.01	2.91	2.80	2.75	2.67	2.70	2.73	2.75	2.78	2.80	2.82	2.83	2.85	2.87	2.88	2.90
Wave Energy 10 kW+	LI	Grid-RE	0.16	0.16	0.14	0.16	0.17	0.19	0.20	0.21	0.22	0.24	0.25	0.27	0.28	0.30	0.31	0.32	0.34	0.36
Tidal Energy 30 kW+	LI	Grid-RE	0.44	0.45	0.42	0.46	0.49	0.52	0.55	0.58	0.62	0.66	0.68	0.70	0.72	0.74	0.76	0.77	0.79	0.81
Tidal Energy 30 kW+	NYC	Grid-RE	0.40	0.43	0.46	0.49	0.52	0.55	0.58	0.62	0.66	0.71	0.74	0.76	0.79	0.82	0.85	0.88	0.91	0.94

Appendix E: Renewable Technology Levelized Cost of Energy (Net \$/kWh) by Measure and Year

Measure Name	Zone	Sector	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Solar PV																				
Residential PV	LI	CST-RE	0.17	0.15	0.14	0.13	0.13	0.12	0.12	0.12	0.13	0.13	0.13	0.13	0.13	0.14	0.13	0.13	0.13	0.13
Residential PV	NYC	CST-RE	0.20	0.18	0.17	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.16	0.16	0.16	0.16	0.16	0.15	0.15
Residential PV	HV	CST-RE	0.18	0.16	0.15	0.13	0.13	0.13	0.13	0.13	0.13	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14
Residential PV	UP	CST-RE	0.19	0.17	0.16	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.14
Small Commercial PV	LI	CST-RE	0.16	0.15	0.14	0.13	0.12	0.12	0.12	0.12	0.12	0.13	0.13	0.13	0.13	0.14	0.13	0.13	0.13	0.13
Small Commercial PV	NYC	CST-RE	0.20	0.18	0.16	0.15	0.15	0.14	0.14	0.14	0.15	0.15	0.15	0.15	0.16	0.16	0.16	0.15	0.15	0.15
Small Commercial PV	HV	CST-RE	0.17	0.16	0.15	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.13
Small Commercial PV	UP	CST-RE	0.18	0.17	0.15	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.15	0.15	0.15	0.15	0.15	0.14	0.14
Large Commercial PV	LI	CST-RE	0.12	0.11	0.10	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.10	0.10	0.10	0.10	0.10	0.09	0.09
Large Commercial PV	NYC	CST-RE	0.14	0.13	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.10
Large Commercial PV	HV	CST-RE	0.13	0.12	0.11	0.10	0.10	0.10	0.10	0.09	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Large Commercial PV	UP	CST-RE	0.13	0.12	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.11	0.11	0.11	0.11	0.11	0.10	0.10
Utility Scale PV	LI	Grid-RE	0.12	0.11	0.11	0.10	0.10	0.10	0.10	0.09	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Utility Scale PV	NYC	Grid-RE	0.16	0.15	0.14	0.13	0.13	0.13	0.13	0.12	0.13	0.13	0.13	0.13	0.13	0.14	0.13	0.13	0.13	0.13
Utility Scale PV	HV	Grid-RE	0.13	0.12	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.11	0.11	0.11	0.11	0.11	0.11	0.10
Utility Scale PV	UP	Grid-RE	0.14	0.13	0.12	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.12	0.11	0.11	0.11	0.11
Biomass																				
Direct-fired stand alone power plants (per MW for a 45 MW plant)	HV	Grid-RE	0.12	0.12	0.12	0.12	0.12	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
Direct-fired stand alone power plants (per MW for a 45 MW plant)	UP	Grid-RE	0.12	0.12	0.12	0.12	0.12	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
CHP/ District heat (institutional, district) (per MW for a 2 MWe thermal led plant)	LI	CST-RE	(0.25)	(0.25)	(0.25)	(0.26)	(0.26)	(0.26)	(0.26)	(0.26)	(0.26)	(0.27)	(0.27)	(0.27)	(0.27)	(0.27)	(0.27)	(0.28)	(0.28)	(0.28)
CHP/ District heat (institutional, district) (per MW for a 2 MWe thermal led plant)	NYC	CST-RE	(0.20)	(0.21)	(0.21)	(0.22)	(0.23)	(0.24)	(0.24)	(0.25)	(0.26)	(0.26)	(0.27)	(0.28)	(0.28)	(0.29)	(0.29)	(0.30)	(0.30)	(0.30)
CHP/ District heat (institutional, district) (per MW for a 2 MWe thermal led plant)	HV	CST-RE	(0.19)	(0.20)	(0.20)	(0.20)	(0.21)	(0.21)	(0.21)	(0.21)	(0.21)	(0.21)	(0.21)	(0.21)	(0.22)	(0.22)	(0.22)	(0.22)	(0.22)	(0.22)
CHP/ District heat (institutional, district) (per MW for a 2 MWe thermal led plant)	UP	CST-RE	(0.19)	(0.20)	(0.20)	(0.20)	(0.20)	(0.21)	(0.21)	(0.21)	(0.21)	(0.21)	(0.21)	(0.21)	(0.21)	(0.22)	(0.22)	(0.22)	(0.22)	(0.22)
Grid-tied Bio-liquids to power co-firing in boilers (soy biodiesel, or other biodiesel)(per MMBTU/h)	LI	Grid-RE	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Grid-tied Bio-liquids to power co-firing in boilers (soy biodiesel, or other biodiesel)(per MMBTU/h)	NYC	Grid-RE	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Grid-tied Bio-liquids to power co-firing in boilers (soy biodiesel, or other biodiesel)(per MMBTU/h)	HV	Grid-RE	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Grid-tied Bio-liquids to power co-firing in boilers (soy biodiesel, or other biodiesel)(per MMBTU/h)	UP	Grid-RE	0.05	0.05	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Landfill gas (per MW for a 3MW system)	LI	Grid-RE	0.04	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Landfill gas (per MW for a 3MW system)	NYC	Grid-RE	0.04	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Landfill gas (per MW for a 3MW system)	HV	Grid-RE	0.04	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Landfill gas (per MW for a 3MW system)	UP	Grid-RE	0.04	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Farm waste, food waste, and wastewater digesters (per MW for a 0.3 MW system)	LI	CST-RE	0.09	0.09	0.09	0.09	0.10	0.10	0.10	0.10	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
Farm waste, food waste, and wastewater digesters (per MW for a 0.3 MW system)	NYC	CST-RE	0.08	0.08	0.08	0.08	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
Farm waste, food waste, and wastewater digesters (per MW for a 0.3 MW system)	HV	CST-RE	0.09	0.09	0.09	0.09	0.10	0.10	0.10	0.10	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
Farm waste, food waste, and wastewater digesters (per MW for a 0.3 MW system)	UP	CST-RE	0.09	0.09	0.09	0.09	0.10	0.10	0.10	0.10	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11

Solar Thermal			2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Residential SWH - Elec	LI	CST-RE	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.09	0.09	0.09	0.09	0.08	0.08	0.08	0.08	0.07	0.07
Residential SWH - Elec	NYC	CST-RE	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.10	0.10	0.09	0.09	0.09	0.09	0.08	0.08	0.08	0.08
Residential SWH - Elec	HV	CST-RE	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.09	0.08	0.08	0.08	0.08	0.08	0.07	0.07	0.07	0.07
Residential SWH - Elec	UP	CST-RE	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.07	0.07	0.07	0.07	0.07	0.06	0.06	0.06	0.06	0.06
Commercial SWH - Elec	LI	CST-RE	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Commercial SWH - Elec	NYC	CST-RE	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Commercial SWH - Elec	HV	CST-RE	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.03	0.03
Commercial SWH - Elec	UP	CST-RE	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Wind																				
Residential Wind (1-10 kW)	LI	CST-RE	0.24	0.24	0.24	0.24	0.25	0.26	0.27	0.28	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29
Residential Wind (1-10 kW)	HV	CST-RE	0.26	0.26	0.26	0.26	0.27	0.28	0.29	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Residential Wind (1-10 kW)	UP	CST-RE	0.25	0.25	0.25	0.25	0.26	0.27	0.27	0.28	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29
Commercial Wind (3kW-1 MW)	LI	CST-RE	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.08	0.08	0.08	0.08	0.08	0.08
Commercial Wind (3kW-1 MW)	HV	CST-RE	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.09	0.09	0.09	0.09	0.09	0.09	0.08
Commercial Wind (3kW-1 MW)	UP	CST-RE	0.10	0.09	0.09	0.10	0.10	0.10	0.10	0.09	0.09	0.09	0.09	0.09	0.09	0.08	0.08	0.08	0.08	0.08
Community Scale Wind (1-3MW)	LI	Grid-RE	0.10	0.09	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.09	0.09	0.09	0.09	0.09	0.09	0.08	0.08	0.08
Community Scale Wind (1-3MW)	HV	Grid-RE	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.11	0.11	0.11	0.11	0.11	0.11	0.10	0.10	0.10	0.10
Community Scale Wind (1-3MW)	UP	Grid-RE	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.09	0.09	0.09	0.09	0.09	0.09	0.08	0.08
Windfarm (2-5 MW)	LI	Grid-RE	0.07	0.07	0.07	0.08	0.08	0.08	0.08	0.08	0.08	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Windfarm (2-5 MW)	HV	Grid-RE	0.08	0.08	0.08	0.09	0.09	0.09	0.09	0.09	0.09	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.07
Windfarm (2-5 MW)	UP	Grid-RE	0.08	0.07	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Offshore Wind (2-5 MW)	LI	Grid-RE	0.13	0.13	0.13	0.12	0.12	0.12	0.12	0.12	0.12	0.11	0.11	0.11	0.11	0.11	0.10	0.10	0.10	0.10
Offshore Wind (2-5 MW)	NYC	Grid-RE	0.13	0.13	0.13	0.12	0.12	0.12	0.12	0.12	0.12	0.11	0.11	0.11	0.11	0.11	0.10	0.10	0.10	0.10
Hydro																				
Run of the River Low Power 10kW-	UP	Grid-RE	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Run of the River Low Power 10kW-	HV	Grid-RE	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Run of the River Low Power 10kW-	LI	Grid-RE	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Run of the River High Power 1-30	UP	Grid-RE	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Run of the River High Power 1-30	HV	Grid-RE	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Undeveloped Sites 100+ kW	UP	Grid-RE	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Undeveloped Sites 100+ kW	HV	Grid-RE	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Non-Powered Dams 1+ MW	UP	Grid-RE	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Non-Powered Dams 1+ MW	HV	Grid-RE	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Re-Powered Dams 100+ kW	UP	Grid-RE	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Re-Powered Dams 100+ kW	HV	Grid-RE	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Wave Energy 10 kW+	LI	Grid-RE	0.31	0.30	0.29	0.28	0.27	0.26	0.25	0.25	0.24	0.23	0.22	0.22	0.21	0.21	0.20	0.20	0.19	0.19
Tidal Energy 30 kW+	LI	Grid-RE	0.16	0.15	0.14	0.14	0.14	0.13	0.13	0.12	0.12	0.12	0.12	0.11	0.11	0.11	0.11	0.11	0.11	0.11
Tidal Energy 30 kW+	NYC	Grid-RE	0.16	0.15	0.14	0.14	0.14	0.13	0.13	0.12	0.12	0.12	0.12	0.11	0.11	0.11	0.11	0.11	0.11	0.11

Appendix F: Renewable Technology Levelized Cost of Energy (Gross \$/kWh) by Measure and Year

Measure Name	Zone	Sector	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Solar PV																				
Residential PV	LI	CST-RE	0.17	0.16	0.15	0.14	0.13	0.13	0.13	0.13	0.13	0.14	0.14	0.14	0.14	0.15	0.14	0.14	0.14	0.14
Residential PV	NYC	CST-RE	0.23	0.21	0.20	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.19	0.19	0.19	0.19	0.19	0.19	0.18
Residential PV	HV	CST-RE	0.18	0.17	0.16	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.14
Residential PV	UP	CST-RE	0.20	0.18	0.17	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.15
Small Commercial PV	LI	CST-RE	0.17	0.16	0.15	0.14	0.13	0.13	0.13	0.13	0.13	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14
Small Commercial PV	NYC	CST-RE	0.23	0.21	0.19	0.18	0.18	0.17	0.17	0.17	0.18	0.18	0.18	0.18	0.19	0.19	0.19	0.19	0.18	0.18
Small Commercial PV	HV	CST-RE	0.18	0.17	0.16	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.14
Small Commercial PV	UP	CST-RE	0.19	0.18	0.16	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.16	0.16	0.16	0.16	0.16	0.15	0.15
Large Commercial PV	LI	CST-RE	0.13	0.12	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.11	0.11	0.11	0.10	0.10	0.10
Large Commercial PV	NYC	CST-RE	0.17	0.16	0.14	0.13	0.13	0.13	0.13	0.13	0.13	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.13
Large Commercial PV	HV	CST-RE	0.14	0.13	0.12	0.11	0.11	0.10	0.10	0.10	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
Large Commercial PV	UP	CST-RE	0.14	0.13	0.12	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.12	0.12	0.12	0.12	0.12	0.11	0.11
Utility Scale PV	LI	Grid-RE	0.12	0.11	0.10	0.10	0.09	0.09	0.09	0.09	0.09	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Utility Scale PV	NYC	Grid-RE	0.16	0.15	0.14	0.13	0.13	0.12	0.12	0.12	0.13	0.13	0.13	0.13	0.13	0.14	0.13	0.13	0.13	0.13
Utility Scale PV	HV	Grid-RE	0.13	0.12	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.11	0.11	0.11	0.10	0.10	0.10
Utility Scale PV	UP	Grid-RE	0.14	0.13	0.12	0.11	0.11	0.10	0.10	0.10	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
Biomass																				
Direct-fired stand alone power plants (per MW for a 45 MW plant)	HV	Grid-RE	0.10	0.10	0.10	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
Direct-fired stand alone power plants (per MW for a 45 MW plant)	UP	Grid-RE	0.10	0.10	0.10	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
CHP/ District heat (institutional, district) (per MW for a 2 MWe thermal led plant)	LI	CST-RE	0.33	0.33	0.33	0.34	0.34	0.34	0.34	0.34	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35
CHP/ District heat (institutional, district) (per MW for a 2 MWe thermal led plant)	NYC	CST-RE	0.33	0.33	0.33	0.34	0.34	0.34	0.34	0.34	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35
CHP/ District heat (institutional, district) (per MW for a 2 MWe thermal led plant)	HV	CST-RE	0.33	0.33	0.33	0.34	0.34	0.34	0.34	0.34	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35
CHP/ District heat (institutional, district) (per MW for a 2 MWe thermal led plant)	UP	CST-RE	0.33	0.33	0.33	0.34	0.34	0.34	0.34	0.34	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35
Grid-tied Bio-liquids to power co-firing in boilers (soy biodiesel, or other biodiesel(per MMBTU/h)	LI	Grid-RE	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Grid-tied Bio-liquids to power co-firing in boilers (soy biodiesel, or other biodiesel(per MMBTU/h)	NYC	Grid-RE	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Grid-tied Bio-liquids to power co-firing in boilers (soy biodiesel, or other biodiesel(per MMBTU/h)	HV	Grid-RE	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Grid-tied Bio-liquids to power co-firing in boilers (soy biodiesel, or other biodiesel(per MMBTU/h)	UP	Grid-RE	0.05	0.05	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Landfill gas (per MW for a 3MW system)	LI	Grid-RE	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Landfill gas (per MW for a 3MW system)	NYC	Grid-RE	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Landfill gas (per MW for a 3MW system)	HV	Grid-RE	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Landfill gas (per MW for a 3MW system)	UP	Grid-RE	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Farm waste, food waste, and wastewater digesters (per MW for a 0.3 MW system)	LI	CST-RE	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Farm waste, food waste, and wastewater digesters (per MW for a 0.3 MW system)	NYC	CST-RE	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Farm waste, food waste, and wastewater digesters (per MW for a 0.3 MW system)	HV	CST-RE	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Farm waste, food waste, and wastewater digesters (per MW for a 0.3 MW system)	UP	CST-RE	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06

Solar Thermal			2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Residential SWH - Elec	LI	CST-RE	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.08	0.08	0.08	0.07	0.07	0.07	0.07	0.06	0.06	0.06
Residential SWH - Elec	NYC	CST-RE	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.08	0.08	0.08	0.08	0.08	0.07	0.07	0.07	0.07	0.06
Residential SWH - Elec	HV	CST-RE	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.07	0.07	0.07	0.07	0.07	0.06	0.06	0.06	0.06	0.06
Residential SWH - Elec	UP	CST-RE	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.06	0.05	0.05	0.05	0.05	0.05
Commercial SWH - Elec	LI	CST-RE	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.03	0.03	0.03	0.03
Commercial SWH - Elec	NYC	CST-RE	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.03	0.03	0.03
Commercial SWH - Elec	HV	CST-RE	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Commercial SWH - Elec	UP	CST-RE	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.02
Wind																				
Residential Wind (1-10 kW)	LI	CST-RE	0.22	0.22	0.22	0.22	0.23	0.24	0.25	0.26	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27
Residential Wind (1-10 kW)	HV	CST-RE	0.23	0.23	0.23	0.23	0.24	0.25	0.26	0.27	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28
Residential Wind (1-10 kW)	UP	CST-RE	0.23	0.23	0.23	0.23	0.24	0.24	0.25	0.26	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27
Commercial Wind (3kW-1 MW)	LI	CST-RE	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.07	0.07	0.07	0.07	0.07	0.07
Commercial Wind (3kW-1 MW)	HV	CST-RE	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.08	0.08	0.08	0.08	0.08	0.08	0.07
Commercial Wind (3kW-1 MW)	UP	CST-RE	0.09	0.08	0.08	0.09	0.09	0.09	0.09	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.07	0.07	0.07	0.07
Community Scale Wind (1-3MW)	LI	Grid-RE	0.07	0.07	0.07	0.08	0.08	0.08	0.08	0.08	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.06	0.06
Community Scale Wind (1-3MW)	HV	Grid-RE	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.08	0.08	0.08	0.08	0.08	0.08	0.07
Community Scale Wind (1-3MW)	UP	Grid-RE	0.08	0.07	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.06
Windfarm (2-5 MW)	LI	Grid-RE	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Windfarm (2-5 MW)	HV	Grid-RE	0.06	0.06	0.06	0.06	0.06	0.06	0.07	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.05	0.05
Windfarm (2-5 MW)	UP	Grid-RE	0.05	0.05	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.05	0.05	0.05	0.05	0.05	0.05
Offshore Wind (2-5 MW)	LI	Grid-RE	0.08	0.08	0.08	0.08	0.08	0.08	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.06	0.06	0.06	0.06	0.06
Offshore Wind (2-5 MW)	NYC	Grid-RE	0.08	0.08	0.08	0.08	0.08	0.08	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.06	0.06	0.06	0.06	0.06
Hydro																				
Run of the River Low Power 10kW-1MW	UP	Grid-RE	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Run of the River Low Power 10kW-1MW	HV	Grid-RE	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Run of the River Low Power 10kW-1MW	LI	Grid-RE	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Run of the River High Power 1-30 MW	UP	Grid-RE	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Run of the River High Power 1-30 MW	HV	Grid-RE	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Undeveloped Sites 100+ kW	UP	Grid-RE	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Undeveloped Sites 100+ kW	HV	Grid-RE	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Non-Powered Dams 1+ MW	UP	Grid-RE	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Non-Powered Dams 1+ MW	HV	Grid-RE	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Re-Powered Dams 100+ kW	UP	Grid-RE	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Re-Powered Dams 100+ kW	HV	Grid-RE	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Wave Energy 10 kW+	LI	Grid-RE	0.27	0.26	0.25	0.24	0.23	0.22	0.21	0.20	0.20	0.19	0.18	0.18	0.17	0.17	0.16	0.15	0.15	0.14
Tidal Energy 30 kW+	LI	Grid-RE	0.13	0.12	0.12	0.11	0.11	0.10	0.10	0.10	0.09	0.09	0.09	0.09	0.09	0.08	0.08	0.08	0.08	0.08
Tidal Energy 30 kW+	NYC	Grid-RE	0.13	0.12	0.12	0.11	0.11	0.10	0.10	0.10	0.09	0.09	0.09	0.09	0.09	0.08	0.08	0.08	0.08	0.08

Appendix G: Renewable Technology Levelized Cost of Energy (Net \$/MMBtu) by Measure and Year

Measure Name	Zone	Sector	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Biomass																				
Commercial and industrial boilers , furnaces, and kilns (per MMBTU/h for a 1 MMBTU/h system)	LI	CST-RE	23.77	23.83	23.88	23.92	23.95	23.98	24.01	24.04	24.06	24.09	24.11	24.00	24.02	24.04	24.06	24.07	24.09	24.10
Commercial and industrial boilers , furnaces, and kilns (per MMBTU/h for a 1 MMBTU/h system)	NYC	CST-RE	23.77	23.83	23.88	23.92	23.95	23.98	24.01	24.04	24.06	24.09	24.11	24.00	24.02	24.04	24.06	24.07	24.09	24.10
Commercial and industrial boilers , furnaces, and kilns (per MMBTU/h for a 1 MMBTU/h system)	HV	CST-RE	23.77	23.83	23.88	23.92	23.95	23.98	24.01	24.04	24.06	24.09	24.11	24.00	24.02	24.04	24.06	24.07	24.09	24.10
Commercial and industrial boilers , furnaces, and kilns (per MMBTU/h for a 1 MMBTU/h system)	UP	CST-RE	23.77	23.83	23.88	23.92	23.95	23.98	24.01	24.04	24.06	24.09	24.11	24.00	24.02	24.04	24.06	24.07	24.09	24.10
Residential stove, boiler, furnace (per MMBTU/h for a 0.04 MMBTU/h system)	LI	CST-RE	31.67	31.75	31.82	31.87	31.91	31.95	31.99	32.03	32.06	32.10	32.13	32.61	32.64	32.66	32.68	32.71	32.72	32.74
Residential stove, boiler, furnace (per MMBTU/h for a 0.04 MMBTU/h system)	NYC	CST-RE	31.67	31.75	31.82	31.87	31.91	31.95	31.99	32.03	32.06	32.10	32.13	32.61	32.64	32.66	32.68	32.71	32.72	32.74
Residential stove, boiler, furnace (per MMBTU/h for a 0.04 MMBTU/h system)	HV	CST-RE	31.67	31.75	31.82	31.87	31.91	31.95	31.99	32.03	32.06	32.10	32.13	32.61	32.64	32.66	32.68	32.71	32.72	32.74
Residential stove, boiler, furnace (per MMBTU/h for a 0.04 MMBTU/h system)	UP	CST-RE	31.67	31.75	31.82	31.87	31.91	31.95	31.99	32.03	32.06	32.10	32.13	32.61	32.64	32.66	32.68	32.71	32.72	32.74
Cofiring 5% biomass per cofired MW	HV	Grid-RE	5.21	5.30	5.44	5.56	5.68	5.76	5.86	5.90	5.94	5.98	6.02	6.05	6.08	6.11	6.13	6.16	6.18	6.19
Cofiring 5% biomass per cofired MW	UP	Grid-RE	5.21	5.30	5.44	5.56	5.68	5.76	5.86	5.90	5.94	5.98	6.02	6.05	6.08	6.11	6.13	6.16	6.18	6.19
CHP/ District heat (institutional, district) (per MW for a 2 MWe thermal led plant)	LI	CST-RE	12.91	13.07	13.39	13.38	13.43	13.47	13.52	13.57	13.62	13.61	13.61	13.61	13.61	13.61	13.61	13.61	13.60	13.59
CHP/ District heat (institutional, district) (per MW for a 2 MWe thermal led plant)	NYC	CST-RE	11.70	11.74	11.77	11.79	11.85	11.90	11.95	12.00	12.04	12.02	12.00	11.98	11.95	11.92	11.89	11.86	11.81	11.77
CHP/ District heat (institutional, district) (per MW for a 2 MWe thermal led plant)	HV	CST-RE	13.68	13.71	13.73	13.73	13.81	13.87	13.94	14.00	14.06	14.06	14.06	14.07	14.07	14.08	14.08	14.08	14.07	14.07
CHP/ District heat (institutional, district) (per MW for a 2 MWe thermal led plant)	UP	CST-RE	14.04	14.08	14.10	14.09	14.16	14.21	14.27	14.33	14.39	14.39	14.40	14.41	14.41	14.42	14.43	14.43	14.44	14.44
C&I B5 blend for statewide use	LI	CST-RE	24.83	26.19	27.38	27.86	28.36	28.48	28.62	28.80	29.05	29.23	29.42	29.62	29.92	30.04	30.26	30.46	30.61	30.87
C&I B5 blend for statewide use	NYC	CST-RE	18.63	19.85	20.98	21.58	22.23	22.61	23.02	23.49	24.05	24.59	25.16	25.78	26.53	27.18	27.97	28.81	29.67	30.74
C&I B5 blend for statewide use	HV	CST-RE	22.68	23.93	25.04	25.49	25.96	26.06	26.19	26.34	26.56	26.71	26.88	27.06	27.32	27.43	27.63	27.81	27.94	28.18
C&I B5 blend for statewide use	UP	CST-RE	22.63	23.88	24.98	25.43	25.90	26.00	26.13	26.28	26.50	26.65	26.82	27.00	27.26	27.37	27.56	27.75	27.88	28.12
Res B5 blend for statewide use	LI	CST-RE	29.00	30.35	31.55	32.04	32.56	32.70	32.87	33.07	33.35	33.56	33.77	34.00	34.32	34.48	34.72	34.96	35.14	35.43
Res B5 blend for statewide use	NYC	CST-RE	29.19	30.55	31.76	32.25	32.78	32.92	33.09	33.29	33.57	33.78	34.00	34.23	34.55	34.71	34.96	35.19	35.37	35.67
Res B5 blend for statewide use	HV	CST-RE	28.13	29.44	30.60	31.08	31.58	31.72	31.88	32.07	32.34	32.54	32.75	32.97	33.28	33.43	33.67	33.89	34.06	34.35
Res B5 blend for statewide use	UP	CST-RE	27.27	28.53	29.66	30.12	30.61	30.73	30.89	31.08	31.33	31.53	31.73	31.94	32.25	32.38	32.62	32.84	33.00	33.27
Solar Thermal																				
Residential SWH - NG	LI	CST-RE	15.48	15.48	15.48	15.48	15.63	15.76	15.88	15.97	18.53	18.05	17.58	17.13	16.69	16.26	15.84	15.44	15.05	14.67
Residential SWH - NG	NYC	CST-RE	16.38	16.38	16.38	16.38	16.55	16.69	16.81	16.91	19.62	19.11	18.62	18.13	17.67	17.21	16.78	16.35	15.94	15.54
Residential SWH - NG	HV	CST-RE	14.39	14.39	14.39	14.39	14.53	14.66	14.76	14.85	17.23	16.79	16.35	15.93	15.52	15.12	14.73	14.36	14.00	13.64
Residential SWH - NG	UP	CST-RE	12.23	12.23	12.23	12.23	12.35	12.46	12.55	12.62	14.65	14.27	13.90	13.54	13.19	12.85	12.52	12.21	11.90	11.60
Residential SWH - Petro	LI	CST-RE	13.80	13.80	13.80	13.80	13.94	14.06	14.16	14.24	17.27	16.82	16.38	15.96	15.55	15.15	14.76	14.39	14.03	13.67
Residential SWH - Petro	NYC	CST-RE	14.61	14.61	14.61	14.61	14.76	14.88	14.99	15.08	18.29	17.81	17.35	16.90	16.46	16.04	15.63	15.23	14.85	14.48
Residential SWH - Petro	HV	CST-RE	12.83	12.83	12.83	12.83	12.96	13.07	13.16	13.24	16.06	15.64	15.23	14.84	14.46	14.09	13.73	13.38	13.04	12.71
Residential SWH - Petro	UP	CST-RE	10.91	10.91	10.91	10.91	11.02	11.11	11.19	11.26	13.65	13.29	12.95	12.61	12.29	11.98	11.67	11.37	11.09	10.81
Commercial SWH - NG	LI	CST-RE	8.73	8.73	8.73	8.73	8.82	8.90	8.97	9.03	9.07	8.82	8.58	8.35	8.12	7.90	7.69	7.48	7.28	7.09
Commercial SWH - NG	NYC	CST-RE	9.25	9.25	9.25	9.25	9.34	9.43	9.50	9.56	9.60	9.34	9.09	8.84	8.60	8.37	8.14	7.92	7.71	7.51
Commercial SWH - NG	HV	CST-RE	8.12	8.12	8.12	8.12	8.20	8.28	8.34	8.39	8.43	8.20	7.98	7.76	7.55	7.35	7.15	6.96	6.77	6.59
Commercial SWH - NG	UP	CST-RE	6.90	6.90	6.90	6.90	6.97	7.04	7.09	7.13	7.17	6.97	6.78	6.60	6.42	6.25	6.08	5.92	5.76	5.60
Commercial SWH - Petro	LI	CST-RE	7.79	7.79	7.79	7.79	7.87	7.94	8.00	8.05	8.09	7.87	7.65	7.44	7.24	7.05	6.86	6.67	6.50	6.32
Commercial SWH - Petro	NYC	CST-RE	8.24	8.24	8.24	8.24	8.33	8.40	8.47	8.52	8.56	8.33	8.10	7.88	7.67	7.46	7.26	7.07	6.88	6.69
Commercial SWH - Petro	HV	CST-RE	7.24	7.24	7.24	7.24	7.32	7.38	7.44	7.48	7.52	7.32	7.12	6.92	6.74	6.55	6.38	6.21	6.04	5.88
Commercial SWH - Petro	UP	CST-RE	6.15	6.15	6.15	6.15	6.22	6.27	6.32	6.36	6.39	6.22	6.05	5.88	5.72	5.57	5.42	5.27	5.13	5.00

Appendix H: Renewable Technology Levelized Cost of Energy (Gross \$/MMBtu) by Measure and Year

Measure Name	Zone	Sector	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Biomass																				
Commercial and industrial boilers , furnaces, and kilns (per MMBTU/h for a 1 MMBTU/h system)	LI	CST-RE	22.32	22.39	22.43	22.47	22.51	22.53	22.56	22.59	22.62	22.64	22.67	22.56	22.58	22.59	22.61	22.63	22.64	22.65
Commercial and industrial boilers , furnaces, and kilns (per MMBTU/h for a 1 MMBTU/h system)	NYC	CST-RE	22.32	22.39	22.43	22.47	22.51	22.53	22.56	22.59	22.62	22.64	22.67	22.56	22.58	22.59	22.61	22.63	22.64	22.65
Commercial and industrial boilers , furnaces, and kilns (per MMBTU/h for a 1 MMBTU/h system)	HV	CST-RE	22.32	22.39	22.43	22.47	22.51	22.53	22.56	22.59	22.62	22.64	22.67	22.56	22.58	22.59	22.61	22.63	22.64	22.65
Commercial and industrial boilers , furnaces, and kilns (per MMBTU/h for a 1 MMBTU/h system)	UP	CST-RE	22.32	22.39	22.43	22.47	22.51	22.53	22.56	22.59	22.62	22.64	22.67	22.56	22.58	22.59	22.61	22.63	22.64	22.65
Residential stove, boiler, furnace (per MMBTU/h for a 0.04 MMBTU/h system)	LI	CST-RE	30.78	30.87	30.93	30.98	31.03	31.07	31.11	31.14	31.18	31.21	31.24	31.72	31.75	31.78	31.80	31.82	31.84	31.85
Residential stove, boiler, furnace (per MMBTU/h for a 0.04 MMBTU/h system)	NYC	CST-RE	30.78	30.87	30.93	30.98	31.03	31.07	31.11	31.14	31.18	31.21	31.24	31.72	31.75	31.78	31.80	31.82	31.84	31.85
Residential stove, boiler, furnace (per MMBTU/h for a 0.04 MMBTU/h system)	HV	CST-RE	30.78	30.87	30.93	30.98	31.03	31.07	31.11	31.14	31.18	31.21	31.24	31.72	31.75	31.78	31.80	31.82	31.84	31.85
Residential stove, boiler, furnace (per MMBTU/h for a 0.04 MMBTU/h system)	UP	CST-RE	30.78	30.87	30.93	30.98	31.03	31.07	31.11	31.14	31.18	31.21	31.24	31.72	31.75	31.78	31.80	31.82	31.84	31.85
Cofiring 5% biomass per cofired MW	HV	Grid-RE	4.97	5.06	5.19	5.32	5.44	5.52	5.62	5.66	5.70	5.74	5.77	5.81	5.84	5.87	5.89	5.91	5.93	5.95
Cofiring 5% biomass per cofired MW	UP	Grid-RE	4.97	5.06	5.19	5.32	5.44	5.52	5.62	5.66	5.70	5.74	5.77	5.81	5.84	5.87	5.89	5.91	5.93	5.95
CHP/ District heat (institutional, district) (per MW for a 2 MWe thermal led plant)	LI	CST-RE	16.01	16.12	16.20	16.26	16.37	16.47	16.57	16.66	16.76	16.80	16.84	16.88	16.91	16.94	16.97	16.99	17.01	17.03
CHP/ District heat (institutional, district) (per MW for a 2 MWe thermal led plant)	NYC	CST-RE	16.01	16.12	16.20	16.26	16.37	16.47	16.57	16.66	16.76	16.80	16.84	16.88	16.91	16.94	16.97	16.99	17.01	17.03
CHP/ District heat (institutional, district) (per MW for a 2 MWe thermal led plant)	HV	CST-RE	16.01	16.12	16.20	16.26	16.37	16.47	16.57	16.66	16.76	16.80	16.84	16.88	16.91	16.94	16.97	16.99	17.01	17.03
CHP/ District heat (institutional, district) (per MW for a 2 MWe thermal led plant)	UP	CST-RE	16.01	16.12	16.20	16.26	16.37	16.47	16.57	16.66	16.76	16.80	16.84	16.88	16.91	16.94	16.97	16.99	17.01	17.03
C&I B5 blend for statewide use	LI	CST-RE	24.83	26.19	27.38	27.86	28.36	28.48	28.62	28.80	29.05	29.23	29.42	29.62	29.92	30.04	30.26	30.46	30.61	30.87
C&I B5 blend for statewide use	NYC	CST-RE	18.63	19.85	20.98	21.58	22.23	22.61	23.02	23.49	24.05	24.59	25.16	25.78	26.53	27.18	27.97	28.81	29.67	30.74
C&I B5 blend for statewide use	HV	CST-RE	22.68	23.93	25.04	25.49	25.96	26.06	26.19	26.34	26.56	26.71	26.88	27.06	27.32	27.43	27.63	27.81	27.94	28.18
C&I B5 blend for statewide use	UP	CST-RE	22.63	23.88	24.98	25.43	25.90	26.00	26.13	26.28	26.50	26.65	26.82	27.00	27.26	27.37	27.56	27.75	27.88	28.12
Res B5 blend for statewide use	LI	CST-RE	29.00	30.35	31.55	32.04	32.56	32.70	32.87	33.07	33.35	33.56	33.77	34.00	34.32	34.48	34.72	34.96	35.14	35.43
Res B5 blend for statewide use	NYC	CST-RE	29.19	30.55	31.76	32.25	32.78	32.92	33.09	33.29	33.57	33.78	34.00	34.23	34.55	34.71	34.96	35.19	35.37	35.67
Res B5 blend for statewide use	HV	CST-RE	28.13	29.44	30.60	31.08	31.58	31.72	31.88	32.07	32.34	32.54	32.75	32.97	33.28	33.43	33.67	33.89	34.06	34.35
Res B5 blend for statewide use	UP	CST-RE	27.27	28.53	29.66	30.12	30.61	30.73	30.89	31.08	31.33	31.53	31.73	31.94	32.25	32.38	32.62	32.84	33.00	33.27
Solar Thermal																				
Residential SWH - NG	LI	CST-RE	13.37	13.37	13.37	13.37	13.52	13.66	13.77	13.86	16.10	15.62	15.15	14.70	14.25	13.83	13.41	13.01	12.62	12.24
Residential SWH - NG	NYC	CST-RE	14.15	14.15	14.15	14.15	14.32	14.46	14.58	14.68	17.05	16.54	16.04	15.56	15.09	14.64	14.20	13.77	13.36	12.96
Residential SWH - NG	HV	CST-RE	12.43	12.43	12.43	12.43	12.58	12.70	12.80	12.89	14.97	14.52	14.09	13.66	13.25	12.86	12.47	12.10	11.73	11.38
Residential SWH - NG	UP	CST-RE	10.57	10.57	10.57	10.57	10.69	10.79	10.88	10.96	12.73	12.34	11.97	11.62	11.27	10.93	10.60	10.28	9.97	9.68
Residential SWH - Petro	LI	CST-RE	11.92	11.92	11.92	11.92	12.06	12.18	12.28	12.36	15.00	14.55	14.12	13.69	13.28	12.88	12.50	12.12	11.76	11.41
Residential SWH - Petro	NYC	CST-RE	12.62	12.62	12.62	12.62	12.77	12.89	13.00	13.09	15.89	15.41	14.95	14.50	14.06	13.64	13.23	12.83	12.45	12.08
Residential SWH - Petro	HV	CST-RE	11.08	11.08	11.08	11.08	11.21	11.32	11.42	11.50	13.95	13.53	13.13	12.73	12.35	11.98	11.62	11.27	10.93	10.61
Residential SWH - Petro	UP	CST-RE	9.42	9.42	9.42	9.42	9.53	9.63	9.70	9.77	11.86	11.50	11.16	10.82	10.50	10.18	9.88	9.58	9.29	9.02
Commercial SWH - NG	LI	CST-RE	7.92	7.92	7.92	7.92	8.01	8.09	8.16	8.21	8.26	8.01	7.77	7.54	7.31	7.09	6.88	6.67	6.47	6.28
Commercial SWH - NG	NYC	CST-RE	8.39	8.39	8.39	8.39	8.48	8.57	8.64	8.70	8.75	8.48	8.23	7.98	7.74	7.51	7.28	7.07	6.85	6.65
Commercial SWH - NG	HV	CST-RE	7.37	7.37	7.37	7.37	7.45	7.52	7.59	7.64	7.68	7.45	7.23	7.01	6.80	6.60	6.40	6.21	6.02	5.84
Commercial SWH - NG	UP	CST-RE	6.26	6.26	6.26	6.26	6.33	6.40	6.45	6.49	6.53	6.33	6.14	5.96	5.78	5.61	5.44	5.27	5.12	4.96
Commercial SWH - Petro	LI	CST-RE	7.06	7.06	7.06	7.06	7.14	7.22	7.28	7.32	7.37	7.14	6.93	6.72	6.52	6.32	6.13	5.95	5.77	5.60
Commercial SWH - Petro	NYC	CST-RE	7.48	7.48	7.48	7.48	7.56	7.64	7.70	7.75	7.80	7.56	7.34	7.12	6.90	6.70	6.50	6.30	6.11	5.93
Commercial SWH - Petro	HV	CST-RE	6.57	6.57	6.57	6.57	6.64	6.71	6.76	6.81	6.85	6.64	6.44	6.25	6.06	5.88	5.70	5.53	5.37	5.21
Commercial SWH - Petro	UP	CST-RE	5.58	5.58	5.58	5.58	5.65	5.70	5.75	5.79	5.82	5.65	5.48	5.31	5.15	5.00	4.85	4.70	4.56	4.43

Appendix I: Photovoltaic Installed Cost \$/kW DC

	<u>2013</u>	<u>2014</u>	<u>2015</u>	<u>2016</u>	<u>2017</u>	<u>2018</u>	<u>2019</u>	<u>2020</u>	<u>2021</u>	<u>2022</u>	<u>2023</u>	<u>2024</u>	<u>2025</u>	<u>2026</u>	<u>2027</u>	<u>2028</u>	<u>2029</u>	<u>2030</u>
Res Upstate/LIPA	\$ 4,626	\$ 4,256	\$ 3,915	\$ 3,602	\$ 3,422	\$ 3,251	\$ 3,121	\$ 2,996	\$ 2,936	\$ 2,877	\$ 2,820	\$ 2,778	\$ 2,736	\$ 2,695	\$ 2,654	\$ 2,615	\$ 2,575	\$ 2,537
Res NYC	\$ 5,899	\$ 5,427	\$ 4,993	\$ 4,593	\$ 4,364	\$ 4,146	\$ 3,980	\$ 3,821	\$ 3,744	\$ 3,669	\$ 3,596	\$ 3,542	\$ 3,489	\$ 3,437	\$ 3,385	\$ 3,334	\$ 3,284	\$ 3,235
Small C Upstate/LIPA	\$ 4,496	\$ 4,136	\$ 3,805	\$ 3,501	\$ 3,326	\$ 3,160	\$ 3,033	\$ 2,912	\$ 2,854	\$ 2,797	\$ 2,741	\$ 2,700	\$ 2,659	\$ 2,619	\$ 2,580	\$ 2,541	\$ 2,503	\$ 2,466
Small C NYC	\$ 5,690	\$ 5,235	\$ 4,816	\$ 4,431	\$ 4,209	\$ 3,999	\$ 3,839	\$ 3,685	\$ 3,612	\$ 3,539	\$ 3,469	\$ 3,416	\$ 3,365	\$ 3,315	\$ 3,265	\$ 3,216	\$ 3,168	\$ 3,120
Large C Upstate/LIPA	\$ 3,406	\$ 3,133	\$ 2,882	\$ 2,652	\$ 2,519	\$ 2,393	\$ 2,298	\$ 2,206	\$ 2,162	\$ 2,118	\$ 2,076	\$ 2,045	\$ 2,014	\$ 1,984	\$ 1,954	\$ 1,925	\$ 1,896	\$ 1,868
Large C NYC	\$ 4,311	\$ 3,966	\$ 3,648	\$ 3,357	\$ 3,189	\$ 3,029	\$ 2,908	\$ 2,792	\$ 2,736	\$ 2,681	\$ 2,628	\$ 2,588	\$ 2,549	\$ 2,511	\$ 2,473	\$ 2,436	\$ 2,400	\$ 2,364
MW	\$ 3,140	\$ 2,889	\$ 2,658	\$ 2,445	\$ 2,323	\$ 2,207	\$ 2,118	\$ 2,034	\$ 1,993	\$ 1,953	\$ 1,914	\$ 1,885	\$ 1,857	\$ 1,829	\$ 1,802	\$ 1,775	\$ 1,748	\$ 1,722
MW LIPA	\$ 3,140	\$ 2,889	\$ 2,658	\$ 2,445	\$ 2,323	\$ 2,207	\$ 2,118	\$ 2,034	\$ 1,993	\$ 1,953	\$ 1,914	\$ 1,885	\$ 1,857	\$ 1,829	\$ 1,802	\$ 1,775	\$ 1,748	\$ 1,722
MW NYC	\$ 3,975	\$ 3,657	\$ 3,364	\$ 3,095	\$ 2,940	\$ 2,793	\$ 2,681	\$ 2,574	\$ 2,523	\$ 2,472	\$ 2,423	\$ 2,386	\$ 2,351	\$ 2,315	\$ 2,281	\$ 2,246	\$ 2,213	\$ 2,180

Appendix J: Primary Energy Conversion Factors

Renewable Energy Technology Conversion Factors (TBtu/GWh)					
	Hydro	Solar	Wind	Biomass	Landfill Gas
2010	0.009388	0.009428	0.009761	0.009388	0.009388
2011+	0.009088	0.009401	0.009761	0.009388	0.009388

Appendix K: Renewable Energy Bibliography

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Appendix L: Glossary of Selected Terms

Biodiesel - Vegetable or animal fat based diesel fuel

B5 – Blended diesel fuel with 5% biodiesel and 95% petroleum diesel

B20 - Blended diesel fuel with 20% biodiesel and 80% petroleum diesel

B100 – 100% biodiesel

Capacity factor – The capacity factor describes the relationship between the Nameplate output of a technology and the actual output for a given time period. A wind turbine in New York may be expected to produce at a capacity factor of 30% of its nameplate rating on an annual basis.

Capacity Weighted Average – The process of using a weighted average that incorporates the installed energy producing capacity of a system. Dividing the total installed cost of a number of photovoltaic systems by the total installed capacity yields a capacity weighted average cost.

Degradation – The annual decrease in energy output of a solar photovoltaic module. Typical degradation is 0.5% per year

District heating – The use of one central heating plant to provide heat (or cooling) to a number of separate buildings. Typically used on a campus, office park, or even entire cities.

Global Horizontal Irradiance (GHI) – Sum of direct beam and diffuse solar radiation measured at a certain location on the surface of the earth.

Hydraulic head – The difference in elevation between the surface of the water behind a dam or at the intake of a penstock and the elevation of where the water exits the turbine. Hydraulic head is a measurement of the potential energy of falling water.

Kiln – An industrial oven used for heating wood.

Lignocellulosic biomass – Plant biomass typically consisting of agricultural residues such as corn stover, dedicated energy crops such as willow, wood residues from sawmills, and municipal paper waste.

Nameplate – The rated capacity of a generator or technology. A wind turbine or photovoltaic panel has a nameplate rating for power output under certain conditions, but does not normally operate at that capacity all the time.

Net metered – Net metered refers to the generating technology being on the customer's side of the meter. In this configuration the energy produced by the technology can be either used on site or sent to the grid, depending on the amount of energy being produced versus the energy being used on site at that moment.

Non-Powered dams – An existing dam that does not have electricity generating equipment.

Peak coincidence – The availability of a technology to produce energy during either the summer or winter peak demand. A photovoltaic panel will be able to produce more power and thus have a higher peak coincidence with the summer peak, which typically occurs on a weekday summer afternoon, than with the winter peak, which typically occurs on a weekday winter evening.

Penetration – The percentage of power supplied for a given time period from a specific technology as compared to the total supply.

Penstock – The intake pipe that directs water to a hydro turbine.

Process steam – Steam used as part of a manufacturing process, as opposed to space or hot water heat.

Repowering – The process of upgrading existing electric generation equipment at a dam in order to make more energy.

Run of the River – A hydro installation that does not rely on a dam to impound water.

Shoulder heating season – The fall and spring months when heat is required intermittently to keep a building warm.

Saturation – The percentage of power supplied for a given time period from a specific technology as compared to the total supply.

Thermochemical conversion – The process of using heat and pressure to convert biomass into fuel, chemicals and/or power.

Weir – A barrier in a river that directs water into a penstock. Weirs typically either project partway into a river to scoop some of the water flow into the penstock, or extend all the way across but allow water to flow over the top of the weir.

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