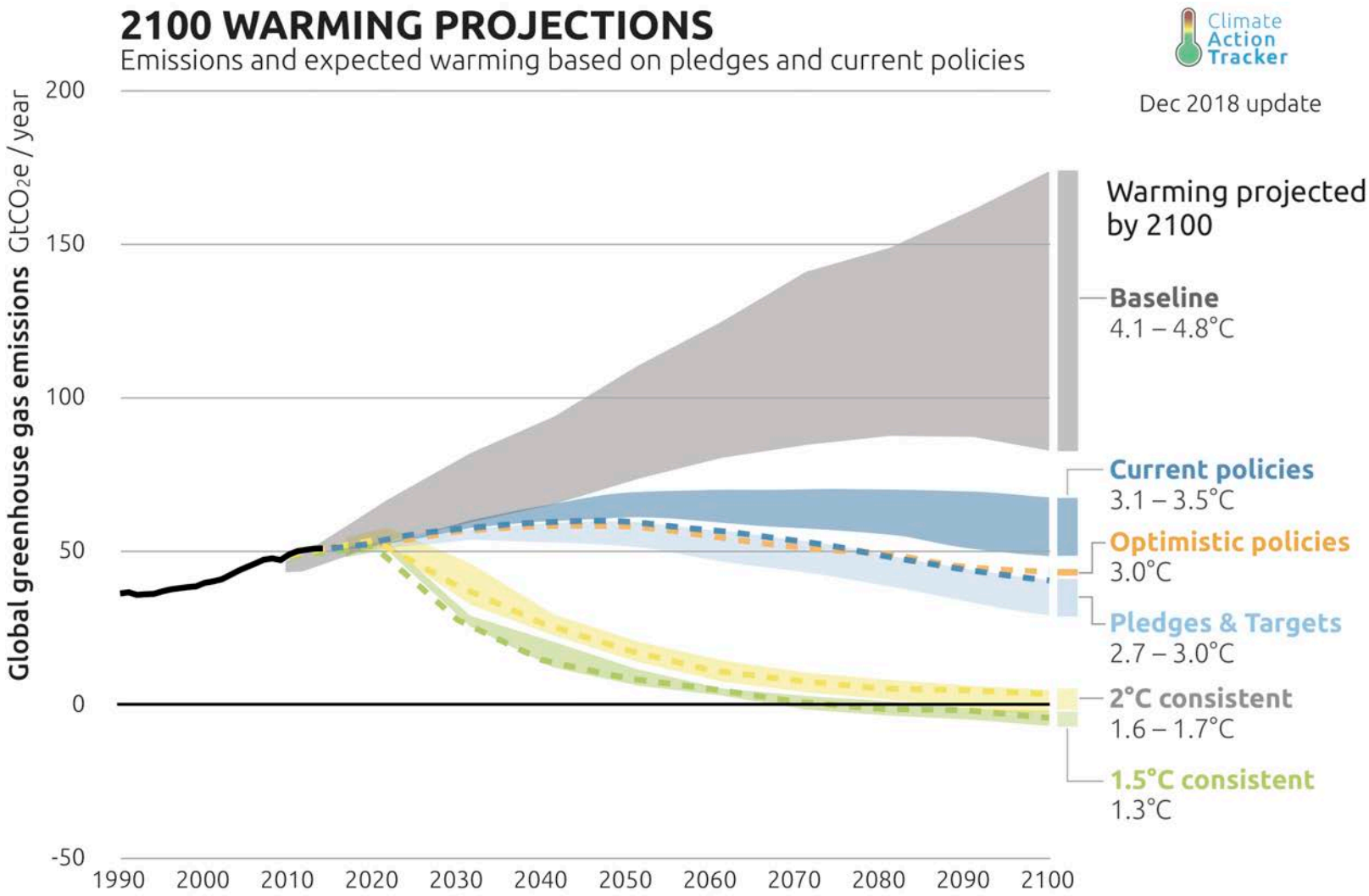
Emerging Policy Challenges for Integrated Assessment

Jonathan Pershing

Rapid System Transitions towards Low GHG Futures Workshop
Snowmass, CO
July 2019

WILLIAM + FLORA
Hewlett Foundation

Reviewing Actions Against the Paris Goal



What did we miss? Systemic model error?

Table 22. Total energy related carbon dioxide emissions, projected vs. actual (continued)

Projected vs. actual
(percent difference)

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
AEO 1994	-2.4	-2.5	-2.6	-4.9	-5.3	-5.3	-5.4	-7.3	-4.9	-4.7	-4.3	-5.2	-5.0	-2.9	-3.4	1.1	10.0	7.3							
AEO 1995		-2.4	-2.8	-5.8	-5.8	-5.8	-5.8	-8.1	-5.6	-5.4	-5.2	-5.8	-5.2	-3.1	-3.8	0.6	9.3	6.6							
AEO 1996			-2.6	-5.2	-5.2	-5.0	-4.8	-6.9	-4.1	-3.7	-3.3	-3.9	-3.0	-0.5	-1.3	3.0	12.0	9.2	12.9	18.7	16.9	17.0	21.0		
AEO 1997				-3.9	-3.6	-2.6	-1.8	-3.6	-0.8	-0.4	0.2	-0.6	0.3	3.3	3.1	7.3	16.4	13.3	17.0	22.8	20.8	21.0	25.5		
AEO 1998					-2.0	-0.3	0.4	-1.4	2.3	2.6	3.0	2.1	3.3	6.5	6.3	11.3	21.5	18.6	22.9	29.2	27.0	26.9	31.7	34.4	36.8
AEO 1999						-2.0	0.0	-1.0	2.6	3.0	3.1	1.9	2.6	5.7	5.4	10.5	20.6	17.7	22.1	28.2	26.4	26.7	31.8	34.8	37.5
AEO 2000							-2.0	-3.0	0.3	1.0	2.0	1.8	3.0	6.0	5.7	10.5	20.3	17.5	21.5	27.8	26.1	26.6	32.0	34.9	37.5
AEO 2001								-4.1	0.3	1.8	2.9	2.4	3.4	6.3	6.4	11.4	21.5	19.0	23.3	29.9	28.5	28.9	34.5	37.9	40.9
AEO 2002									-0.7	0.1	2.2	2.1	3.6	7.0	7.3	12.4	23.0	20.6	25.7	32.7	31.3	31.7	37.1	40.7	43.8
AEO 2003										-3.0	-1.8	-1.9	-0.7	3.1	3.9	9.5	20.2	18.4	23.5	30.6	29.3	29.9	35.6	39.3	42.4
AEO 2004											-1.9	-2.4	-0.1	3.6	4.2	9.4	19.8	17.6	22.4	29.4	28.0	28.5	33.7	37.3	40.4
AEO 2005												-1.1	0.5	3.9	4.6	10.4	21.3	18.8	23.6	30.3	28.6	29.1	34.1	37.5	40.8
AEO 2006													-0.4	1.1	1.3	6.4	16.6	14.1	18.4	25.0	23.1	23.1	27.8	31.0	33.6
AEO 2007														0.5	0.0	4.3	13.7	11.4	15.7	21.9	20.3	20.7	25.3	28.4	30.7
AEO 2008															-0.4	3.0	11.0	7.8	11.9	17.6	14.9	14.5	18.4	20.9	22.7
AEO 2009																0.7	5.8	3.0	6.7	11.8	9.4	8.3	10.9	12.6	13.9
AEO 2010																	2.3	-1.0	3.7	9.2	6.6	6.2	9.0	10.8	12.1
AEO 2011																		1.2	3.0	7.6	5.7	4.5	8.0	9.9	11.0
AEO 2012																			3.5	6.6	1.8	0.6	2.9	4.2	5.1
AEO 2013																				2.6	0.2	-0.8	2.3	2.9	4.5
AEO 2014																					1.2	0.4	3.1	3.7	5.4
AEO 2015																						1.5	3.2	4.8	5.1
AEO 2016																							0.3	2.0	3.5
AEO 2017																								-0.6	0.8
AEO 2018																									0.2
Average absolute percent difference	2.4	2.4	2.7	5.0	4.4	3.5	2.9	4.4	2.4	2.6	2.7	2.6	2.4	3.8	3.8	7.0	15.6	12.4	16.3	21.2	18.2	17.3	20.4	19.5	20.4

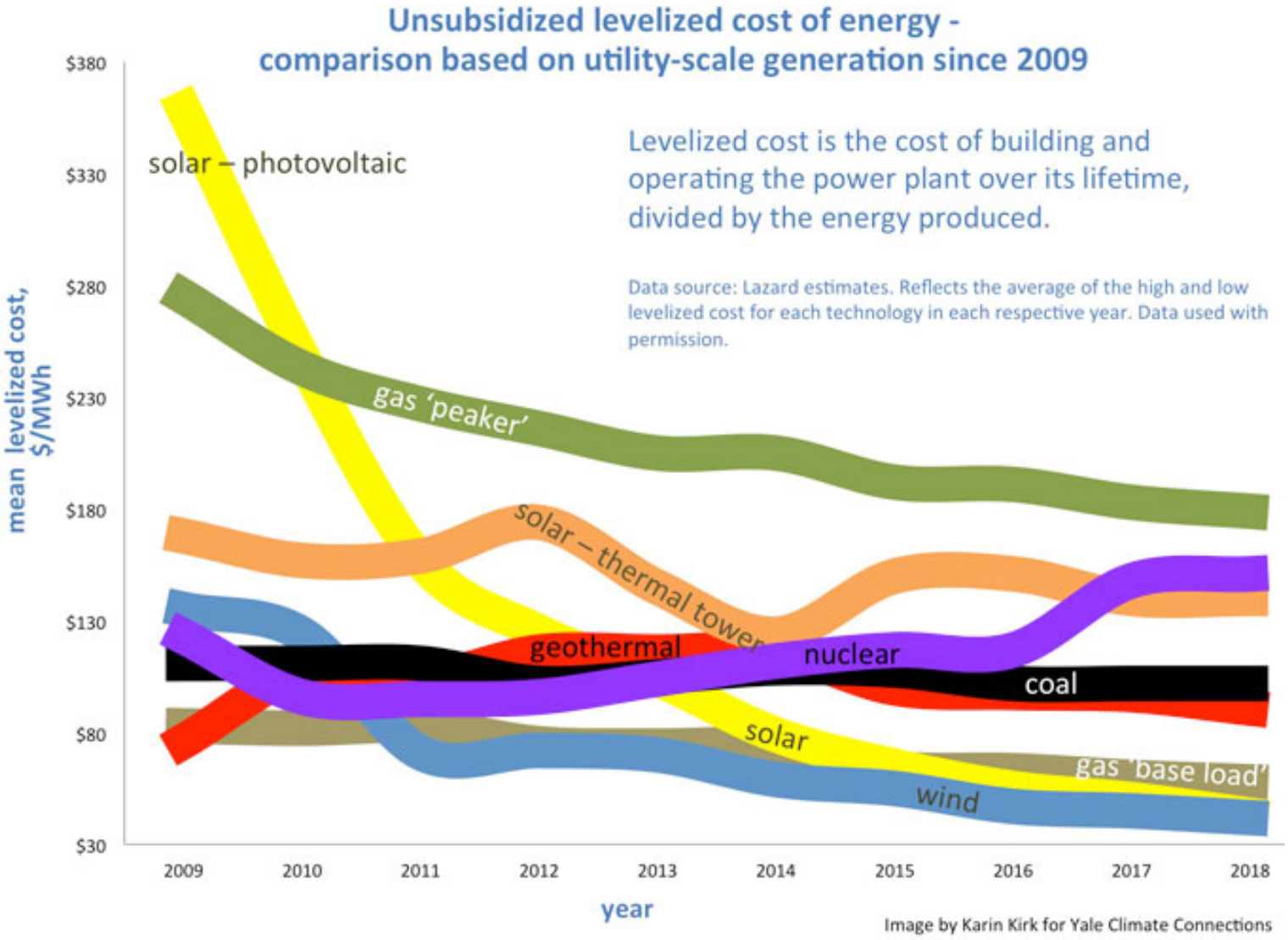
Sources: Projections: *Annual Energy Outlook*, Reference case projections, various editions.

Historical data: U.S. Energy Information Administration open data API (http://www.eia.gov/opendata/) (Washington, DC). Retrieved July 18, 2018. Series: TOTAL.TETCEUS.A. Shading indicates overestimation (blue) or underestimation (green).

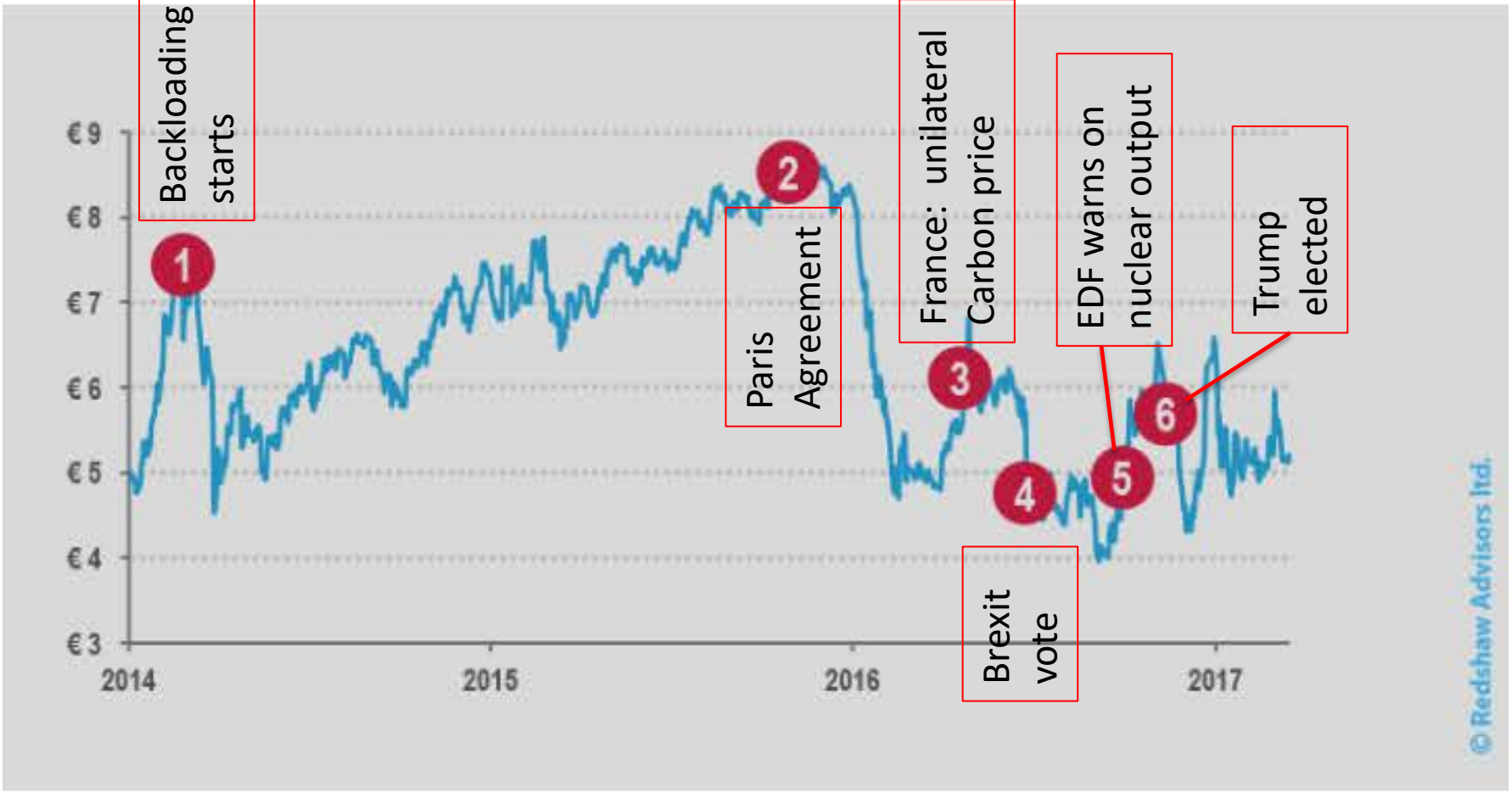
Ten year error

1998 – 2008: 11.3% (high)
1999 – 2009: 20.6% (high)
2000 – 2010: 17.5% (high)
2001 – 2011: 23.3% (high)
2002 – 2012: 32.7% (high)
2003 – 2013: 29.3% (high)
2004 – 2014: 28.5% (high)
2005 – 2015: 34.1% (high)
2006 – 2016: 31.0% (high)
2007 – 2017: 30.7% (high)

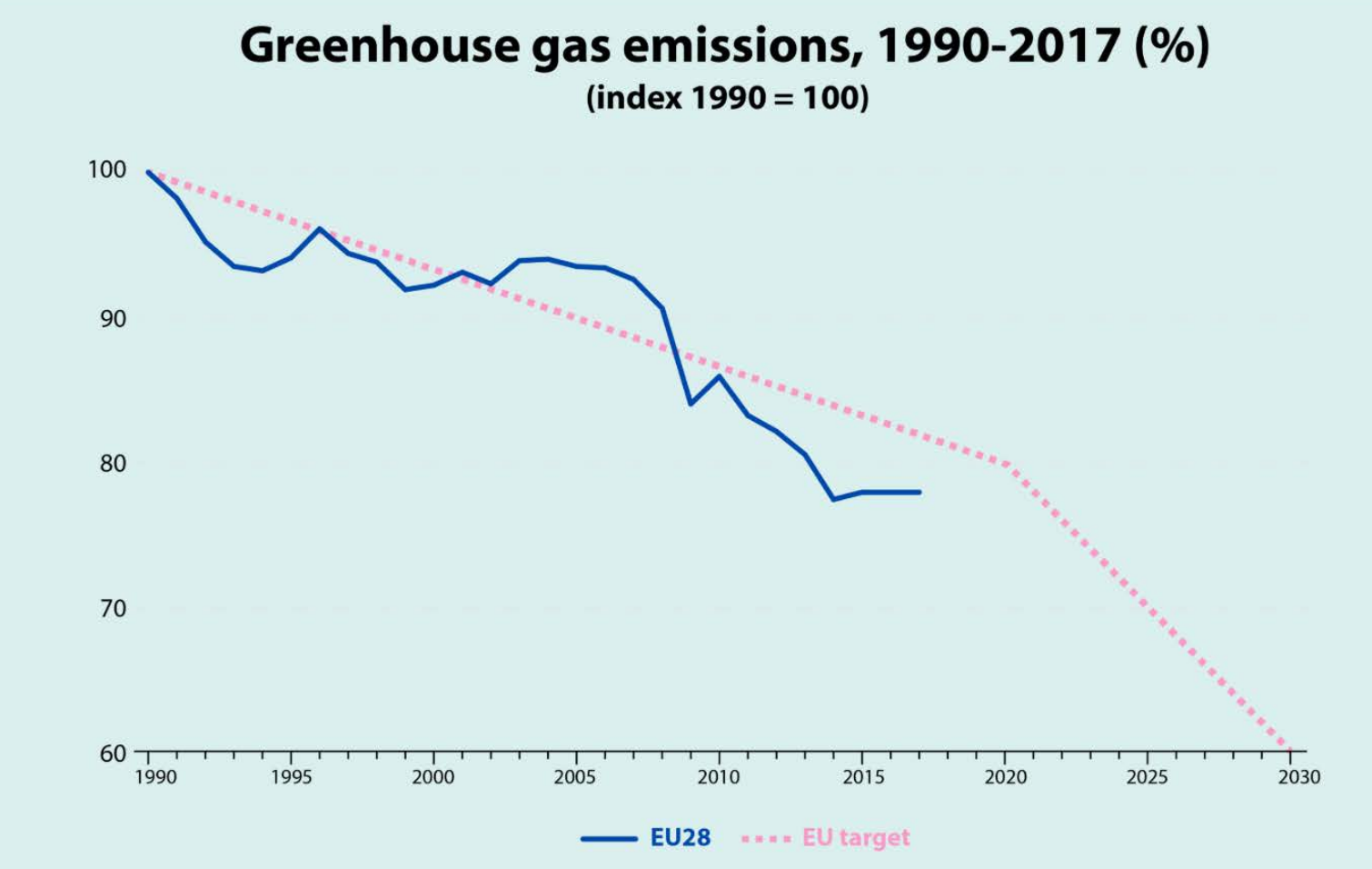
What did we miss? GDP growth, gas and renewables?



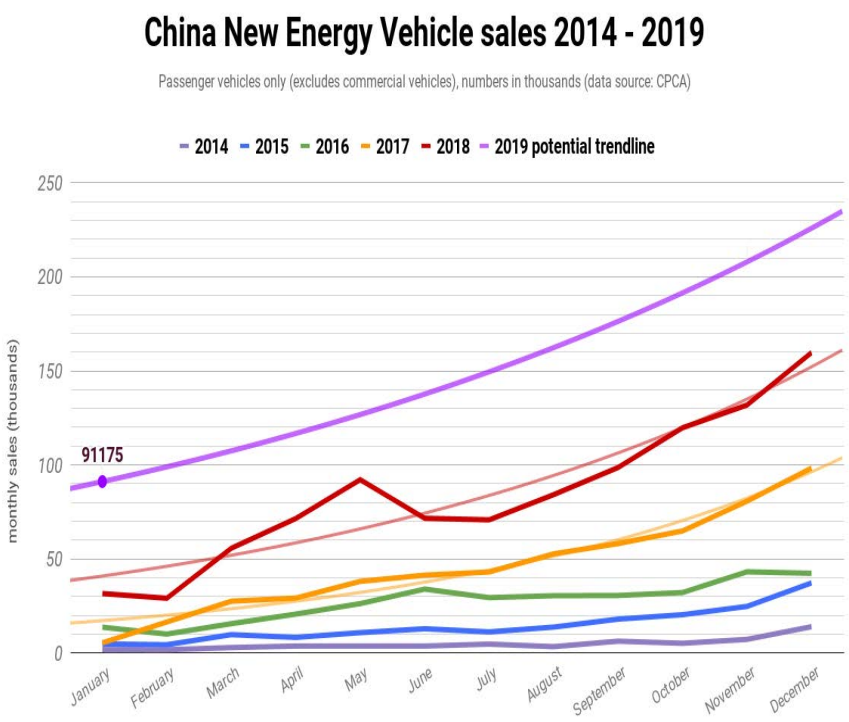
What did we miss? Politics in EU Affecting Allowance Prices?

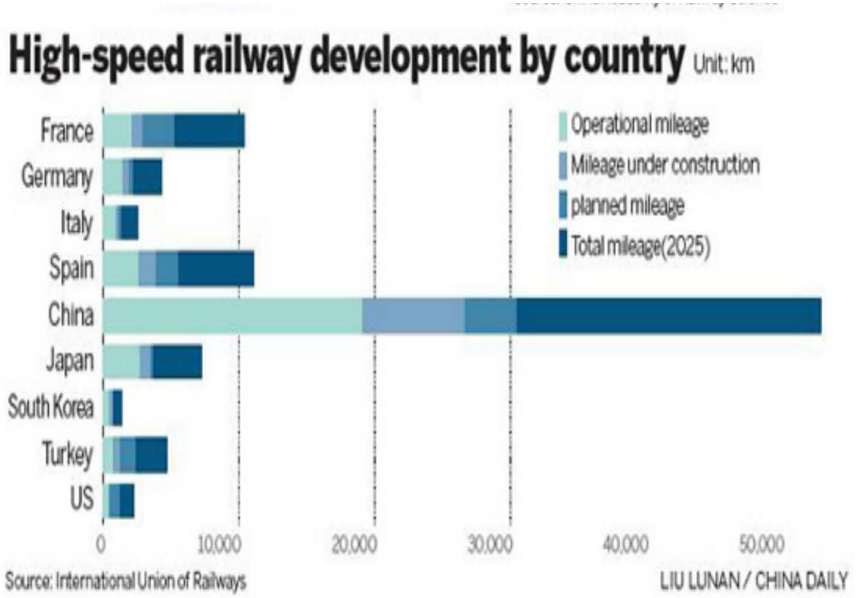


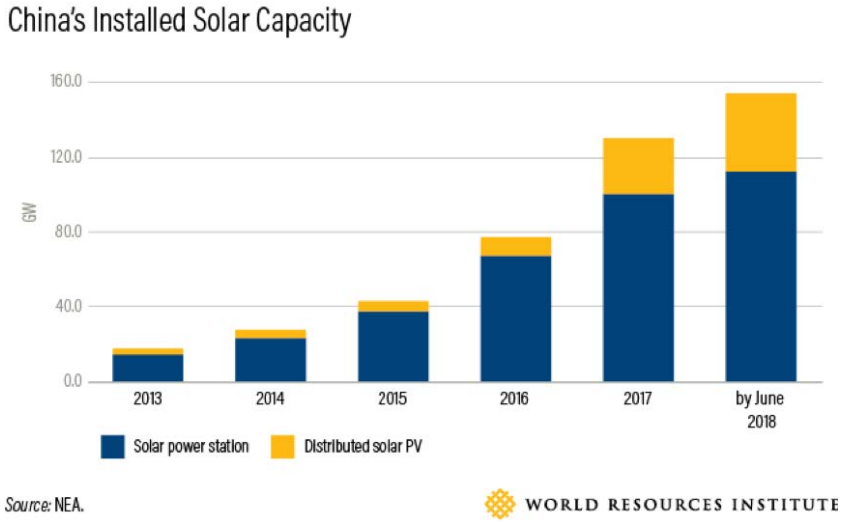
But EU GHG emissions have gone down anyway



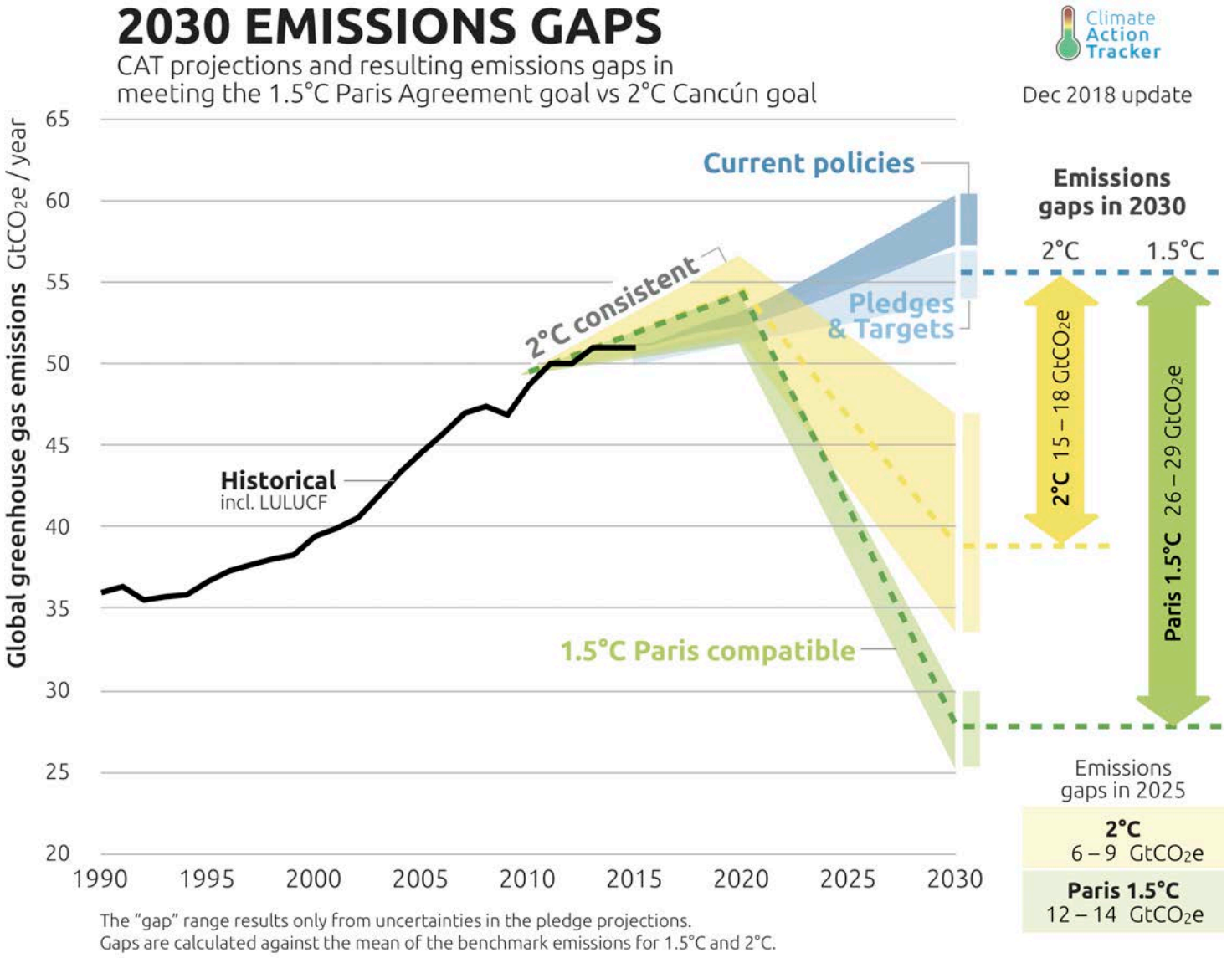
What did we miss? Chinese clean growth?



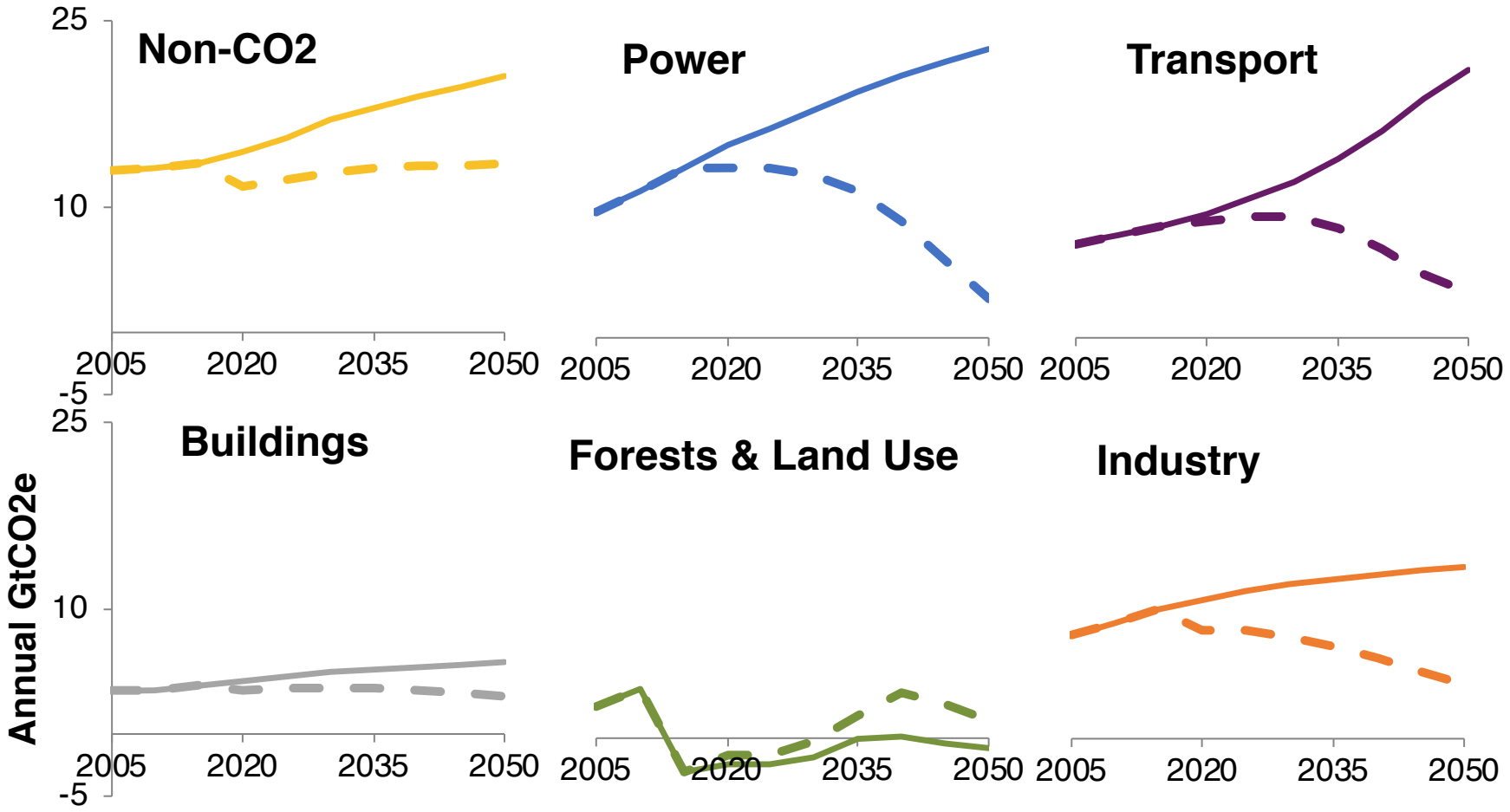




Closing the Gap to Meet the Paris Goal



How do we deliver that abatement? Essentially all sectors move to net zero



Solid lines for BAU, dashed lines for 2°C scenario.

Source: ClimateWorks 2050 Pathways Modeling (GCAM v4.2, 2017)

Consideration for IAMs (1)

The common thread leading to a disconnect between our projections and today's reality seem mostly linked to political choices. These include everything from just transition to difficulty in adopting carbon prices. How we evaluate such choices going forward will be essential – and many are not currently incorporated into our IAM analyses which are largely built on price equilibrium assumptions.

Consideration for IAMs (2)

- Non price related policy (just transition, trade barriers, political disruptions)
- Technology shifts that are price insensitive and more rapid than market would indicate (eg, Chinese decisions on technology development and scaling)
- Interactions between sectors and economic impacts (including on jobs and workforce requirements as well as feedbacks from climate on decision-making; feedback from agriculture, water, land, industrial policy)
- Distributional equity will matter hugely for politics