Climate Policy
Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/tcpo20

Policy uncertainty and diffusion of carbon capture and storage in an optimal region

Chris Bataille[a,b], Noel Melton[b] & Mark Jaccard[a]
[a] School of Resource and Environmental Management, Simon Fraser University, Vancouver, BC, Canada
[b] Navius Research Inc., Simon Fraser University, Vancouver, BC, Canada
Published online: 18 Nov 2014.

To cite this article: Chris Bataille, Noel Melton & Mark Jaccard (2014): Policy uncertainty and diffusion of carbon capture and storage in an optimal region, Climate Policy, DOI: 10.1080/14693062.2014.953905

To link to this article: http://dx.doi.org/10.1080/14693062.2014.953905

■ research article

P c ce a a d d ca b ca e a d a e a a e

CHRIS BATAILLE[1,2*], NOEL MELTON[2], MARK JACCARD[1]

[1] School of Resource and Environmental Management, Simon Fraser University, Vancouver, BC, Canada
[2] Navius Research Inc., Simon Fraser University, Vancouver, BC, Canada

Carbon capture and storage (CCS) has the potential to dramatically reduce GHG emissions in energy supply and industry. However, its high costs mean that uncertainty about the stringency of future climate policy may dissuade firms from investing in this technology. This article explores the relationship between firms expectations of government policy and investment in CCS. First, it synthesizes recent cost estimates for CCS applications in electricity generation and oil sands extraction in Canada. Second, it uses these estimates to investigate the potential impact of policy stringency and uncertainty on CCS adoption in Alberta, a Canadian province with near-ideal CCS potential. The results suggest investment in CCS, and by extension other costly abatement actions, will not occur unless governments create a more stringent and durable climate policy environment than currently exists.

Policy relevance

This paper has two novel and linked objectives, the first of significant utility to researchers and energy modellers in particular, the

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Tab e 1 Base load thermal electricity plant characteristics for first-of-a-kind new construction equipped with carbon capture

	Plant size and efficiency			GHG emissions		Incremental CCS plant costs[1,2]				
Source	Gross capacity (MW)	Thermal efficiency (%)	Energy efficiency penalty (%)	Capture rate (%)	Avoided emissions (g/kWh)	Capital ($/kW)	Operating ($/MWh)	Energy ($/MWh)	Levelized cost ($/MWh)	$/t avoided
Coal supercritical										
CCPC (2008) Keephills	481	33	−22	87	646	3072	8	3	64	99
CCPC (2008) Point Tupper	491	36	−20	88	636	2474	7	3	52	82
CCPC (2008) Shand	479	30	−24	87	695	3185	10	4	68	98
DOE (2010)	663	28	−29	88	692	2993	20	5	76	110
EIA (2011)	650	28	−28	87	708	3216	22	4	82	115
GCCSI (2011) PC 1	663	27	−30	86	676	2863	14	5	68	101
GCCSI (2011) PC 2	661	28	−28	86	680	2815	13	5	66	98
IEA (2011)	550	28	−28	86	689	3736	-	5	69	100
Average	580	30	−26	87	678	3044	12	4	68	101
Natural gas combined cycle										
DOE (2010)	511	43	−15	90	320	1334	10	9	43	134
EIA (2011)	340	45	−14	90	303	1733	14	9	51	170
GCCSI (2011)	520	44	−14	88	309	1207	5	9	35	113
IEA (2011)	461	48	−14	85	265	1238	-	8	30	112
Average	458	45	−14	88	299	1378	7	9	40	132

Notes: (1) Does not include cost of transport and storage. These costs are estimated to add $3–30/t depending on distance, pipeline capacity, and utilization, the market for CO_2, and other factors (see, e.g., DOE, 2010; Herzog, 2009

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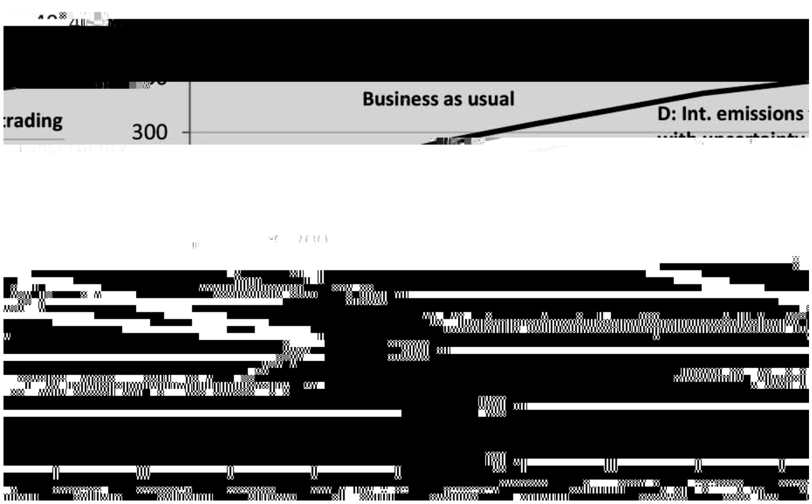

F e 1 Alberta's energy-related GHG emissions in each scenario

Table 4 Total abatement in Alberta relative to business-as-usual emissions (in Mt CO_2e)

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5.2. CCS

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