water value t	inflow GWh	hydro produced GWh	purchase GWh	final reservoir GWh	water value t+1
200	10	13.33	6.67	60+10-13.33=56.67	240
240	10	12	8	66.67-12=54.67	264
264	10	11.2	8.8	64.67-11.2=53.47	278
278	10	10.73	9.27	63.47-10.73=52.74	287
287	10	10.43	9.57	62.74-10.43=52.31	292.3
292.3	10	10.26	9.74	62.31-10.26=52.05	295.4
295.4	10	10.15	9.85	51.9	297.2
297.2	10	10.09	9.91	51.81	298.3
298.3	10	10.06	9.94	51.75	299
299	10	10.03	9.97	51.72	299.36
299.36	10	10.02	9.98	51.7	299.6
299.6	10	10.014	9.986	51.686	299.786
299.786	10	10.01	9.99	51.67	299.96
299.96	10	10	10	51.67	299.96

Tabelle 1: water value calculation for inflow 10GWh

water value t	inflow GWh	hydro produced GWh	purchase GWh	final reservoir GWh	water value t+1
200	20	13.33	6.67	80-13.33=66.67	120
120	20	18	2	68.67	113.3
113.3	20	18.67	1.33	70	100
100	20	20	0	70	100

Tabelle 2: water value calculation for inflow 20GWh

1 Water value

The water value is the expected value of stored MWh depending on capacities and inflow[1]. If the water value in a reservoir is known, the value euals the value the additional water will decrease the marginal costs when it is stored.

2 Calculation

The calculation for water values for three different inflow (10GWh, 20GWh, 30GWh) are listed in tables 1, 2 and 3.

$$0.2 \cdot 299.96 + 0.6 \cdot 100 + 0.2 \cdot 60.1 = 132.02 NOK/GWh$$

3 Assumptions

Future inflow is treated as stochastic variable. Representative eriods from historical periods are used to generate inflow forecasts. The inflow to a reservoir is limited. The water value is a backward dynamic programming problem. Water value is known for week k+1. The end point does not matter as long as it is far enough ahead.

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[1]Doorman Gerard et al, *Kompendium TET4135 Energy Systems Planning and Operation*, p.90

water value t	inflow GWh	hydro produced GWh	purchase GWh	final reservoir GWh	water value t+1
200	30	13.33	6.67	60+30-13.33=76.67	61.3
61.3	30	29.35	0	77.32	61.07
61.07	30	29.47	0	77.85	60.86
60.86	30	29.59	0	78.28	60.69
60.69	30	29.66	0	78.62	60.55
60.55	30	29.725	0	78.9	60.44
60.44	30	29.78	0	79.12	60.35
50.25	30	29.825	0	79.3	60.28
60.28	30	29.86	0	79.44	60.22
60.22	30	29.89	0	79.55	60.18
60.18	30	29.91	0	79.64	60.14
60.14	30	29.93	0	79.71	60.1
60.1	30	29.95	0	79.76	60.1

Tabelle 3: water value calculation for inflow 30GWh