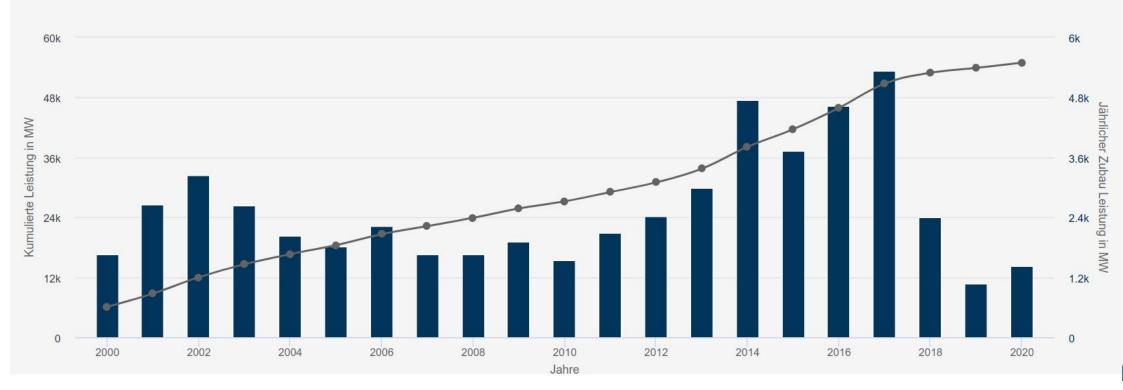


Is wind energy indispensable for the energy transition?

=

Installierte Windenergieleistung in Deutschland

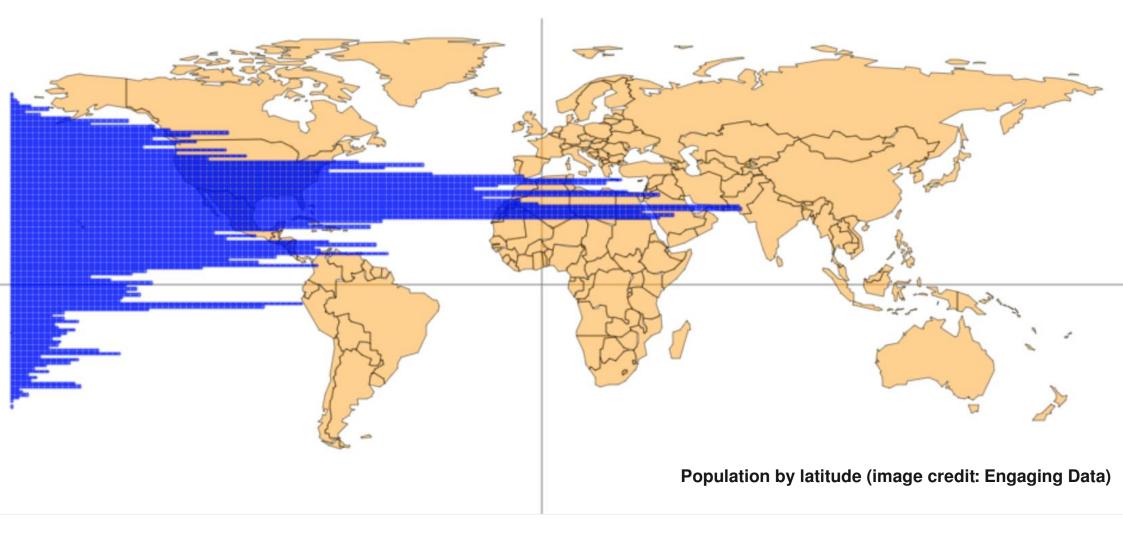
Stand: 31.12.2020



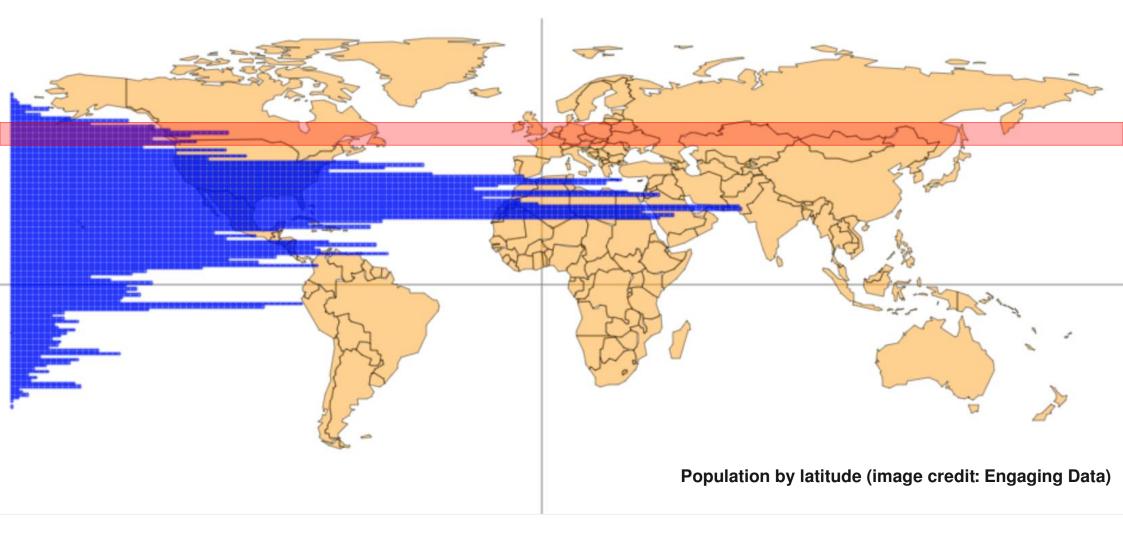
Or would it also work with solar electricity alone?



Fortunately, most people live at latitudes where the difference between summer and winter is small:



Fortunately, most people live at latitudes where the difference between summer and winter is small:



A20	$ f_X \Sigma - =$		
	A	B	8
4			
5	Max value	125,320	
6	Assumed PV	200,000	
7			
8	Scenario		
9	PV	1,400	GW
10	Mult	0.007	
11	Yearly demand	900	TWh
12	Usage	103	GW
<mark>1</mark> 3	Batteries	4,000	GWh
14	eff to battery	0.95	
15	eff from battery	0.95	
16	Methane	300,000	GWh
17	eff to methane	0.55	
18	eff from methane	0.55	
19			
	Image: PowerToCH4 CCPP CCPP_PtM Sunny_May Find Image: PowerToCH4 Image: PowerToCH4 CCPP CCPP_PtM Sunny_May	h Case Qe	
Sheel	1 of 5 PageStyle_Tabelle1	English (USA)	



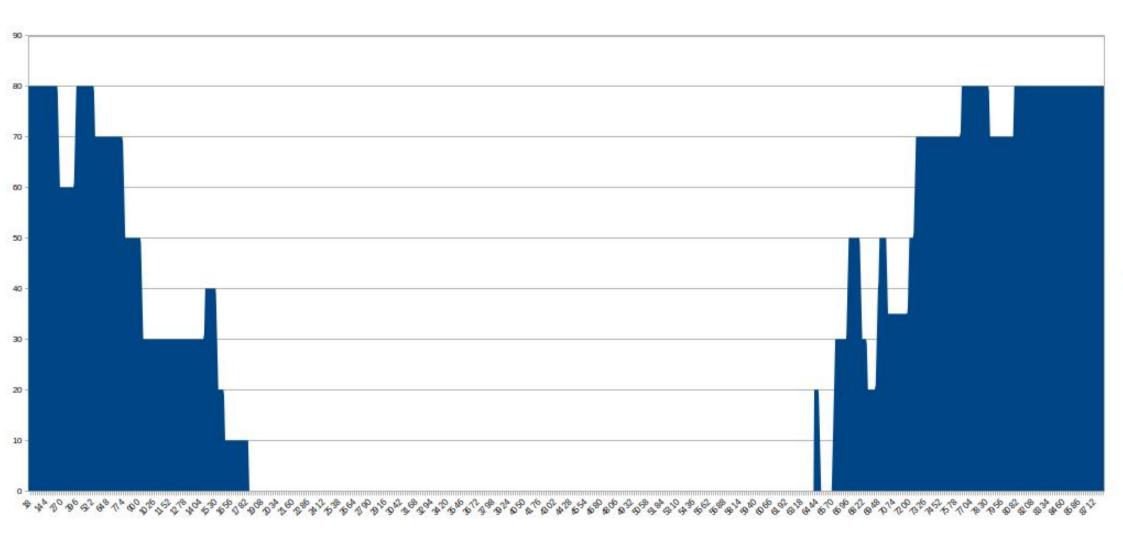
- f_x Σ - =

						111 (1995)	1	1	T 222 T
A	B	D	E	F	G	H		J	К
Mittelwert ITC, data for previous hour PV Production	17,475	CW/ DV	Ē	and Dattany	to Dottom	Battery GWh	CCDD	Devuer to CUA	Mathana
		GW PV	-		to Battery		CCPP	Power to CH4	Methane F
2008-01-01 00:29:59 2008-01-01 01:29:59	0		0	23	0				300,000
	0		0	23	0				299,855
2008-01-01 02:29:59	0		0	23	0				299,709
2008-01-01 03:29:59	0		0	23	0				299,564
2008-01-01 04:29:59	0		0	23	C				299,418
2008-01-01 05:29:59	0		0	23	C				299,273
2008-01-01 06:29:59	0		0	23	0				299,127
2008-01-01 07:29:59	0		0	23	0			4	298,982
2008-01-01 08:29:59	731		5	18					298,836
2008-01-01 09:29:59	5,003		35	0					298,691
2008-01-01 10:29:59	10,706		75	0					298,545
2008-01-01 11:29:59	15,397		108	0					298,400
2008-01-01 12:29:59	17,332		121	0					298,255
2008-01-01 13:29:59	16,546		116	0					298,109
2008-01-01 14:29:59	11,297		79	0					297,964
2008-01-01 15:29:59	4,613		32	0	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1				297,818
2008-01-01 16:29:59	343		2	20					297,673
2008-01-01 17:29:59	0		0	23	C				297,527
2008-01-01 18:29:59	0		0	23	C				297,382
2008-01-01 19:29:59	0		0	23	C				297,236
2008-01-01 20:29:59	0		0	23	C				297,091
2008-01-01 21:29:59	0		0	23	C				296,945
2008-01-01 22:29:59	0		0	23	C				296,800
2008-01-01 23:29:59	0		0	23	C				296,655
2008-01-02 00:29:59	0		0	23	C	1,989	80		296,509
2008-01-02 01:29:59	0		0	23	C	1,966			296,364
2008-01-02 02:29:59	0		0	23	C	1,942	80		296,218
2008-01-02 03:29:59	0		0	23	C	1,918	80		296,073
2008-01-02 04:29:59	0		0	23	C	1,894	80		295,927
2008-01-02 05:29:59	0		0	23	C	1,870	80		295,782
2008-01-02 06:29:59	0		0	23	C	1,846	6 80		295,636
2008-01-02 07:29:59	0		0	23	C				295,491
2008-01-02 08:29:59	1,118		8	15	C				295,345
2008-01-02 09:29:59	7,610		53	0					295,200
				-					
Data PowerToCH4 CCPP CCPP_PI	:M Sunny_May								
👻 🛧 🕁 Find All	Formatted Display Match	Case 😪							

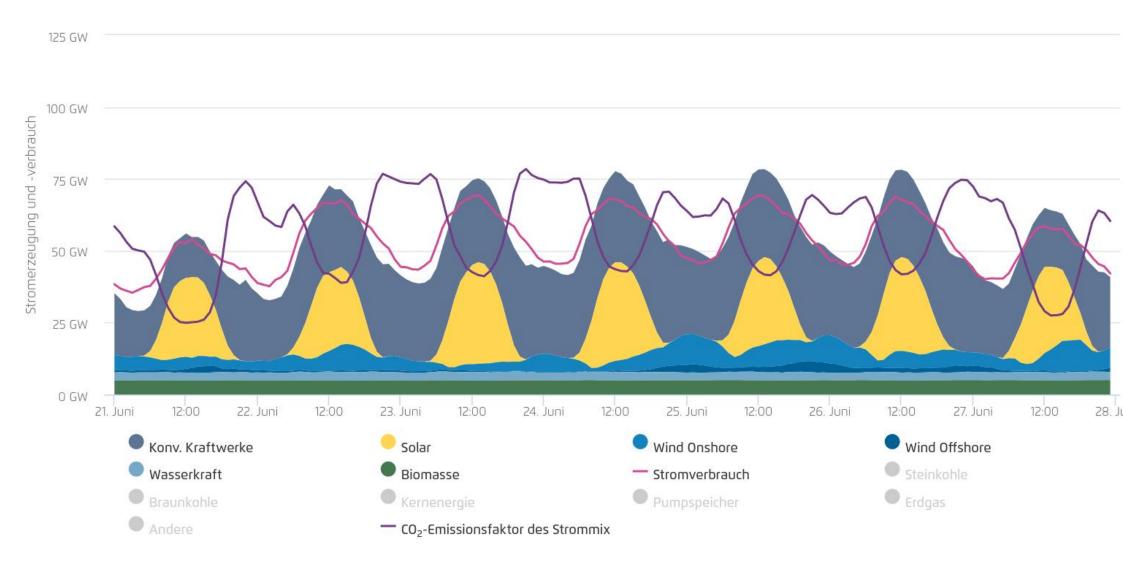
PageStyle_Tabelle1

English (USA)

80 GW CCGT power plants are sufficient, Power adjustments with only 1 GW per hour



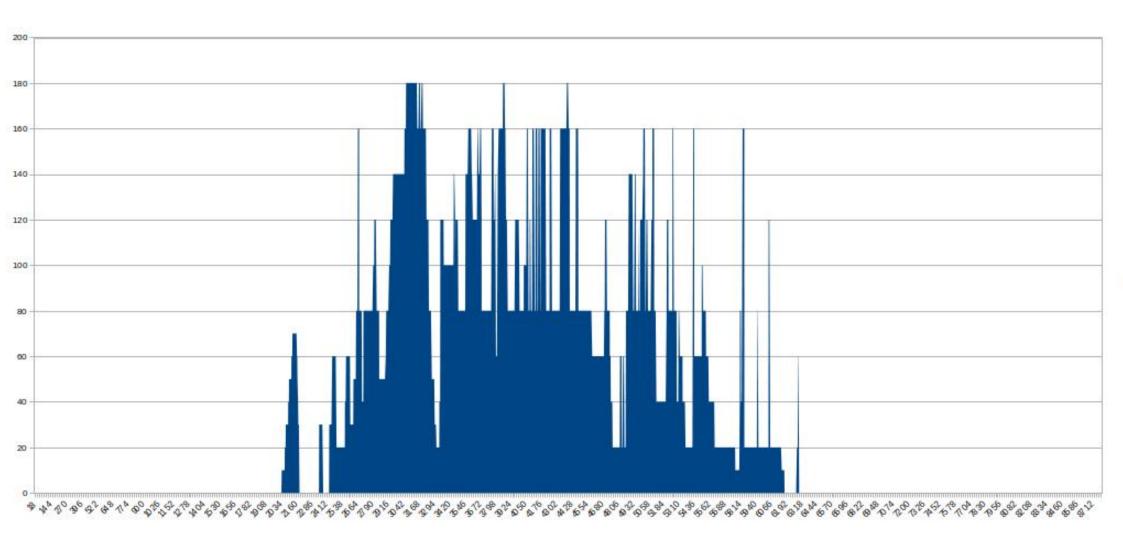
Compare that to the madness of today:



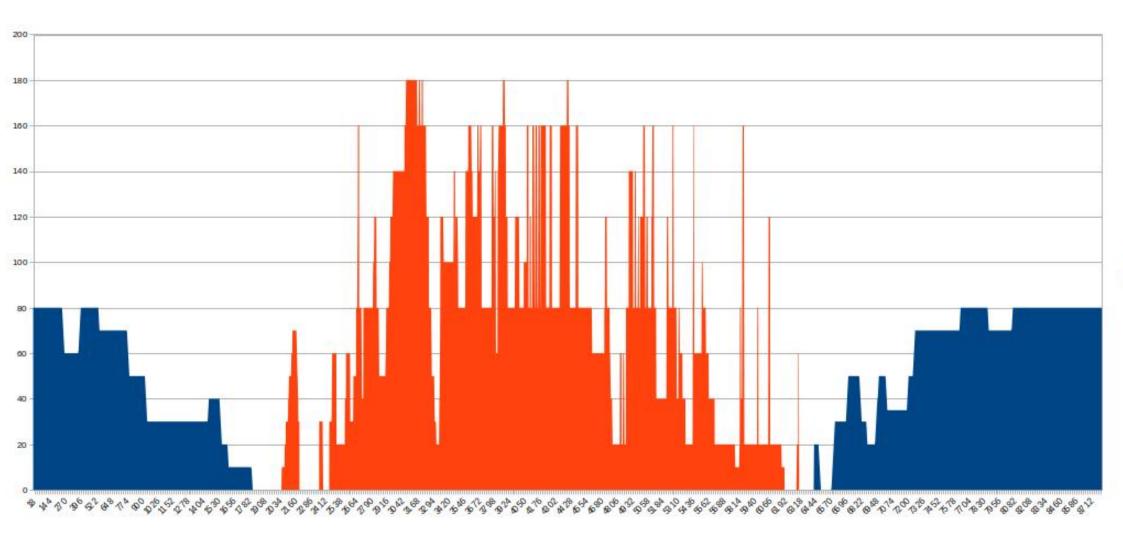
More power adjustments in 2 days than in an entire year in this scenario.



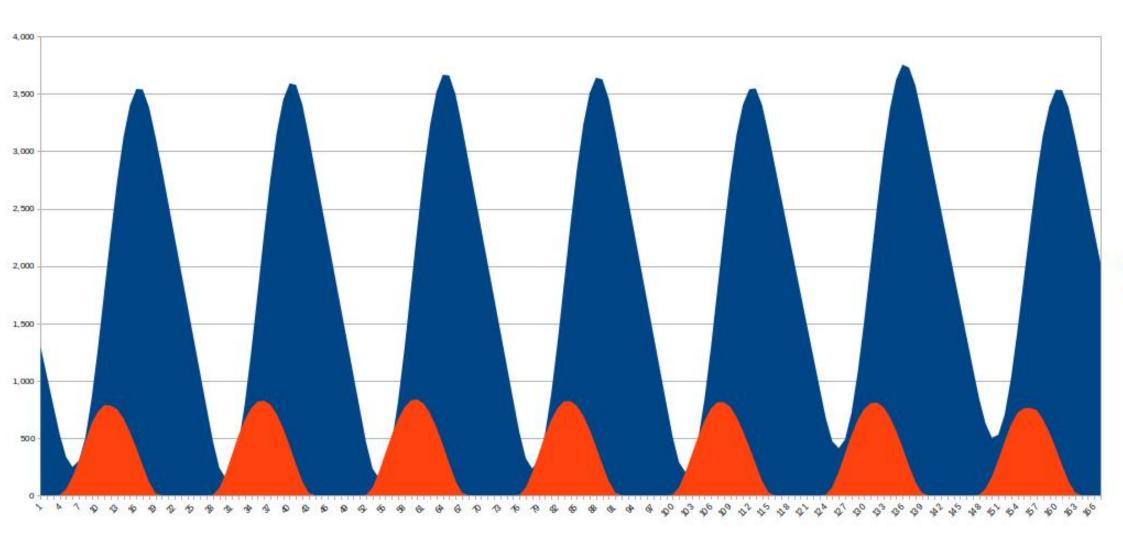
180 GW power to methane is enough, full 180 GW only 143 hours, 160 GW is enough for the rest.



Use of CCGT power plants and power to gas are clearly separated in terms of time



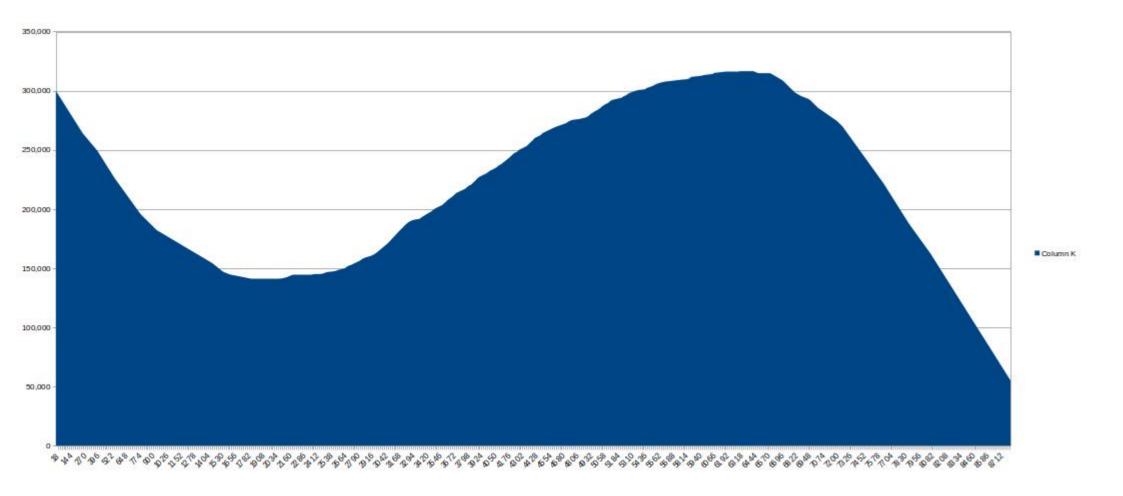
A very sunny May week. Only here, most of the battery capacity was used daily to supply the Power to Gas systems evenly with 180 GW.



2008-05-07 - 2008-05-13

from Battery	to Battery	Battery GWh	CCPP	Power to CH4	Methane P
Total	Total	Difference	Total	Total	Difference H
507,303	562,787	668	231,175	318,950	-244,750 w
Min	Min	Min	Min	Min	Min P
0	0	40	0	0	55,250
Мах	Max	Max	Max	Max	Max
283	559	3,994	80	180	316,477
			Full hours	Full hours	
			2,890	1,772	
T	Fotal 507,303 Min 0 Max	Total Total 507,303 562,787 Min 0 0 Max Max 0	Total Total Difference 507,303 562,787 668 Min Min 40 Max Max Max 283 559 3,994	TotalTotalDifferenceTotal507,303562,787668231,175MinMinMinMin00400MaxMaxMaxMax2835593,99480Full hours	TotalTotalDifferenceTotalTotal507,303562,787668231,175318,950MinMinMinMinMin004000MaxMaxMaxMaxMax2835593,99480180

Methane storage would need to be supplemented by 245 TWh in the summer half-year.



Southern countries are pleased with the decrease in surpluses.

600 kWh per month for household, hot water and electric cars additional demand for space heating and cooling:

	+				·	L							
General monthly consumption kWh	600	1				1							
Extra usage for heating and cooling	January	Feb.	March	April	Мау	June	July	August	Sept.	October	Nov.	Dec.	Total
Oslo	500	300	100			1				100	300	500	1,800
Berlin	400	200									200	400	1,200
Vienna	400	200				50	50	1			200	400	1,300
Rome	150	100			100	200	200	100	1		100	0 150	1,100
Athens	150	100			100	200	200	100	1		100	0 150	0 1,100
Tel <u>Avi</u> y	100	100	150	200	200	200	200	200	200	150	100	0 100	1,900
Cairo	50	100	150	200	250	250	250	250	200	150	100	50	2,000
						1							
Electricity balance	January	Feb.	March	April	May	June	July	August	Sept.	October	Nov.	Dec.	Total
Oslo	-989	-443	869	2,012	2,956	3,376	2,969	2,196	1,222	73	-697	7 -1,036	<mark>6</mark> 12,510
Berlin	-575	66	1,281	2,478	3,108	3,327	3,184	2,657	1,747	716	-254	4 -676	<mark>6</mark> 17,060
Vienna	-341	326	1,701	2,873	3,410	3,508	3,593	3,017	2,051	998	-23	3 -435	<mark>5</mark> 20,678
Rome	586	1,130	2,317	3,204	4,003	4,171	4,533	3,959	2,714	1,790	801	L 488	3 29,695
Athens	933	1,313	2,738	3,692	4,390	4,619	4,941	4,480	3,223	2,087	1,147	7 697	34,259
Tel <u>Avi</u> v	1,491	1,800	3,073	3,657	4,369	4,624	4,684	4,254	3,412	2,606	1,726	5 1,353	37,049
Cairo	2,099	2,313	3,557	4,024	4,578	4,723	4,799	4,410	3,679	2,995	2,154	1,906	6 41,237
		1	1	1	1	1	1	T	T	T	1		1

Summer / winter compensation only required from Vienna to Oslo

Methane storage would need to be doubled from 24.6 km³ to 50 km³.



Hydrogen requires 3.2 times more volume for the same energy. An expansion to 160 km³ is likely to be very difficult.





