Q. Indicate the average energy capability of each of Hydro's hydro-electric generating stations for the years 1992 to 2002 and identify the changes to such capability associated, in each year, with the addition of the previous year's hydrological data to the long term average (and with any other changes). Explain the assumptions and derivation of Schedule III of R.J. Henderson's evidence on total system energy storage by month (minimum energy storage target and maximum energy operating level), and provide equivalent schedules for each year from 1992 to 2000.

A. The attached table on page 3 of 14 provides the average energy capability by year for each of Hydro's hydro-electric generating stations, along with the year-to-year changes in the same. A review of the annual average energy capability is made in most years but the averages are only updated when significant differences are observed. They were updated in 1993, 1996, 1998 and 2000. The tables on pages 4 and 5 of 14 provide the changes in average energy capability associated with the factors which impact its calculation as described in NP-44.

Schedule III of R.J. Henderson's evidence shows the combined energy in storage for all of Hydro's major reservoirs as compared to the minimum that should be maintained in each month, and the maximum level below which total storage must remain or water spillage must occur. The minimum levels are established by using simulations to determine the amount of energy that must be retained in storage in order to ensure that all firm loads can be met should the historical dry sequence recur. The maximum operating level represents the physical limitation of the system with respect to storage and dam safety. The physical volume of water in storage related to the maximum operating level, actual storage and minimum levels are converted to energy by applying an appropriate water to energy conversion factor. For an example of the calculations used to translate live storage into energy in storage, see demand for particular NP-46. The attached graphs show the daily energy in storage for the period 1992 to 2000. Note that until 2001, storage targets were based upon guide curve simulations. Guide curve simulations provide the levels below which maximum thermal production is required in order to meet firm loads in the event of the recurrence of the critical dry sequence. The guide curve simulations did not integrate operation of the Cat Arm and Hinds Lake reservoirs with the Bay D’Espoir river system. In 2000, Hydro implemented the Vista decision support system, which integrated all reservoir operations in the development of the minimum storage levels. Minimum storage levels developed using Vista represents the level above which total energy storage should remain, even using maximum thermal production, in order to protect against a repeat of the critical dry sequence.

Annual Average Energy Capability by Plant
1992-2000
(GWh)

Year		Bay D'Espoir	Upper Salmon	Hinds Lake	Cat Arm	Paradise River
1992	Capability	2541	541	342	745	36.3
1993	Capability	2535	541	340	735	38.2
	Change	*-6*	*0*	*-2*	*-10*	*+1.9*
1994	Capability	2535	541	340	735	38.2
	Change	*0*	*0*	*0*	*0*	*0*
1995	Capability	2535	541	340	735	38.2
	Change	*0*	*0*	*0*	*0*	*0*
1996	Capability	2570	543	341	742	39.37
	Change	*+35*	*+2*	*+1*	*+7*	*+1.2*
1997	Capability	2570	543	341	742	39.37
	Change	*0*	*0*	*0*	*0*	*0*
1998	Capability	2587	549	339	736	39.37
	Change	*+17*	*+6*	*-2*	*-6*	*0*
1999	Capability	2587	549	339	736	39.37
	Change	*0*	*0*	*0*	*0*	*0*
2000	Capability	2598	552	340	735	39.37
	Change	*+11*	*+3*	*+1*	*-1*	*0*

Bay d'Espoir Annual Average Energy Changes

Year	Average Annual Energy	Change	Factor Causing the Change			
			Hydrological Data	Spill History	Fisheries Compensation History	Conversion Factor
		GWh	GWh	GWh	GWh	GWh
1992	2541					
1993	2535	-6	-10	4	-1	1
1996	2570	35	28	-1	-3	11
1998	2587	17	9	2	-1	7
2000	2598	11	17	-5	0	-1

Upper Salmon Annual Average Energy Changes

Year	Average Annual Energy	Change	Factor Causing the Change			
			Hydrological Data	Spill History	Fisheries Compensation History	Conversion Factor
		GWh	GWh	GWh	GWh	GWh
1992	541					
1993	541	0	-1	1	0	0
1996	543	2	4	-3	-1	2
1998	549	6	3	1	0	2
2000	552	3	3	0	0	0

Hinds Lake Annual Average Energy Changes

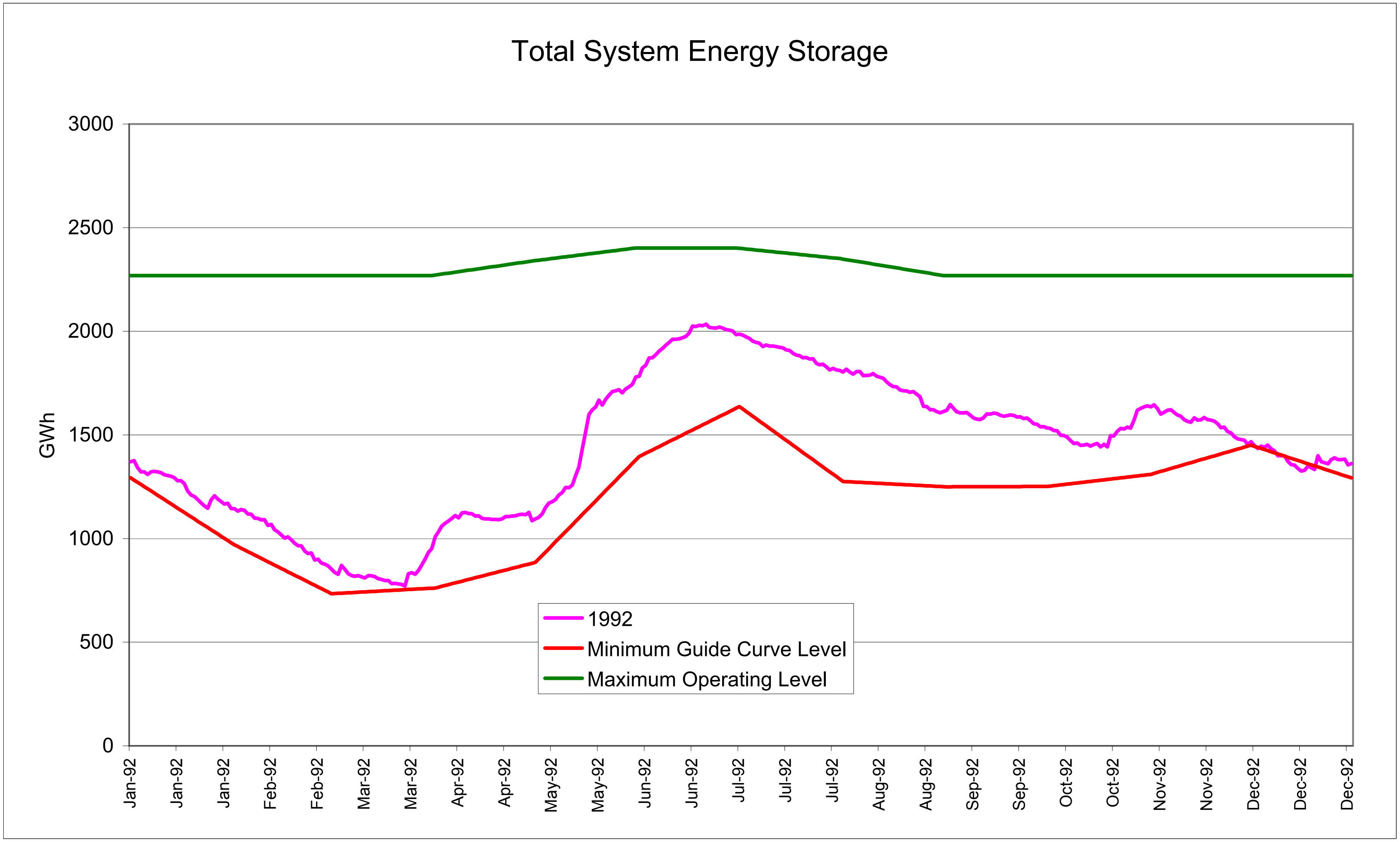
Year	Average Annual Energy	Change	Factor Causing the Change			
			Hydrological Data	Spill History	Fisheries Compensation History	Conversion Factor
		GWh	GWh	GWh	GWh	GWh
1992	342					
1993	340	-2	-2	0	0	0
1996	341	1	2	0	0	-1
1998	339	-2	2	0	-1	-3
2000	340	1	2	-1	0	0

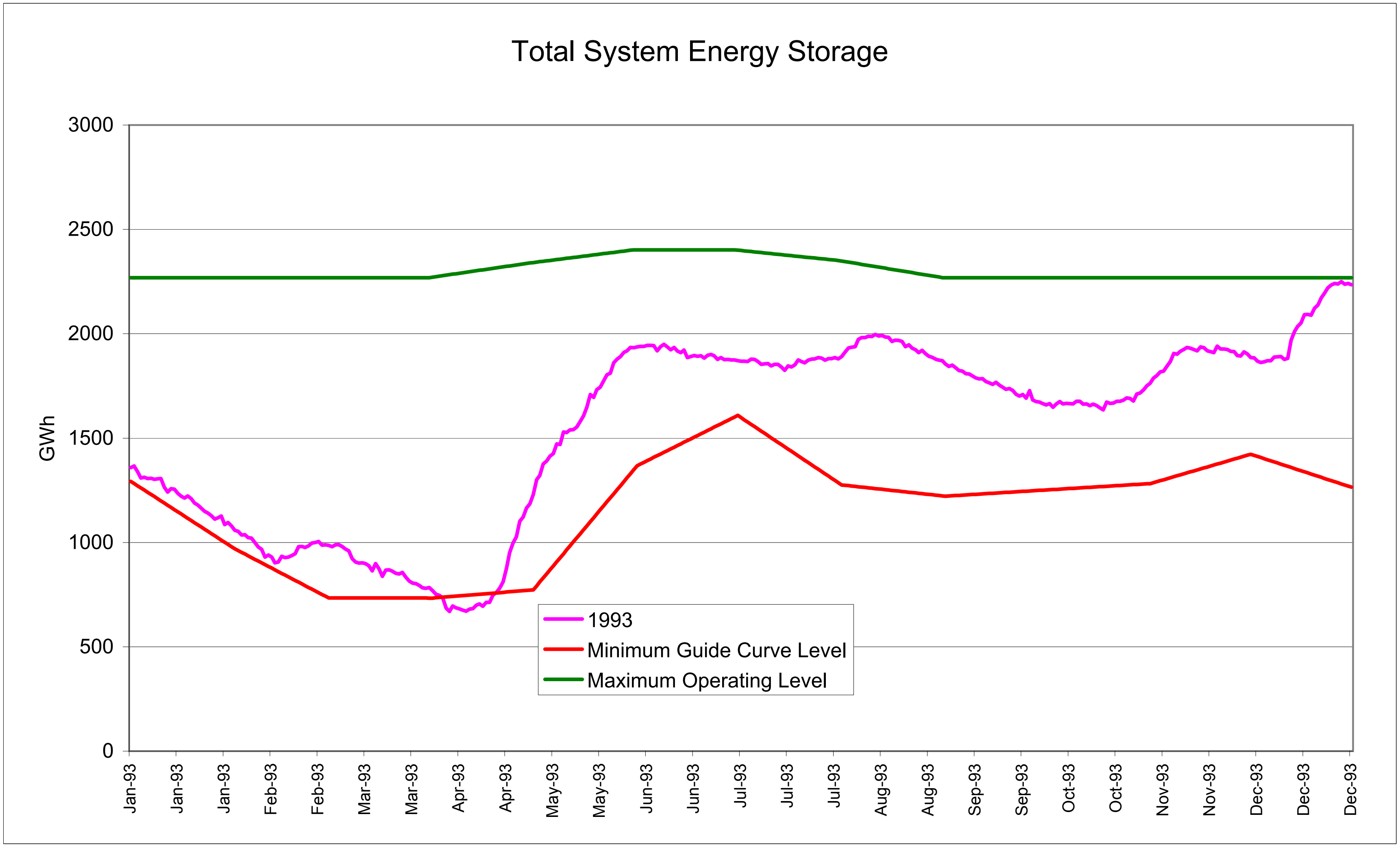
Cat Arm Annual Average Energy Changes

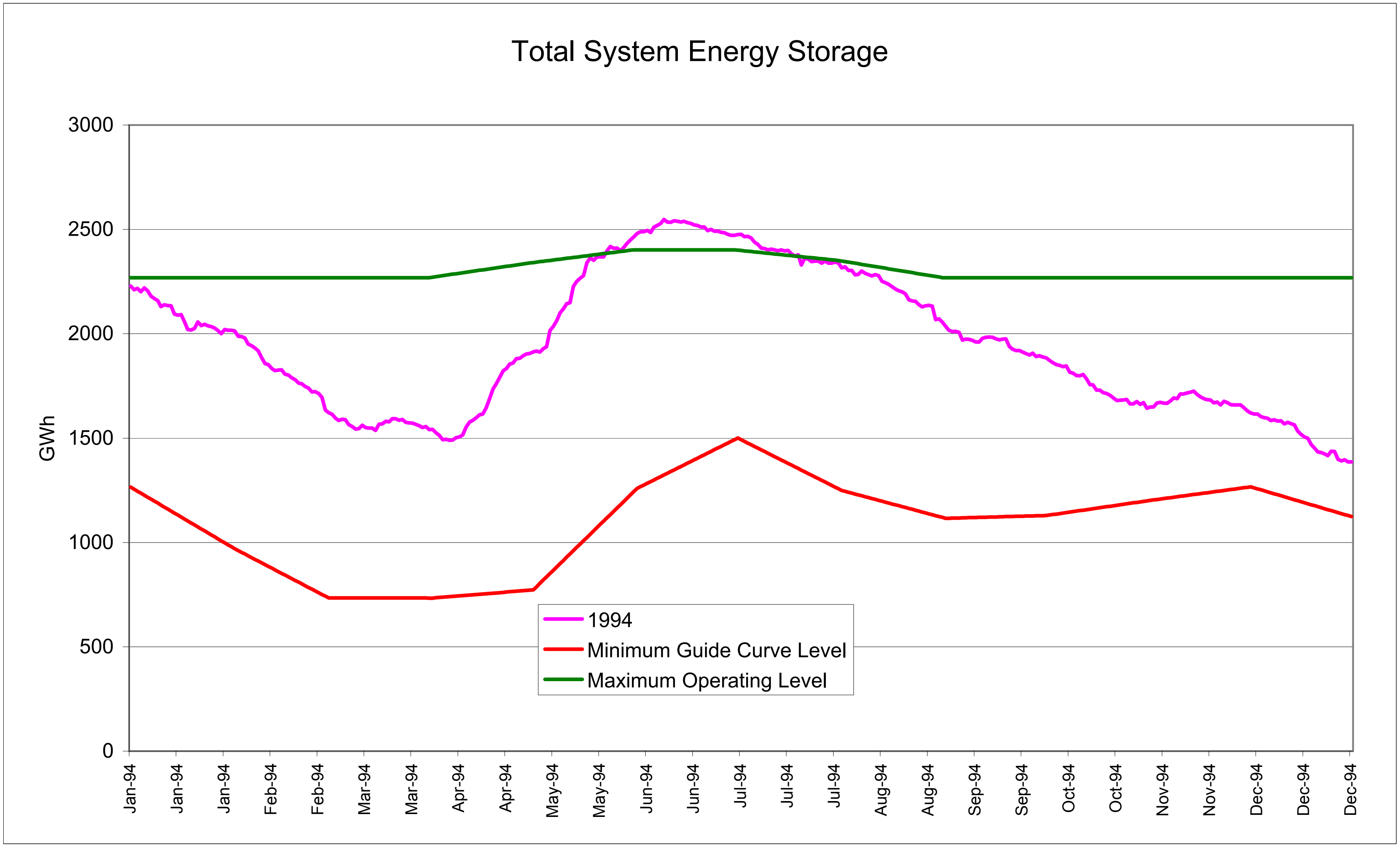
Year	Average Annual Energy	Change	Factor Causing the Change			
			Hydrological Data	Spill History	Fisheries Compensation History	Conversion Factor
		GWh	GWh	GWh	GWh	GWh
1992	745					
1993	735	-10	-6	0	0	-4
1996	742	7	2	11	0	-6
1998	736	-6	-1	3	0	-8
2000	735	-1	2	-1	0	-2

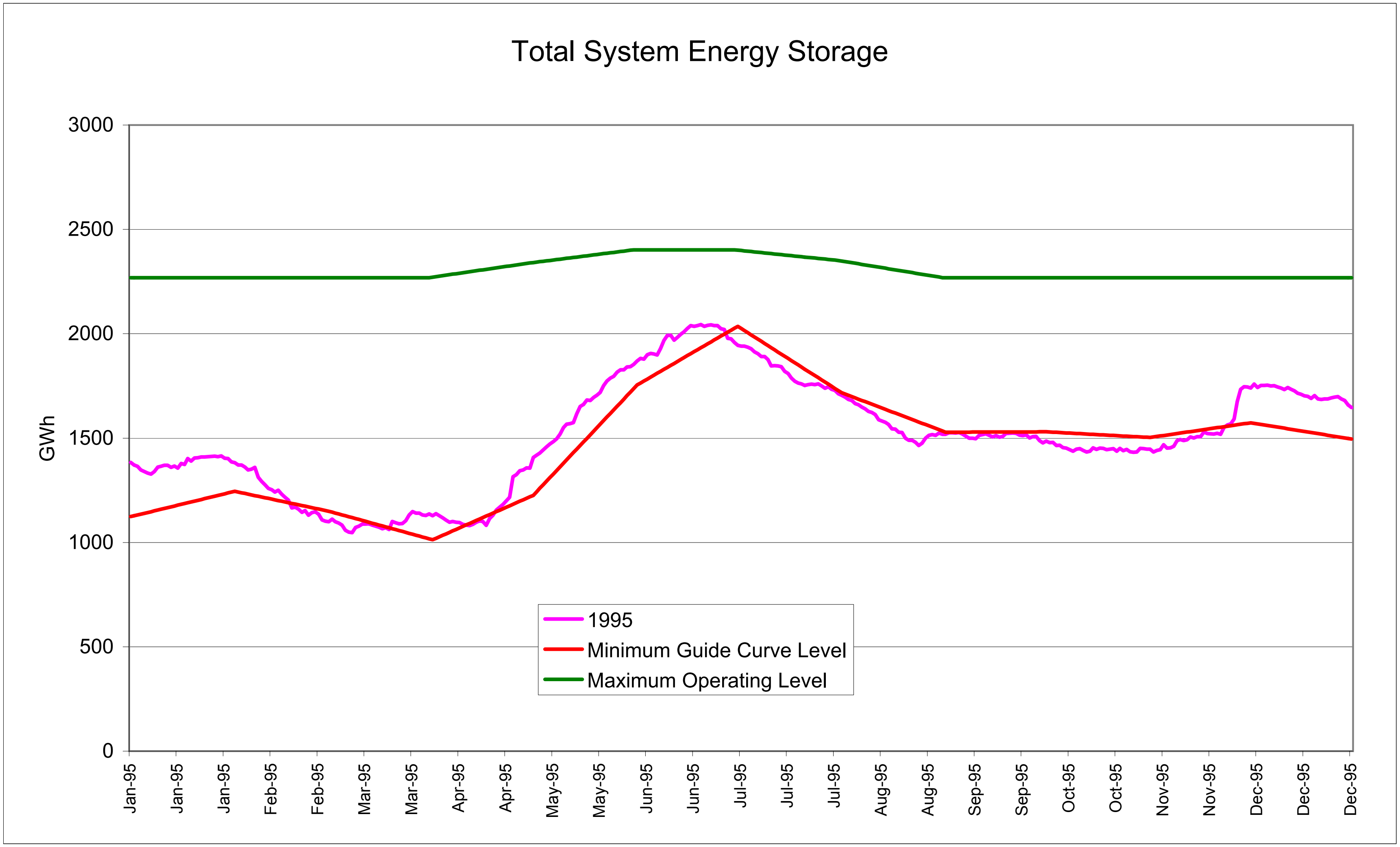
Paradise River Annual Average Energy Changes

Year	Average Annual Energy	Change	Factor Causing the Change			
			Hydrological Data	Spill History	Fisheries Compensation History	Conversion Factor
		GWh	GWh	GWh	GWh	GWh
1992	36					
1993	38	2	0	1	0	1
1996	39	1	-1	0	0	2
1998	39	0	0	0	0	0
2000	39	0	0	0	0	0


Total System Energy Storage
GWh
3000
2500
2000
1500
1000
500
0
Jan-92
Jan-92
Jan-92
Feb-92
Feb-92
Mar-92
Mar-92
Apr-92
Apr-92
May-92
May-92
Jun-92
Jun-92
Jul-92
Jul-92
Jul-92
Aug-92
Aug-92
Sep-92
Sep-92
Oct-92
Oct-92
Nov-92
Nov-92
Dec-92
Dec-92
Dec-92
1992
Minimum Guide Curve Level
Maximum Operating Level


Total System Energy Storage
GWh
3000
2500
2000
1500
1000
500
0
Jan-93
Jan-93
Jan-93
Feb-93
Feb-93
Mar-93
Mar-93
Apr-93
Apr-93
May-93
May-93
Jun-93
Jun-93
Jul-93
Jul-93
Jul-93
Aug-93
Aug-93
Sep-93
Sep-93
Oct-93
Oct-93
Nov-93
Nov-93
Dec-93
Dec-93
Dec-93
1993
Minimum Guide Curve Level
Maximum Operating Level


Total System Energy Storage
GWh
3000
2500
2000
1500
1000
500
0
Jan-94
Jan-94
Jan-94
Feb-94
Feb-94
Mar-94
Mar-94
Apr-94
Apr-94
May-94
May-94
Jun-94
Jun-94
Jul-94
Jul-94
Jul-94
Aug-94
Aug-94
Sep-94
Sep-94
Oct-94
Oct-94
Nov-94
Nov-94
Dec-94
Dec-94
Dec-94
1994
Minimum Guide Curve Level
Maximum Operating Level


Total System Energy Storage
GWh
3000
2500
2000
1500
1000
500
0
Jan-95
Jan-95
Jan-95
Feb-95
Feb-95
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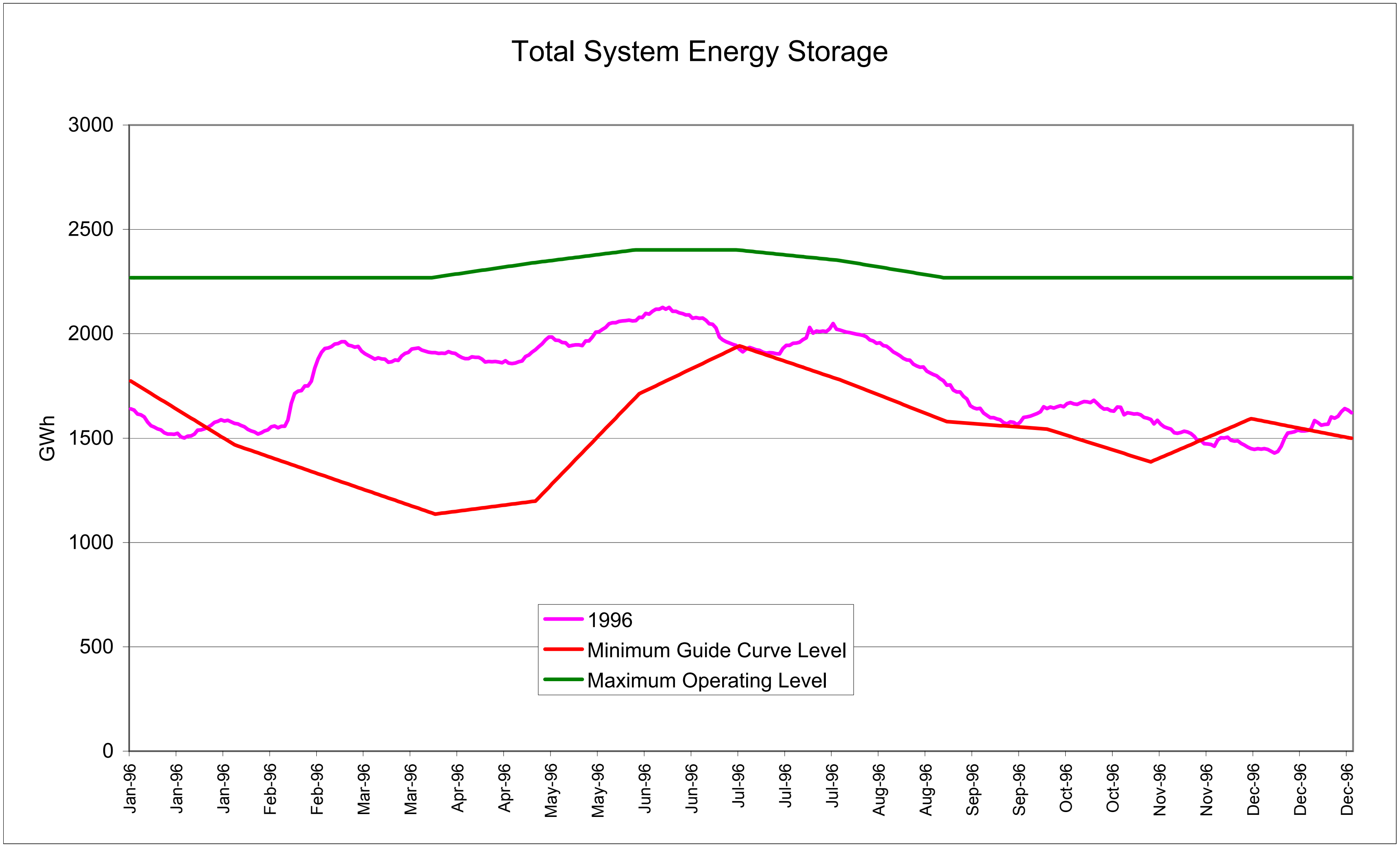
Apr-95
Apr-95
May-95
May-95
Jun-95
Jun-95
Jul-95
Jul-95
Jul-95
Aug-95
Aug-95
Sep-95
Sep-95
Oct-95
Oct-95
Nov-95
Nov-95
Dec-95
Dec-95
Dec-95
1995
Minimum Guide Curve Level
Maximum Operating Level


Total System Energy Storage
3000
2500
2000
1500
1000
500
0
GWh
Jan-96
Jan-96
Jan-96
Feb-96
Feb-96
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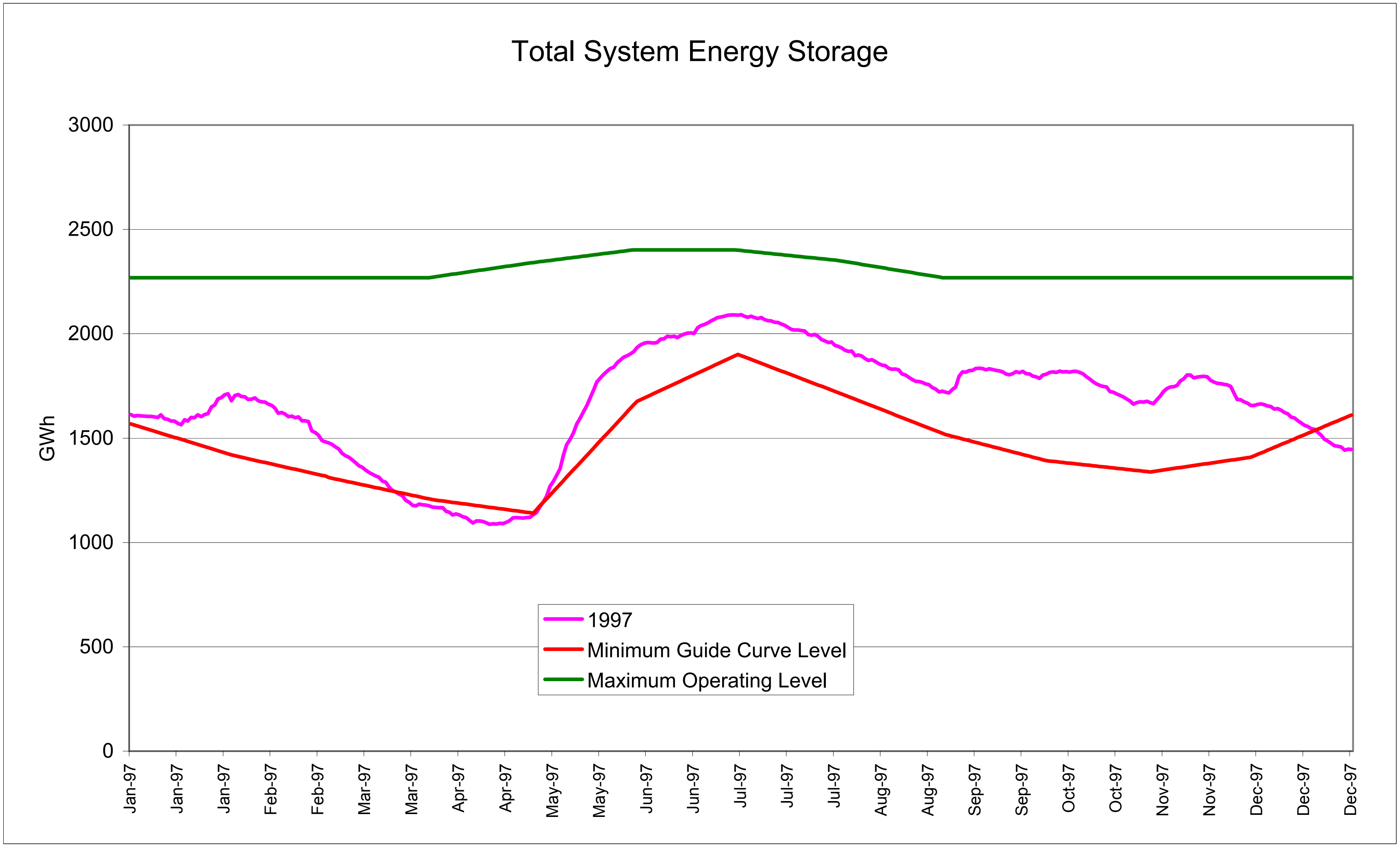
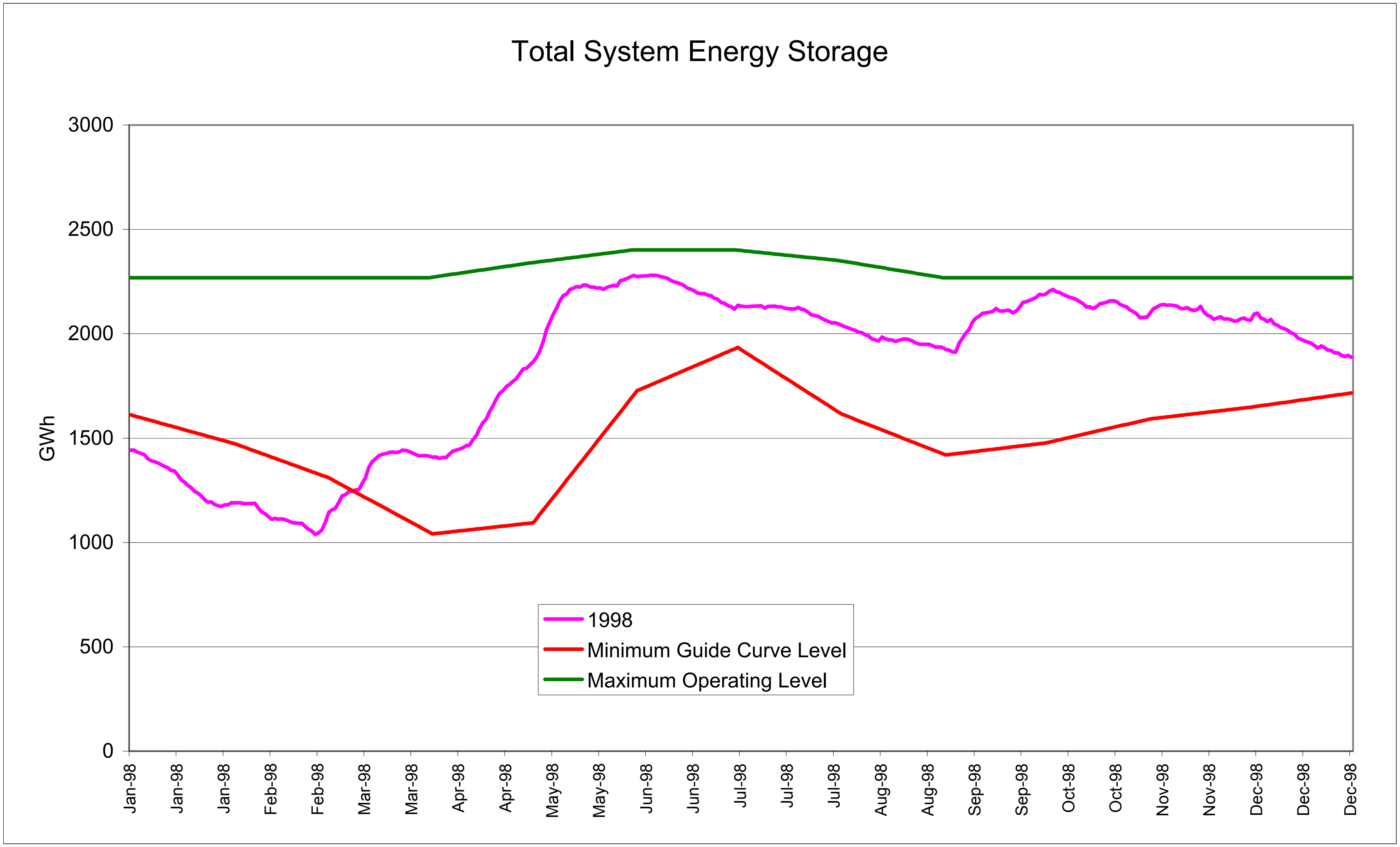
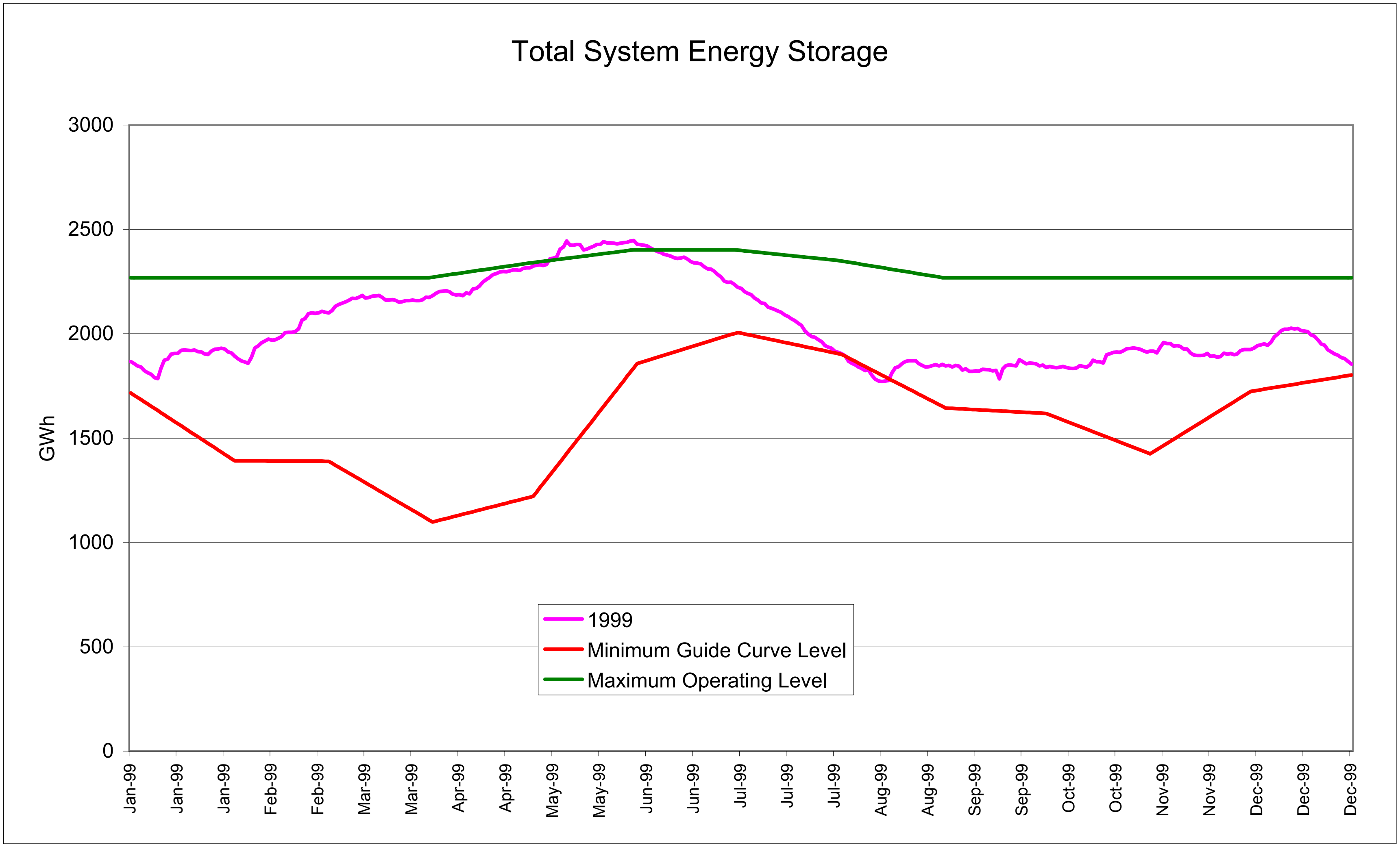
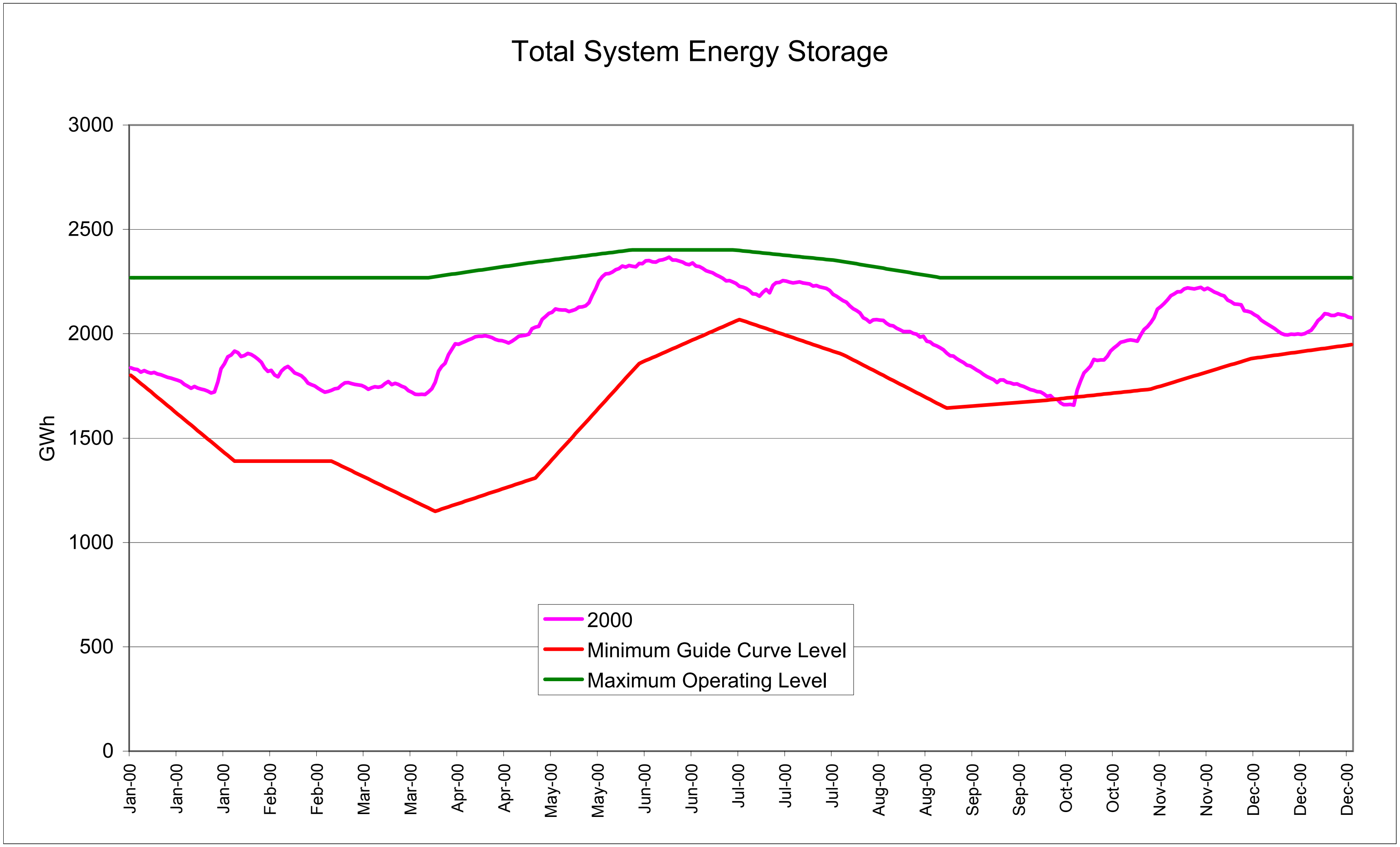
Mar-96
Apr-96
Apr-96
May-96
May-96
Jun-96
Jun-96
Jul-96
Jul-96
Jul-96
Aug-96
Aug-96
Sep-96
Sep-96
Oct-96
Oct-96
Nov-96
Nov-96
Dec-96
Dec-96
Dec-96
1996
Minimum Guide Curve Level
Maximum Operating Level


Total System Energy Storage
3000
2500
2000
1500
1000
500
0
GWh
Jan-97
Jan-97
Jan-97
Feb-97
Feb-97
Mar-97
Mar-97
Apr-97
Apr-97
May-97
May-97
Jun-97
Jun-97
Jul-97
Jul-97
Jul-97
Aug-97
Aug-97
Sep-97
Sep-97
Oct-97
Oct-97
Nov-97
Nov-97
Dec-97
Dec-97
Dec-97
1997
Minimum Guide Curve Level
Maximum Operating Level


Total System Energy Storage
GWh
3000
2500
2000
1500
1000
500
0
Jan-98
Jan-98
Jan-98
Feb-98
Feb-98
Mar-98
Mar-98
Apr-98
Apr-98
May-98
May-98
Jun-98
Jun-98
Jul-98
Jul-98
Jul-98
Aug-98
Aug-98
Sep-98
Sep-98
Oct-98
Oct-98
Nov-98
Nov-98
Dec-98
Dec-98
Dec-98
1998
Minimum Guide Curve Level
Maximum Operating Level


Total System Energy Storage
GWh
3000
2500
2000
1500
1000
500
0
Jan-99
Jan-99
Jan-99
Feb-99
Feb-99
Mar-99
Mar-99
Apr-99
Apr-99
May-99
May-99
Jun-99
Jun-99
Jul-99
Jul-99
Jul-99
Aug-99
Aug-99
Sep-99
Sep-99
Oct-99
Oct-99
Nov-99
Nov-99
Dec-99
Dec-99
Dec-99
1999
Minimum Guide Curve Level
Maximum Operating Level


Total System Energy Storage
GWh
3000
2500
2000
1500
1000
500
0
Jan-00
Jan-00
Jan-00
Feb-00
Feb-00
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Mar-00
Apr-00
Apr-00
May-00
May-00
Jun-00
Jun-00
Jul-00
Jul-00
Jul-00
Aug-00
Aug-00
Sep-00
Sep-00
Oct-00
Oct-00
Nov-00
Nov-00
Dec-00
Dec-00
Dec-00
2000
Minimum Guide Curve Level
Maximum Operating Level