

CBAT DOMAIN FOUR - DAMAGES & GROWTH -

<http://www.gci.org.uk/cbat-domains/Domains.swf>

Climate-Damage curves are shown as a 'Damage-Footprint'. The formula for this footprint is the same in all the positions arising in CBAT Domain 4. In all 15 different 'footprints' arise from the: -

- [a] Single Uniform Module [SUM] calculating Damage-Footprints [described separately below] &
- [b] Three 'Carbon-Budgets' ['LOW, MEDIUM, HIGH] times &
- [c] Five 'Climate-Sensitivity' positions [Buttons 1,2,3,4,5] where points [b] & [c] are as set up in and CBAT-user-controlled from the control panel originating in CBAT DOMAIN ONE.

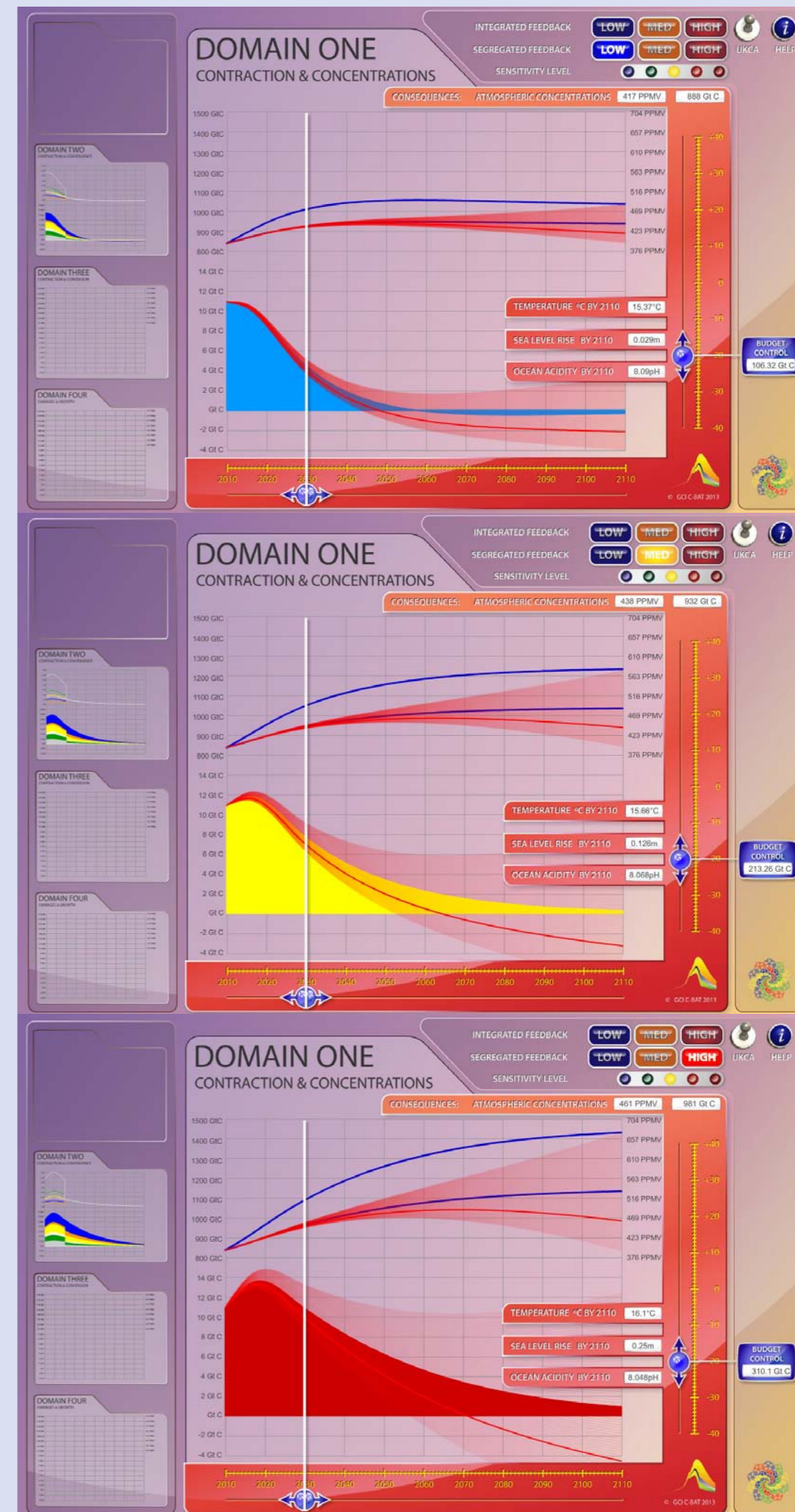
As before, for each of the 3 Budgets, using the Vertical Slider ranges the damage-footprint in 'stepped-positions' [81 in all] from - 40 to + 40, centering on 'zero'. 5 Climate-Sensitivity' settings are available for each 'Carbon-Budget' giving a total of 1200 different footprint positions. However, NB, ALL these differences result from changing JUST ONE SINGLE 'PARAMETER VALUE' in SUM for each, as shown in column 9 in this FYI-table; SUM &/or these values can be in the xml datasheet: -

LOW BUDGET	Sensitivity Level	Start Temp [2010]	for D4 Damages 'Straight-Line'	End Temp [2110]	Difference Start End	Year-on-Year Step	Sensitivity Parameter
Temperature	1	15.01	15.13	15.48	0.47	0.0059	210
Temperature	2	15.01	15.25	15.97	0.96	0.0120	180
Temperature	3	15.01	15.37	16.46	1.45	0.0181	140
Temperature	4	15.01	15.50	16.95	1.94	0.0243	100
Temperature	5	15.01	15.62	17.43	2.42	0.0303	60
MEDIUM BUDGET	Sensitivity Level	Start Temp 2010	for D4 Damages 'Straight-Line'	End 2110	Diff	Step	Sensitivity Parameter
Temperature	1	15.01	15.20	15.78	0.77	0.0096	90
Temperature	2	15.01	15.45	16.75	1.74	0.0218	75
Temperature	3	15.01	15.67	17.63	2.62	0.0328	60
Temperature	4	15.01	15.89	18.51	3.50	0.0438	45
Temperature	5	15.01	16.11	19.39	4.38	0.0548	30
HIGH BUDGET	Sensitivity Level	Start Temp 2010	for D4 Damages 'Straight-Line'	End 2110	Diff	Step	Sensitivity Parameter
Temperature	1	15.01	15.37	16.46	1.45	0.0181	50
Temperature	2	15.01	15.74	17.92	2.91	0.0364	40
Temperature	3	15.01	16.11	19.39	4.38	0.0548	30
Temperature	4	15.01	16.47	20.85	5.84	0.0730	20
Temperature	5	15.01	17.09	23.31	8.30	0.1038	10

For the damage curves in Domain 4, the axis is on the right in Trillions of Dollars [\$Tr] going from -20 \$Tr to +160 \$Tr. The Vertical Slider position at -20 always coincides with the Climate Damages 'FLAT-LINE' [marked as a dotted line]. In every case, this Climate Damages 'FLAT-LINE' separates the 60 Slider positions above it, [which progressively 'accelerate' or curve upwards], from the 40 positions below it [which progressively 'decelerate' or curve downwards] from year 2010 to year 2110.

In Domain Four the Emissions-Lines are programmed the same as in Domain One from selecting the 'Segregated Feedback' Option. The axis is on the left in Gt C from -4Gt C to +32 Gt C. However, from 16 Gt C to 32 Gt C the axis values substitutes the right-hand axis [80-160 \$Tr] for the dotted 'Economic Growth-as-usual' line [top left] where Global GDP is shown constantly rising @ 3%/year.

For each Budget the Emissions-Lines remain the same for each of the 5 Sensitivity settings. Only damage lines get steeper with each setting of 'Climate-Sensitivity' [1-5 as shown alongside]. The Emission-Line at Vertical Slider position -20 is also a dotted line. This is to assist understanding that it corresponds with the Climate-Damages Line at -20. In each case the Climate Damages Line selected with the Slider in the 'Footprint', moves in lock-step with the corresponding Emission-Line.



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Temperature	1	15.01	15.13	15.48	0.47	0.0059	210
Temperature	2	15.01	15.25	15.97	0.96	0.0120	180
Temperature	3	15.01	15.37	16.46	1.45	0.0181	140
Temperature	4	15.01	15.50	16.95	1.94	0.0243	100
Temperature	5	15.01	15.62	17.43	2.42	0.0303	60

MEDIUM BUDGET	Sensitivity Level	Start Temp 2010	for D4 Damages 'Straight-Line'	End 2110	Diff	Step	Sensitivity Parameter
Temperature	1	15.01	15.20	15.78	0.77	0.0096	90
Temperature	2	15.01	15.45	16.75	1.74	0.0218	75
Temperature	3	15.01	15.67	17.63	2.62	0.0328	60
Temperature	4	15.01	15.89	18.51	3.50	0.0438	45
Temperature	5	15.01	16.11	19.39	4.38	0.0548	30

HIGH BUDGET	Sensitivity Level	Start Temp 2010	for D4 Damages 'Straight-Line'	End 2110	Diff	Step	Sensitivity Parameter
Temperature	1	15.01	15.37	16.46	1.45	0.0181	50
Temperature	2	15.01	15.74	17.92	2.91	0.0364	40
Temperature	3	15.01	16.11	19.39	4.38	0.0548	30
Temperature	4	15.01	16.47	20.85	5.84	0.0730	20
Temperature	5	15.01	17.09	23.31	8.30	0.1038	10

'SINGLE UNIFORM MODEL' [SUM] generates 'ALL' DAMAGE CURVES

The MATRIX in SUM, detailed below, generates all the 'damage-curves' in CBAT. In other words the formula that generates through MATRIX remains constant for all curve cases. 5 'climate-sensitivity' settings for each of the 3 Emissions-Budgets programmed in xml into CBAT are generated, giving a total of 15. These '15' come from a single 'sensitivity-parameter' value being changed as the MATRIX is used for each curve. These parameter values are shown in the right-hand column in the table to the left [& can also be programmed into the xml]. As before, there are 40 positions above & 40 below position '0' on the Vertical Slider. The effects of combining these are shown in the damage-curves in the 'damage footprints' [faint red with every 10th curve a bit darker & flat-line dotted-darker] as shown next page.

Extend % values in MATRIX pattern, starting cell J5=100% decelerating Left & accelerating Right as shown, covering 81 columns <Vertical Slider [VS] steps> & 100 rows 2010-2110

'DAMAGE REFERENCE'

DR is shown in Column C in the table to the right. The 'Unit of Measure' is trillions of \$ [\$Tr]. In CBAT DOMAIN 4 these are on the Right-Hand Axes ranging from -\$20Tr to +160\$Tr. DR has a value for each year [2010 to 2110] generated by formula. This starts with the fixed reference 'value' of 5 \$Tr in 2010. The value of each successive year is the previous year + the reference value divided by the parameter value selected. As before, each sensitivity curve has 80 slider positions above & below slider '0' with the constant 100% [the flat-line] set at slider position -20. 81 curves are Column C values * Matrix %s Columns D to BO.

	A	B	C	D
1		B-a-U	Damage Ref [DR]	-40
2			DR = C4 divided by 'Parameter'	-20
3	YEAR	GROWTH @ 3%/yr		
4	2010	62.00 \$Tr	5 \$ Trillion	100.00%
5	2011	63.86 \$ Tr	=C4 + DR	90.00%
6	2012	65.86 \$ Tr	=C5 + DR	80.00%
7	2013	63.78 \$ Tr	=C6 + DR	70.00%
8	2014	67.75 \$ Tr	=C7 + DR	60.00%
9	2015	69.78 \$ Tr	=C8 + DR	50.00%
10	2016	=B9*1.03	=C9 + DR	40.00%
11	2017		=C10 + DR	30.00%
12	2018	we can put this row into xml	=C11 + DR	20.00%
13	2019		=C12 + DR	10.00%
14	2020		=C13 + DR	00.00%
15	2021		=C14 + DR	-10.00%
16	2022		=C15 + DR	-20.00%
17	2023		=C16 + DR	-30.00%
18	2024		=C17 + DR	-40.00%
19	2025		=C18 + DR	-50.00%
20	2026		=C19 + DR	-60.00%
21	2027		=C20 + DR	-70.00%
22	2028		=C21 + DR	-80.00%
23	2029		=C22 + DR	-90.00%
24	2030		=C23 + DR	-100.00%
105	2110		=C104 + DR	-900.00%

E	F	G	H	I	J	K	L	M	N	O	BO
-25	-24	-23	-22	-21	VS @ -20	-19	-18	-17	-16	-15	40
-5	-4	-3	-2	-1	0	1	2	3	4	5	60
<Deceleration curves in 20 increasing steps <<					Flatline	>>Acceleration curvature in 60 increasing steps>					
100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
97.50%	98.00%	98.50%	99.00%	99.50%	100.00%	100.50%	101.00%	101.50%	102.00%	102.50%	130.00%
95.00%	96.00%	97.00%	98.00%	99.00%	100.00%	101.00%	102.00%	103.00%	104.00%	105.00%	190.00%
92.50%	94.00%	95.50%	97.00%	98.50%	100.00%	101.50%	103.00%	104.50%	106.00%	107.50%	220.00%
90.00%	92.00%	94.00%	96.00%	98.00%	100.00%	102.00%	104.00%	106.00%	108.00%	110.00%	250.00%
87.50%	90.00%	92.50%	95.00%	97.50%	100.00%	102.50%	105.00%	107.50%	110.00%	112.50%	280.00%
85.00%	88.00%	91.00%	94.00%	97.00%	100.00%	103.00%	106.00%	109.00%	112.00%	115.00%	310.00%
82.50%	86.00%	89.50%	93.00%	96.50%	100.00%	103.50%	107.00%	110.50%	114.00%	117.50%	340.00%
80.00%	84.00%	88.00%	92.00%	96.00%	100.00%	104.00%	108.00%	112.00%	116.00%	120.00%	370.00%
77.50%	82.00%	86.50%	91.00%	95.50%	100.00%	104.50%	109.00%	113.50%	118.00%	122.50%	400.00%
75.00%	80.00%	85.00%	90.00%	95.00%	100.00%	105.00%	110.00%	115.00%	120.00%	125.00%	430.00%
72.50%	78.00%	83.50%	89.00%	94.50%	100.00%	105.50%	111.00%	116.50%	122.00%	127.50%	460.00%
70.00%	76.00%	82.00%	88.00%	94.00%	100.00%	106.00%	112.00%	118.00%	124.00%	130.00%	490.00%
67.50%	74.00%	80.50%	87.00%	93.50%	100.00%	106.50%	113.00%	119.50%	126.00%	132.50%	520.00%
65.00%	72.00%	79.00%	86.00%	93.00%	100.00%	107.00%	114.00%	121.00%	128.00%	135.00%	550.00%
62.50%	70.00%	77.50%	85.00%	92.50%	100.00%	107.50%	115.00%	122.50%	130.00%	137.50%	580.00%
60.00%	68.00%	76.00%	84.00%	92.00%	100.00%	108.00%	116.00%	124.00%	132.00%	140.00%	610.00%
57.50%	66.00%	74.50%	83.00%	91.50%	100.00%	108.50%	117.00%	126.50%	134.00%	142.50%	640.00%
55.00%	64.00%	73.00%	82.00%	91.00%	100.00%	109.00%	118.00%	127.00%	136.00%	145.00%	670.00%
52.50%	62.00%	71.50%	81.00%	90.50%	100.00%	109.50%	119.00%	128.50%	138.00%	147.50%	700.00%
50.00%	60.00%	70.00%	80.00%	90.00%	100.00%	110.00%	120.00%	130.00%	140.00%	150.00%	730.00%
Continue pattern i.e. Years 2029 to 2109 finishing at 2110											
-150.00%	-100.00%	-50.00%	00.00%	50.00%	100.00%	150.00%	200.00%	250.00%	300.00%	350.00%	3100.00%

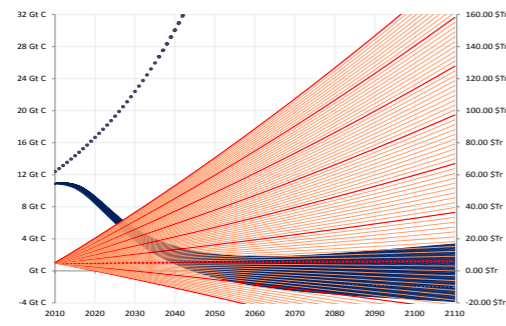
Continue pattern i.e. Vertical Slider -26 to -39 finishing at -40

Continue pattern i.e. Vertical Slider -15 to +39 finishing at +40

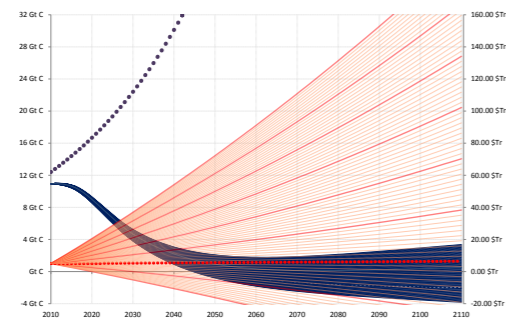
USE ADOBE 'ZOOM' FUNCTION TO SEE DETAIL IN THESE CHARTS

LOW BUDGET - CBAT STANDARD

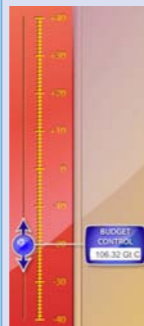
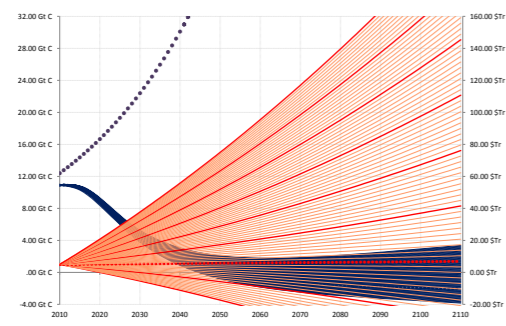
LOW Sensitivity 1 (Parameter 460)



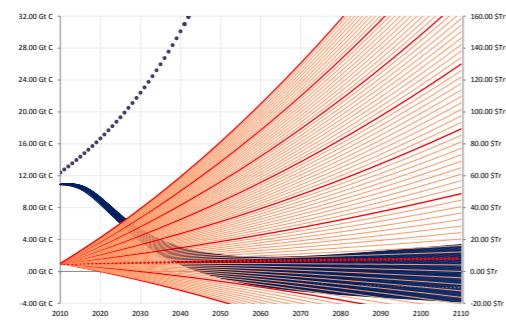
LOW Sensitivity 2 (Parameter 360)



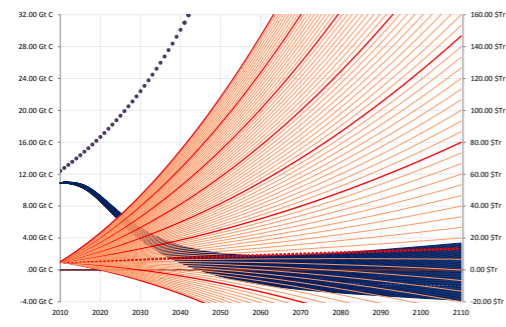
LOW Sensitivity 3 (Parameter 260)



LOW Sensitivity 4 (Parameter 160)

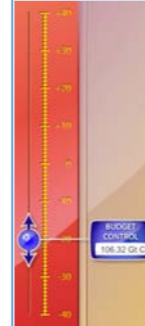
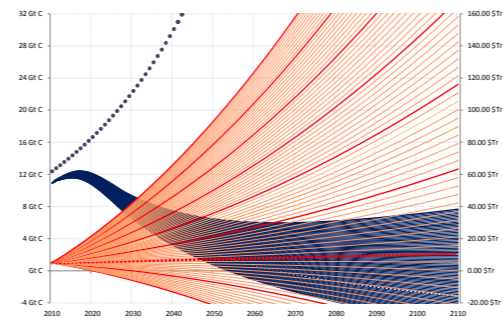


LOW Sensitivity 5 (Parameter 60)

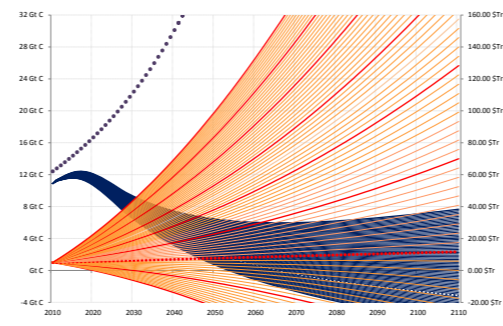


MEDIUM BUDGET - CBAT STANDARD

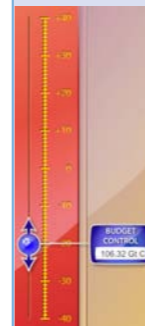
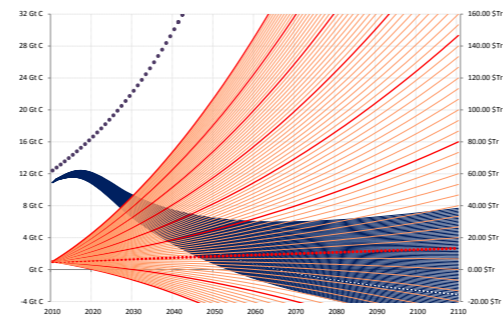
MEDIUM Sensitivity 1 (Parameter 90)



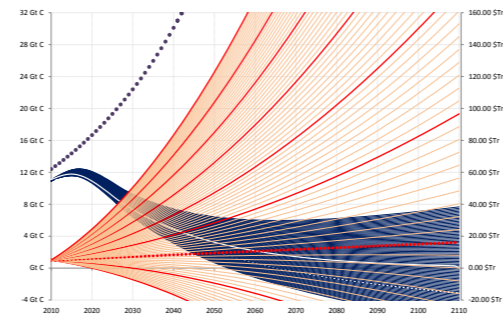
MEDIUM Sensitivity 2 (Parameter 75)



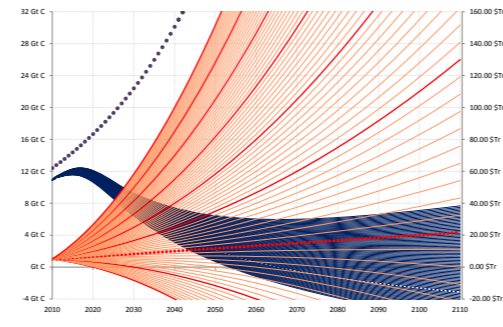
MEDIUM Sensitivity 3 (Parameter 60)



MEDIUM Sensitivity 4 (Parameter 45)

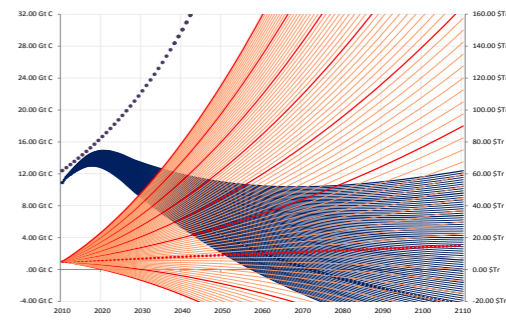


MEDIUM Sensitivity 5 (Parameter 30)

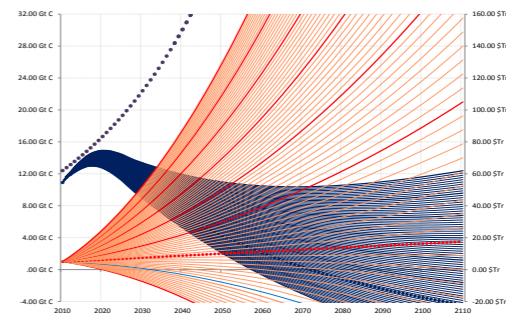


HIGH BUDGET - CBAT STANDARD

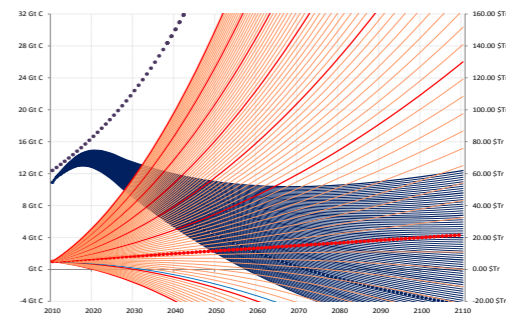
HIGH Sensitivity 1 (Parameter 50)



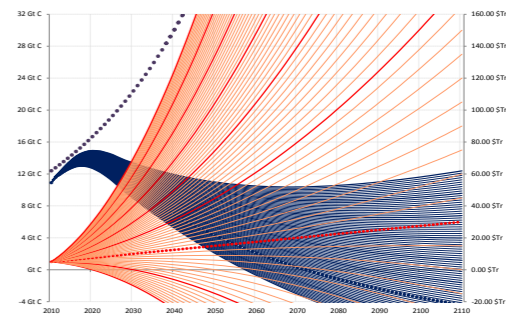
HIGH Sensitivity 2 (Parameter 40)



HIGH Sensitivity 3 (Parameter 30)



HIGH Sensitivity 4 (Parameter 20)



HIGH Sensitivity 5 (Parameter 10)

