

Attachment H-11

ES-14 GHG Cap and Trade

Dr. Adam Rose and Dan Wei, August 6, 2006

S/5% Case NPV (5% discount rate) – Discounted to 2006

Before trading mitigation cost (in million 2000 dollars)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total (not discounted)	NPV
AZ	43.53	73.33	107.86	146.82	189.91	236.86	287.44	341.34	398.41	458.33	521.06	2,804.90	1,663.45
CA	58.70	129.85	212.01	304.49	406.58	517.64	637.03	764.18	898.49	1039.44	1186.74	6,155.16	3,622.32
CO	69.40	105.09	145.59	190.56	239.68	292.63	349.09	408.78	471.44	536.83	604.79	3,413.86	2,040.34
ID	-0.92	1.22	3.85	6.94	10.48	14.42	18.76	23.47	28.55	33.95	39.68	180.41	103.58
MT	-7.58	-4.98	-0.43	5.99	14.22	24.19	35.85	49.14	63.98	80.34	98.21	358.92	197.59
NM	-13.36	-8.41	-0.53	10.17	23.58	39.61	58.16	79.14	102.47	128.04	155.85	574.72	316.40
NV	-6.72	-1.61	5.09	13.32	23.00	34.08	46.49	60.18	75.09	91.16	108.37	448.47	252.64
OR	-9.61	-7.65	-4.93	-1.46	2.71	7.56	13.06	19.18	25.90	33.20	41.05	119.01	60.08
UT	133.27	188.82	251.50	320.79	396.14	477.08	563.18	654.02	749.11	848.13	950.78	5,532.82	3,324.15
WA	19.55	38.75	61.06	86.28	114.22	144.70	177.55	212.62	249.74	288.78	329.64	1,722.90	1,015.93
WY	29.99	71.80	126.00	192.05	269.42	357.64	456.22	564.70	682.54	809.37	945.11	4,504.84	2,621.21
Total	316.25	586.23	907.08	1,275.94	1,689.94	2,146.41	2,642.83	3,176.75	3,745.73	4,347.55	4,981.28	25,816.00	15,217.68

After trading

Mitigation Cost (in million 2000 dollars)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total (not discounted)	NPV
AZ	6.38	21.57	39.68	60.63	84.33	110.73	139.73	171.25	205.25	241.61	280.37	1,361.51	793.23
CA	151.28	274.04	417.30	579.62	759.58	955.82	1167.04	1392.02	1629.51	1878.40	2137.88	11,342.49	6,706.39
CO	11.49	29.61	51.38	76.72	105.60	137.95	173.71	212.80	255.17	300.75	349.54	1,704.71	995.10
ID	2.34	5.44	9.05	13.14	17.67	22.59	27.89	33.54	39.51	45.77	52.31	269.26	158.23
MT	-4.59	-2.93	-1.00	1.18	3.60	6.22	9.04	12.03	15.19	18.49	21.95	79.19	42.40
NM	-6.46	-2.39	2.33	7.66	13.56	19.97	26.85	34.16	41.87	49.93	58.37	245.86	137.78
NV	1.02	7.13	14.24	22.27	31.16	40.83	51.23	62.30	73.98	86.22	99.02	489.42	285.11
OR	8.87	17.84	28.10	39.49	51.89	65.16	79.20	93.92	109.22	124.99	141.22	759.90	449.39
UT	-3.99	3.78	13.30	24.60	37.71	52.66	69.46	88.17	108.78	131.33	155.91	681.71	389.72
WA	19.20	39.83	64.12	91.89	122.96	157.16	194.29	234.23	276.80	321.83	369.27	1,891.58	1,112.22
WY	-13.68	-12.15	-10.32	-8.20	-5.80	-3.14	-0.22	2.94	6.34	9.96	13.88	-20.38	-22.84
Total	171.88	381.76	628.18	909.01	1,222.26	1,565.94	1,938.23	2,337.37	2,761.61	3,209.28	3,679.72	18,805.24	11,046.73

Trading Cost (in million 2000 dollars)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total (not discounted)	NPV
AZ	29.88	42.01	55.70	70.80	87.10	104.50	122.80	141.89	161.61	181.86	202.50	1,200.65	722.75
CA	-103.08	-162.02	-232.30	-313.07	-403.58	-503.07	-610.78	-726.02	-848.07	-976.29	-1110.03	-5,988.31	-3,555.11
CO	44.21	58.97	74.92	91.79	109.37	127.43	145.76	164.18	182.50	200.55	218.18	1,417.86	863.54
ID	-3.81	-4.83	-5.86	-6.90	-7.94	-8.96	-9.95	-10.92	-11.83	-12.70	-13.52	-97.22	-59.99
MT	-4.20	-2.29	0.56	4.31	8.93	14.36	20.58	27.53	35.18	43.50	52.45	200.91	111.41
NM	-9.36	-6.94	-2.98	2.44	9.27	17.45	26.91	37.62	49.49	62.49	76.56	262.95	141.78
NV	-9.43	-10.06	-10.14	-9.65	-8.60	-6.99	-4.83	-2.13	1.11	4.87	9.15	-46.70	-36.78
OR	-29.14	-38.24	-47.88	-57.92	-68.21	-78.66	-89.15	-99.61	-109.94	-120.10	-130.00	-868.85	-531.24
UT	65.90	91.96	121.55	154.40	190.25	228.86	269.98	313.39	358.84	406.13	455.04	2,656.30	1,596.99
WA	0.34	-1.08	-3.08	-5.68	-8.88	-12.69	-17.11	-22.14	-27.77	-34.01	-40.83	-172.93	-98.66
WY	18.69	32.52	49.51	69.48	92.29	117.77	145.79	176.21	208.88	243.70	280.50	1,435.34	845.31
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Net Cost (in million 2000 dollars)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total (not discounted)	NPV
AZ	36.26	63.58	95.38	131.43	171.43	215.23	262.53	313.14	366.86	423.47	482.87	2,562.16	1,515.98
CA	48.21	112.02	185.00	266.55	356.00	452.75	556.26	666.00	781.44	902.11	1027.86	5,354.20	3,151.29
CO	55.70	88.58	126.30	168.51	214.97	265.38	319.47	376.98	437.67	501.30	567.72	3,122.57	1,858.63
ID	-1.47	0.61	3.19	6.24	9.73	13.63	17.94	22.62	27.68	33.07	38.79	172.04	98.24
MT	-8.79	-5.22	-0.44	5.49	12.53	20.58	29.62	39.56	50.37	61.99	74.40	280.10	153.82
NM	-15.82	-9.33	-0.65	10.10	22.83	37.42	53.76	71.78	91.36	112.42	134.93	508.81	279.56
NV	-8.41	-2.93	4.10	12.62	22.56	33.84	46.40	60.17	75.09	91.09	108.17	442.72	248.33
OR	-20.27	-20.40	-19.78	-18.43	-16.32	-13.50	-9.95	-5.69	-0.72	4.89	11.22	-108.95	-81.85
UT	61.91	95.74	134.85	179.00	227.96	281.52	339.44	401.56	467.62	537.46	610.95	3,338.01	1,986.71
WA	19.54	38.75	61.04	86.21	114.08	144.47	177.18	212.09	249.03	287.82	328.44	1,718.65	1,013.56
WY	5.01	20.37	39.19	61.28	86.49	114.63	145.57	179.15	215.22	253.66	294.38	1,414.96	822.47
Total	171.89	381.76	628.18	909.01	1222.26	1565.94	1938.23	2337.37	2761.61	3209.28	3679.73	18,805.26	11,046.75

Permit Traded (million tCO₂)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total*
AZ	4.07	4.74	5.40	6.04	6.65	7.25	7.83	8.40	8.94	9.46	9.96	78.73
CA	-14.02	-18.29	-22.51	-26.69	-30.83	-34.91	-38.95	-42.96	-46.91	-50.77	-54.61	-381.45
CO	6.01	6.66	7.26	7.83	8.36	8.84	9.30	9.71	10.09	10.43	10.73	95.22
ID	-0.52	-0.55	-0.57	-0.59	-0.61	-0.62	-0.63	-0.65	-0.65	-0.66	-0.67	-6.71
MT	-0.57	-0.26	0.05	0.37	0.68	1.00	1.31	1.63	1.95	2.26	2.58	11.00
NM	-1.27	-0.78	-0.29	0.21	0.71	1.21	1.72	2.23	2.74	3.25	3.77	13.48
NV	-1.28	-1.14	-0.98	-0.82	-0.66	-0.49	-0.31	-0.13	0.06	0.25	0.45	-5.03
OR	-3.96	-4.32	-4.64	-4.94	-5.21	-5.46	-5.69	-5.89	-6.08	-6.25	-6.40	-58.83
UT	8.97	10.38	11.78	13.16	14.53	15.88	17.22	18.54	19.85	21.12	22.39	173.82
WA	0.05	-0.12	-0.30	-0.48	-0.68	-0.88	-1.09	-1.31	-1.54	-1.77	-2.01	-10.13
WY	2.54	3.67	4.80	5.92	7.05	8.17	9.30	10.43	11.55	12.67	13.80	89.91
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

* The amount of CO₂ traded is not subject to discounting

Emission Reduction (million tCO₂)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total*
AZ	14.05	16.28	18.55	20.88	23.25	25.68	28.16	30.69	33.28	35.93	38.63	285.37
CA	97.82	115.38	133.04	150.81	168.70	186.70	204.81	223.05	241.41	259.89	278.51	2,060.11
CO	15.77	18.47	21.26	24.14	27.11	30.17	33.32	36.56	39.90	43.33	46.87	336.88
ID	2.77	3.20	3.63	4.05	4.48	4.91	5.33	5.76	6.18	6.61	7.04	53.95
MT	2.66	2.89	3.12	3.34	3.56	3.78	4.00	4.21	4.42	4.63	4.84	41.47
NM	5.55	6.10	6.65	7.20	7.74	8.27	8.79	9.31	9.83	10.34	10.85	90.63
NV	6.17	7.01	7.84	8.67	9.49	10.30	11.11	11.92	12.72	13.52	14.32	113.08
OR	7.88	9.08	10.25	11.39	12.50	13.59	14.66	15.71	16.74	17.74	18.73	148.27
UT	8.49	9.73	11.03	12.38	13.80	15.27	16.82	18.43	20.10	21.85	23.67	171.56
WA	17.31	20.27	23.26	26.30	29.37	32.48	35.62	38.81	42.04	45.31	48.63	359.40
WY	4.42	4.68	4.94	5.20	5.47	5.74	6.00	6.28	6.55	6.83	7.10	63.20
Total	182.88	213.08	243.56	274.35	305.46	336.88	368.63	400.73	433.18	465.99	499.18	3,723.93

* The amount of CO₂ emission reduction is not subject to discounting

**CCS Cost Effectiveness: \$ 3.08
NPV\$/ton**