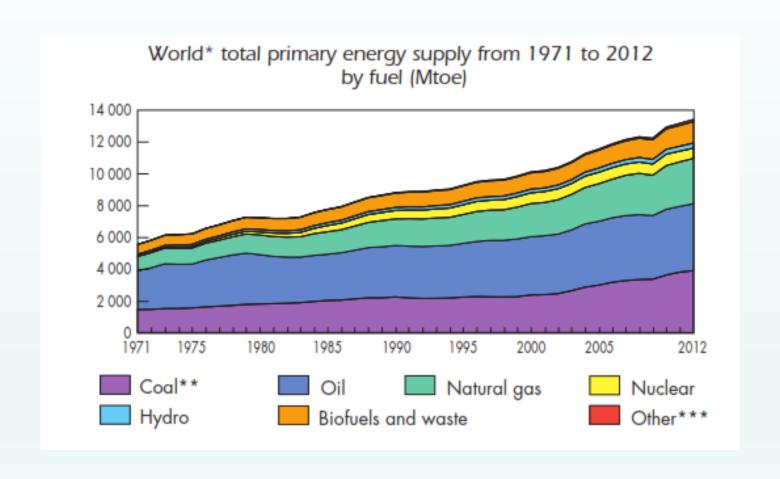


The vision of 100% renewable energy

Emily Rochon November 28, 2016



Is 100% RE possible?



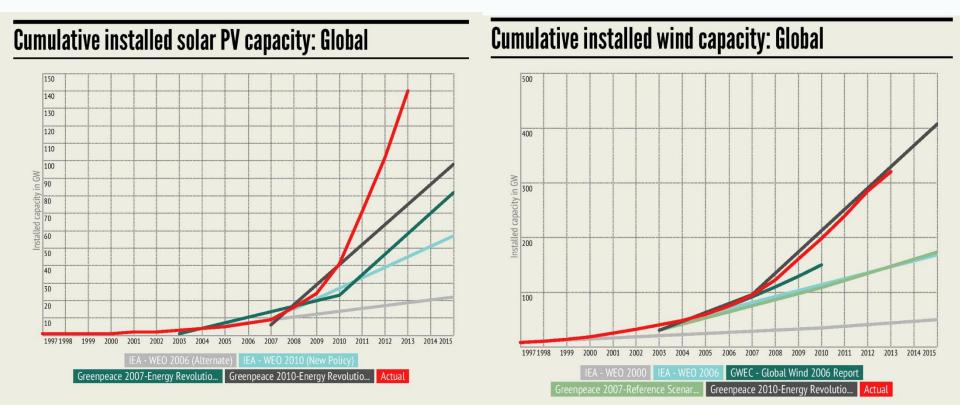
Yes



Greenpeace's Energy [R]evolution

- Scenarios produced in 2005 (Europe), '07, '08, '10, '12, '15
- 2015 scenario includes pathway to 100% renewable energy (RE)
- Energy [R]evolution shows it is technically and economically feasible to achieve 100% RE

Why the E[R] is the best



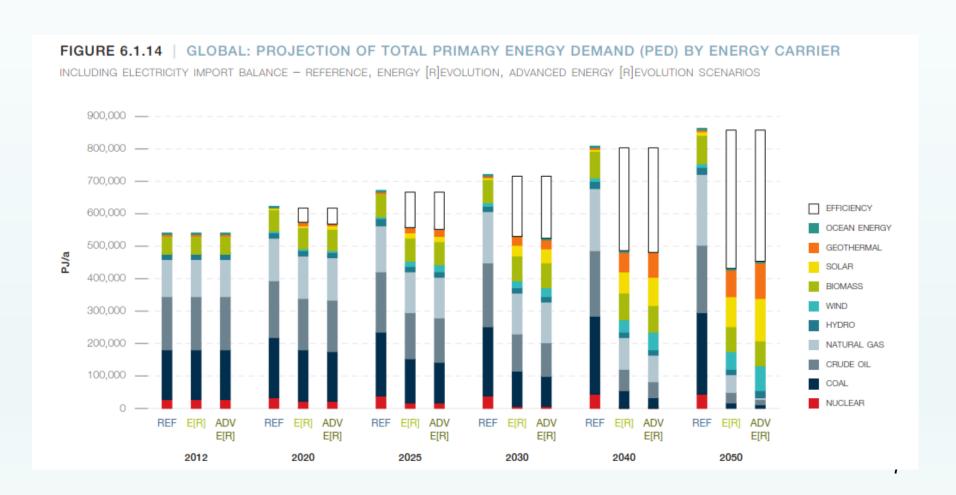
Greenpeace's RE pathways are the most accurate



Key Results

Primary Energy Demand

RE final energy share: 2012: 19% // 2020: 23% // 2030: 42% // 2050: 100%



Electricity Sector

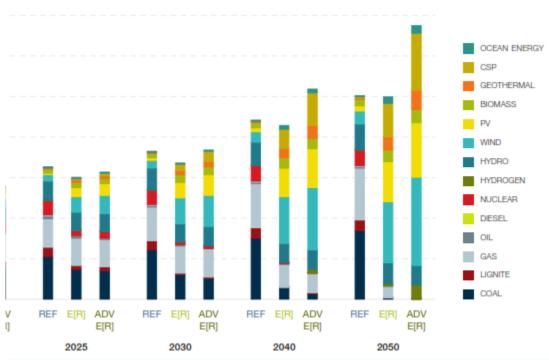
Renewable electricity capacity & generation

Capacity 23,614 GW by 2050

IN GW 2012 2020 2030 2040 2050 1.099 1.331 1.544 1.715 1.878 HYDRO REF 1.099 1.316 1.397 1.445 1,503 1.099 1,316 1,402 1.536 1,457 ADV 87 150 199 243 293 BIOMASS REF 87 194 392 558 746 200 405 579 742 ADV REF 277 554 807 998 1.217 WIND 277 820 2.510 4.316 5,575 3.064 5.892 8.040 277 904 ADV 17 28 42 62 GEOTHERMAL REF 11 28 137 325 485 11 171 708 11 31 452 ADV 494 635 803 PV REF 332 2.839 97 732 4.988 6,745 ADV 97 844 3.725 6.678 9.295 3 11 26 49 74 CSP REF 405 984 1.473 3 42 635 1.616 2,555 ADV 0 15 28 **OCEAN** REF 0 11 95 318 552 0 11 131 432 738 ADV TOTAL REF 1,575 2,396 3,101 3,696 4,355 E[R] 1.575 3.132 7,774 12.934 17.079 9.532 1,575 3,348 17,105 23,614 Generation

2012: 19% / 2020: 23% / 2030: 42%

2050: 100%



Investment Costs & Savings

E[R] costs less than business-as-usual

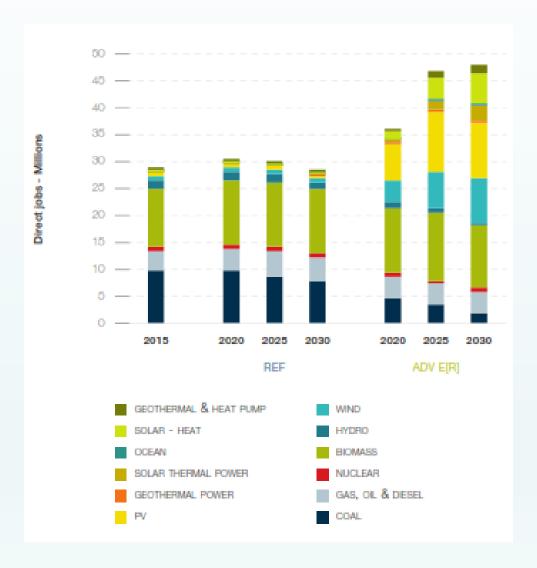
TABLE 6.1.8 | GLOBAL: ACCUMULATED INVESTMENT COSTS FOR ELECTRICITY GENERATION AND FUEL COST SAVINGS UNDER THE ADVANCED ENERGY [R]EVOLUTION SCENARIO COMPARED TO THE REFERENCE SCENARIO

ACCUMULATED INVESTMENT COSTS DIFFERENCE REF MINUS ADVANCED E[R]	UNIT	2012-2020	2021-2030	2031-2040	2041-2050	2012-2050	2012 - 2050 AVERAGE PER YEAR
CONVENTIONAL (FOSSIL + NUCLEAR)	BILLION \$	987.3	2,448.9	2,441.1	2,528.7	8,406.0	215.5
RENEWABLES (INCL. CHP)	BILLION \$	-2,014.1	-11,835.8	-16,264.6	-18,555.9	-48,670.4	-1,248.0
TOTAL	BILLION \$	-1,026.9	-9,386.9	-13,823.5	-16,027.1	-40,264.5	-1,032.4
ACCUMULATED FUEL COST SAVINGS SAVINGS CUMULATIVE ADVANCED E[R] VERSUS	REF						
FUEL OIL	BILLION \$	51.5	483.3	769.7	633.4	1,937.9	49.7
GAS	BILLION \$	-113.0	1,502.4	6,057.6	12,315.0	19,761.9	506.7
HARD COAL	BILLION \$	232.0	2,449.7	5,960.2	8,299.8	16,941.7	434.4
LIGNITE	BILLION \$	32.5	253.7	442.3	562.2	1,290.8	33.1
NUCLEAR ENERGY	BILLION \$	63.4	384.2	698.5	945.4	2,091.4	53.6
TOTAL	BILLION \$	266.4	5,073.2	13,928.3	22,755.8	42,023.8	1,077.5

TABLE 6.1.9 | GLOBAL: ACCUMULATED INVESTMENT COSTS FOR RENEWABLE HEAT GENERATION UNDER THE ADVANCED ENERGY [R]EVOLUTION SCENARIO COMPARED TO THE REFERENCE SCENARIO

ACCUMULATED INVESTMENT COSTS DIFFERENCE REF MINUS ADVANCED E[R]	UNIT	2012-2020	2021-2030	2031-2040	2041-2050	2012-2050	2012 - 2050 AVERAGE PER YEAR
RENEWABLES	BILLION \$	458.8	2,570.7	4,929.7	4,631.6	12,590.9	322.8

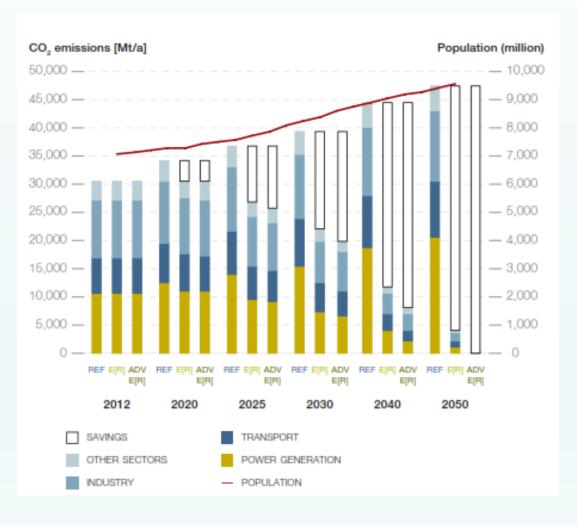
Employment



45.2 million jobs in 100% RE scenario versus 29.1 million jobs in Reference scenario

CO₂ Emission Reductions

% of 1990 emissions: 2012: 146% // 2020: 145% // 2030: 96% // 2040: 39% // 2050: 0%



Key Takeaways of E[R]

- **1.Yes we can.** E[R] is technically & economically feasible.
- **2.Save money.** Fuel costs savings means 100% RE is less expensive than BAU.
- **3.More jobs.** RE provides greater employment opportunities than BAU.
- **4.Safe climate:** 100% RE only way to stay below 2 degrees.

What does 100% RE look like?

Key features:

- 1. Energy efficiency leads the way
- 2. Electricity is the primary renewable fuel; all RE technologies have a role to play
- 3. Everyone has access to RE and energy markets
- 4. Utility business models are align w/a distributed & RE future
- 5. Smart grids, storage, DSM create a dynamic market & enable a 100% RE

Reasons for Optimism

RE cheaper than fossil fuels

...and getting cheaper



Unsubsidized rooftop solar electricity costs between \$0.08-\$0.13/kWh. Utility-scale solar is even cheaper.

That's **30-40% less than** retail price of electricity in many markets globally.

Momentum

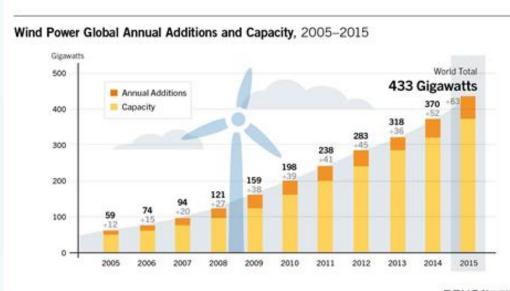
Records set in the power sector in 2015

Capacity

- 147 GW of renewable capacity added
- 63 GW of wind
- 50 GW of solar

Investment

- \$367 billion invested (31% more than in new fossil fuel power generation)



Political Support

- Countries, cities, islands, companies committing to & achieving 100% RE
 - 48 countries pledged to go 100% RE by 2050 at COP22
 - 65 international companies have made commitments to 100% RE
 - 700 cities signed Paris City Hall Declaration promising to transition to 100% RE



New Technologies, Business Models & Investment Vehicles















Thank you