

EXPONENTIAL CLIMATE ACTION ROADMAP 1.0

Trajectories in detail

12th September 2018

Energy Sector 5.9 + 12.3 Gt CO_{2e} baseline

Solution category	Solution	Source	Assumption	2030 emissions reductions (Gt/yr)	Cumulative emissions reductions to 2030 (Gt)	Contribution to sector emissions reduction (%)
Solar photovoltaics	Solar photovoltaics	Own estimate	Annual growth in PV production (TWh/yr) by 23.3%	3.75	14.57	35.57
Solar CSP	Solar CSP	Own estimate	Continued linear growth in CSP production (TWh/yr) to 2020, thereafter annual growth by 40%	0.40	1.26	3.07
Wind power	Wind power	Own estimate	Annual growth in wind production (TWh/yr) by 10.2%	2.00	9.73	23.75
Reduced methane emissions	Reduced methane emissions	Sitra Green to Scale [1]	Worldwide adoption of methane leakage reduction to level of US proof point	0.45	2.68	6.55
Grid flexibility and storage	Grid flexibility and storage	Own estimate	Additional 5% variable renewable energy and electricity demand reduction by 5%	1.57	8.29	20.25
Other low-carbon energy	In-Stream Hydro	Project Drawdown [2]	Increase to 3.7% of world's electricity	0.05	0.26	0.63
	Wave and Tidal	Project Drawdown [2]	Increase from 0.0004% to 0.28% of global electricity production	0.12	0.59	1.44
	Nuclear	Project Drawdown [2]	Increase to 13.6% of global electricity generation by 2030	0.21	1.04	2.54
	Geothermal	Project Drawdown [2]	Increase from 0.66% to 4.9% of global electricity generation	0.22	1.07	2.61
	Biomass	Project Drawdown [2]	Bridge solution, phased out over time	0.10	0.48	1.17
	Cogeneration	Project Drawdown [2]	Increase from 3.2% to 5.4% of global power generation, Increase from 1.7% to 3.3% of global heat generation	0.05	0.26	0.63
	Waste-to-Energy	Project Drawdown [2]	Bridge solution, reduced methane emissions from keeping waste out of landfills	0.01	0.07	0.17
	Methane Digesters (Large)	Project Drawdown [2]	69.8 gigawatt capacity	0.11	0.54	1.32
	Methane Digesters (Small)	Project Drawdown [2]	Replace 57.5 million cookstoves	0.03	0.12	0.29

Industry Sector 16.9 Gt CO_{2e} baseline

Solution category	Solution	Source	Assumption	2030 emissions reductions (Gt/yr)	Cumulative emissions reductions to 2030 (Gt)	Contribution to sector emissions reduction (%)
Materials Recirculation	Materials Recirculation	Sitra Green to Scale [1]	Full implementation of potential identified by Sitra	3.29	14.88	36.31
Product Materials Efficiency	Product Materials Efficiency	Sitra Green to Scale [1]	Full implementation of potential identified by Sitra	1.03	4.68	11.42
Circular Business Models	Circular Business Models	Sitra Green to Scale [1]	Full implementation of potential identified by Sitra	1.14	5.18	12.64
Supply Side Efficiencies	Steel	Sitra and Fossil Free Sweden [1, 3]	Full implementation of direct reduction, bio-based feedstock, carbon capture and zero-carbon electricity for EAF production	0.72	3.26	7.96
	Cement	Sitra and Fossil Free Sweden [1, 3]	Eliminate all energy-related emissions (fuel, electricity, transport)	0.50	2.28	5.56
	Aluminum	Sitra and Fossil Free Sweden [1, 3]	Full implementation of the usage of zero-carbon electricity for electrolysis and low-carbon energy for alumina re-ning	0.27	1.24	3.03
	Plastic	Sitra and Fossil Free Sweden [1, 3]	Eliminate half of production emissions, e.g., by using external, zero-carbon heat	0.43	1.96	4.78
Refrigerant Management	Refrigerant Management	Project Drawdown [2]	Containing 87% of refrigerants	1.66	7.50	18.30

Building Sector 9.7 Gt CO_{2e} baseline

Solution category	Solution	Source	Assumption	2030 emissions reductions (Gt/yr)	Cumulative emissions reductions to 2030 (Gt)	Contribution to sector emissions reduction (%)
Reduced Demand for Building Space Total	Space Demand Reduction	WWF Climate Solver [4]	Reduce demand for building space by 25%	0.05	0.22	0.95
Digital Automation of Temperature and Lighting	Building Automation	Project Drawdown [2]	Increase BAS from 34% to 50% of commercial floorspace	0.30	1.35	5.85
	Smart Thermostats	Project Drawdown [2]	Increase from 0.4% to 46% of households with internet access using smart thermostats	0.17	0.77	3.34
Retrofitting	Insulation	Project Drawdown [2]	Install insulation in 54% of existing buildings (residential and commercial)	0.53	2.42	10.49
	LED Lighting (Commercial)	Project Drawdown [2]	82% of commercial lighting is LED	0.32	1.48	6.42
	LED Lighting (Household)	Project Drawdown [2]	90% of residential lighting is LED	0.50	2.29	9.93
	Smart Glass	Project Drawdown [2]	Increase from 0.004% to 29% of new commercial building space	0.14	0.64	2.77
Low-Carbon Heating and Cooling	Low-carbon Air Conditioning	International Energy Agency [5]	Reduce electricity demand for air conditioning by 20%	1.16	5.28	22.89
	Heat Pumps	Project Drawdown [2]	High efficiency heat pumps increase from 0.02% to 25% of market	0.33	1.52	6.59
	District Heating	Project Drawdown [2]	Increase adoption from 0.01% to 10%	0.60	2.75	11.92
Low-Carbon Construction	Green Roofs	Project Drawdown [2]	Green roofs cover 30 percent of roof space by 2050 and cool roofs cover 60 percent	0.05	0.23	1.00
	Alternative Cement	Project Drawdown [2]	9% of cement as blended mix of Portland cement and 45% fly ash	0.43	1.96	8.50
	Household Recycling	Project Drawdown [2]	Global recycling rate increase from 27% to 65%	0.18	0.81	3.51
	Water Saving - Home	Project Drawdown [2]	Universal adoption of low-flow taps and showerheads	0.30	1.35	5.85

Transport Sector 8.4 Gt CO_{2e} baseline

Solution category	Solution	Source	Assumption	2030 emissions reductions (Gt/yr)	Cumulative emissions reductions to 2030 (Gt)	Contribution to sector emissions reduction (%)
Mass Transit	High-speed Rail	Project Drawdown [2]	Construction at current pace	0.13	0.53	3.00
	Mass Transit	Project Drawdown [2]	Growth from 37% to 40% of urban travel instead of decline to 21%	0.55	2.28	12.90
	Trains	Project Drawdown [2]	Increase miles of electrified track from 166,000 to 621,000	0.04	0.18	1.02
Bikes Total	Bike Infrastructure	Project Drawdown [2]	Increase from 5.5% to 7.5% of urban trips use bicycles	0.19	0.80	4.53
Electric Vehicles	Cars	Project Drawdown [2]	315 million hybrid vehicles (6% of market)	0.33	1.39	7.87
	Electric Bikes	Project Drawdown [2]	1.2 trillion miles travelled by e-bike	0.08	0.33	1.87
	Electric Vehicles	Project Drawdown [2]	Increase EV ownership to 16% of total passenger miles	0.90	3.74	21.17
Mobility and Accessibility	Ridesharing	Project Drawdown [2]	Carpooling in US and Canada increase from 10% to 15%	0.03	0.11	0.62
	Walkable Cities	Project Drawdown [2]	5% of trips currently made by car move to foot	0.24	1.01	5.72
Reduced Air Transport of Goods	Airplanes	Project Drawdown [2]	Adopting latest and most fuel-efficient aircraft, retrofitting existing aircraft, retiring older aircraft early	0.42	1.75	9.90
Efficient Shipping	Ships	Project Drawdown [2]	Increase in efficiency by 50%	0.66	2.73	15.45
Remote Work and Meetings	Telepresence	Project Drawdown [2]	Replace 140 million business-related trips with telepresence	0.17	0.69	3.90
Low-emission Trucks	Trucks	Project Drawdown [2]	Increase in adoption of fuel-saving technologies from 2% to 85%	0.52	2.14	12.11

Land and Ocean Stewardship Sector

6.6 Gt CO_{2e} baseline

Solution category	Solution	Source	Assumption	2030 emissions reductions (Gt/yr)	Cumulative emissions reductions to 2030 (Gt)	Contribution to sector emissions reduction (%)
Sustainable Agriculture	Conservation Agriculture	Project Drawdown [2]	Conservation increase from 177 million acres to 1 billion acres	0.15	0.71	4.31
	Regenerative Agriculture	Project Drawdown [2]	Increase regenerative agriculture from 108 million acres to 1 billion	0.20	0.94	5.74
	Biochar	Project Drawdown [2]	Adoption of biochar	0.01	0.03	0.20
	Perennial Biomass	Project Drawdown [2]	Increase from 0.5 million acres to 143 million acres of perennial biomass	0.03	0.14	0.82
Agroforestry	Multistrata Agroforestry	Project Drawdown [2]	Increase from 247 million acres to 293 million	0.08	0.38	2.30
	Silvopasture	Project Drawdown [2]	Increased adoption of silvopasture from 351 million acres to 554 million	0.27	1.27	7.74
	Tree Intercropping	Project Drawdown [2]	Growth to 571 million acres of tree intercropping	0.15	0.70	4.27
Precision Agriculture	Farmland Irrigation	Project Drawdown [2]	Increase in area using sprinkler and drip irrigation from 133 million acres to 448 million	0.01	0.05	0.33
	Improved Rice Cultivation	Project Drawdown [2]	Improved rice production growth from 70 million acres to 218 million	0.10	0.46	2.82
	Managed Grazing	Project Drawdown [2]	Growth in adoption of managed grazing practices from 195 million acres to 1.1 billion	0.14	0.66	4.06
	Nutrient Management	Project Drawdown [2]	Reduce fertilizer overuse on 2.1 billion acres of farmland	0.02	0.07	0.45
	System of Rice Intensification	Project Drawdown [2]	Expand SRI from 8.4 million acres to 133 million acres	0.03	0.13	0.78
Farmland Restoration	Farmland Restoration	Project Drawdown [2]	Restore 424 acres of abandoned farmland	0.12	0.57	3.49

Land and Ocean Stewardship Sector continued

Solution category	Solution	Source	Assumption	2030 emissions reductions (Gt/yr)	Cumulative emissions reductions to 2030 (Gt)	Contribution to sector emissions reduction (%)
Forest Management	Tropical Staple Trees	Project Drawdown [2]	Increase crops from 116 million acres to 269 million	0.17	0.82	5.01
	Forest Protection	Project Drawdown [2]	Protecting an additional 687 million acres of forest	0.05	0.25	1.54
	Temperate Forests	Project Drawdown [2]	Forest restoration of 235 million acres	0.19	0.92	5.61
	Tropical Forests	Project Drawdown [2]	Forest restoration of 751 million acres	0.52	2.49	15.19
	Afforestation	Project Drawdown [2]	Increase afforestation by 204 million acres (of marginal lands)	0.15	0.73	4.48
	Bamboo	Project Drawdown [2]	Increase bamboo planting from 77 million acres to 114	0.06	0.29	1.79
	Clean Cookstoves	Project Drawdown [2]	Increase from 1.3% of market to 16%	0.13	0.64	3.92
	Reduced Food Waste	Project Drawdown [2]	Reduce food waste by 50%	0.60	2.86	17.50
Indigenous Peoples' Land Management	Project Drawdown [2]	Reduced deforestation through increased secure tenure of 909 million acres	0.05	0.25	1.53	
Peatlands and Wetlands	Coastal Wetlands	Project Drawdown [2]	Increase protection from 18 million acres to 75 million	0.03	0.13	0.79
	Peatlands	Project Drawdown [2]	Increase protected peatlands from 7.9 million acres to 608 million acres (67% of all currently intact peatlands)	0.18	0.88	5.35

Food Sector

5.6 Gt CO_{2e} baseline

Solution category	Solution	Source	Assumption	2030 emissions reductions (Gt/yr)	Cumulative emissions reductions to 2030 (Gt)	Contribution to sector emissions reduction (%)
Reduced Food Waste	Reduced Food Waste	Project Drawdown [2]	Reduce food waste by 50%	0.68	2.93	27.75
Plant-based Diet	Plant-based Diet	Project Drawdown [2]	50% of population restrict diet to 2,500 calories and 57 grams of red meat a day, including avoided deforestation	1.72	7.38	69.89
Composting	Composting	Project Drawdown [2]	Increase composting rates in developing countries to 38%, Increase composting rates in developed countries to 57%	0.06	0.25	2.37

References

[1] Oras Tynkkynen (2015) Green to Scale: Low Carbon Success Stories to Inspire the World. Sitra Publication 105.

[2] Paul Hawken, editor (2017). Drawdown: The most comprehensive plan ever proposed to reverse global warming. Penguin.

[3] Fossil-Free Sweden (2018) Roadmaps for fossil free competitiveness. <http://fossilfritt-sverige.se/in-english/roadmaps-for-fossil-free-competitiveness>

[4] WWF (2018) Climate Solver. <http://www.climatesolver.org/>

[5] International Energy Agency (2018) The Future of Cooling, Opportunities for energy-efficient air conditioning.