Extracting Carbon Value from Natural Gas STAR Projects

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On Election Day, a Political Quiz

Which of the following politicians has proposed legislation that the EPA use a cap-and-trade program for regulating emissions?

a) Al Gore
b) Jim Inhofe
c) John McCain
d) Nancy Pelosi

ANSWER: Jim Inhofe. In 2003, Inhofe first introduced the Clear Skies Act which proposed to use a cap-and-trade system to regulate pollutants like mercury from industrial boilers and other emission sources.

"Moving beyond the confusing, command-and-control mandates of the past, Clear Skies cap-and-trade system harnesses the power of technology and innovation to bring about significant reductions in harmful pollutants."

More on Politics and Carbon Markets

Policy uncertainty having big impact on carbon markets

Democratic candidate for Senate in West Virginia, Joe Manchin, shoots a cap-and-trade bill with a rifle:
http://www.realclearpolitics.com/video/2010/10/11/wv-sen_manchin_ad_dead_aim.html

Roger Martella, General Counsel at EPA under George W. Bush, sees EPA implementing a cap-and-trade program for GHGs under the Clean Air Act in 2012:
http://www.eenews.net/tv/video_guide/1229

California Air Resources Board releases its proposed rules for a cap-and-trade program under that state's climate law, AB 32, BUT….

…Proposition 23 (on ballot today) would effectively repeal AB 32

Also on election day, New Mexico's Environmental Integrity Board will vote on adopting a cap-and-trade program for that state under auspices of WCI, BUT…

…will it remain in force after election of a new Governor?

Large utilities and other emitters continue to fund multi-million dollar carbon projects and purchase carbon credits, BUT…

…at much lower prices than 12 months ago.

In the face of policy uncertainty, ongoing activity in the area of carbon offset projects within the natural gas sector

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ENCANA™

- Developed several Alberta Offset Protocols including engine fuel management and vent capture, instrument gas conversion to instrument air conversion in process control systems, and pumps system conversion

NiSource℠

- Verifying a project for emission reductions from the directed inspection and maintenance of compressor stations

Anadarko Petroleum Corporation

- Developed an enhanced oil recovery and greenhouse gas emission reduction project in Sweetwater County, Wyoming

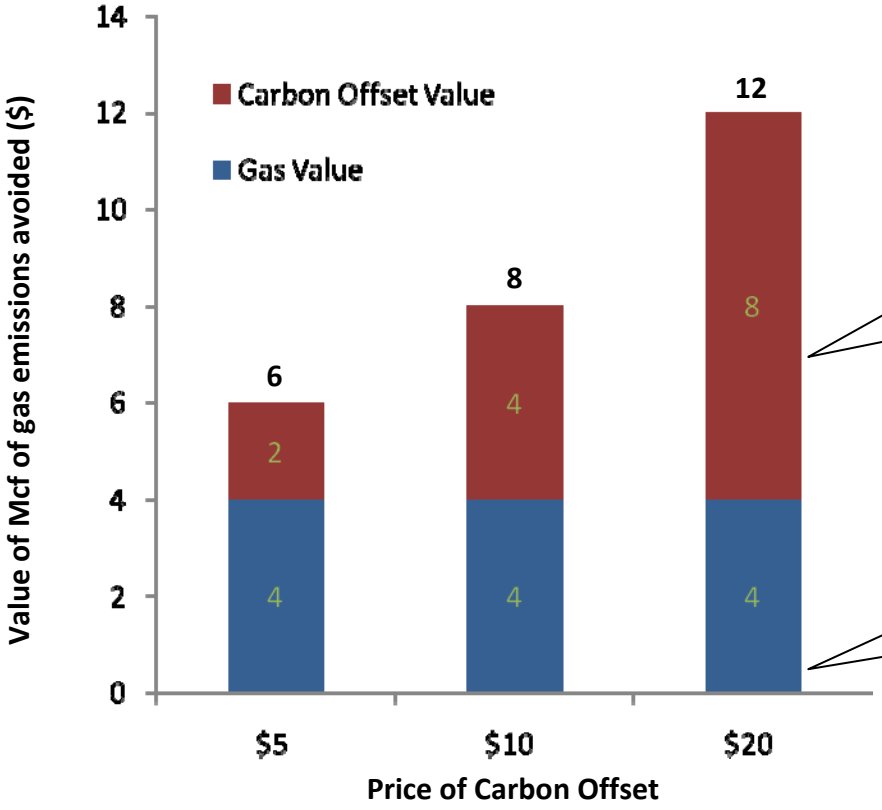
devon

- Recently issued credits for conversion of high-bleed pneumatic controllers. First-ever fugitive methane project verified by a US oil and gas company.

Mizer® Retrofit Project Summary

Project Overview	
Project Description	• Retrofit of over 2,000 high bleed pneumatic controllers in three production basins
Benefits	• Attractive economics – High ROI • Reduced product waste • Reduced Greenhouse Gas emissions
Timing	• Once approved internally, project implemented over 12 months in three phases (one basin at a time): • Each phase of retrofits required approximately 2-3 months including training on retrofit technology • Data collection, document preparation, and verification process for carbon credits occurred in parallel
Reason for Generating Carbon Credits	• **Economic Value** – Credits have value in market today • **Risk Mitigation** – Credits can be banked as a low-cost hedge against future compliance obligations • **Verification** – Credits are verified by a third-party, supporting company claims about environmental benefit of project

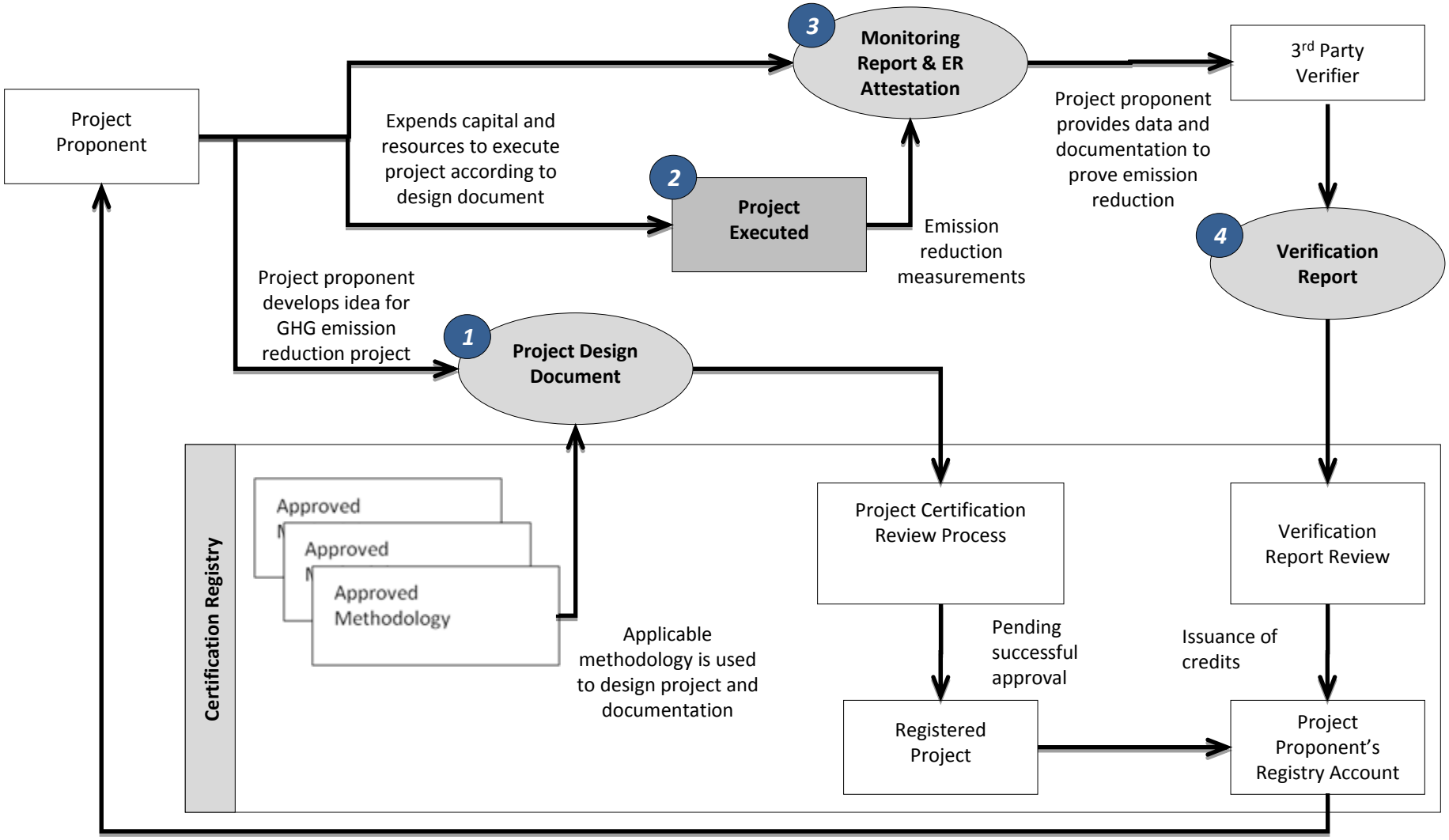
In addition to the potential gas savings, carbon projects can generate significant revenue opportunities from carbon



- Value of carbon offsets per Mcf of gas emission avoided
- Global Warming Potential (GWP) of methane = 21 times that of CO_2
- Revenue requires project validation and periodic verifications of emission reductions

- Value of gas kept in the system and delivered to the consumer
- Savings are immediate
- Assumed at a constant gas price of $4/Mcf

Carbon offset generation process



Project Documentation

Key Elements	Description	Issues Faced
Additionality argument	• Arguments proving that the retrofit project is not required by any existing regulation and above and beyond business as usual practices	• While there are clearly no regulations mandating the retrofits of existing high-bleed pneumatic controllers, there is limited data on the number of retrofits that have been completed.
Project Boundary	• Designation of the project's geographical implementation area (e.g. operational basin), GHG sources and sinks, and duration	• Multiple basins can be included within the project boundary. This means that only one project document is necessary and that all phases of retrofits need to be completed in a contiguous manner
Quantification of Emission Reduction	• Emission reductions within the project boundary (e.g. operational basin) – difference between the Baseline - emissions prior to implementation of the retrofit program and the Project Emissions – emissions post implementation of the retrofit program	• In order to establish a baseline, controller bleed rate measurements were necessary. However as >2000 controllers are being retrofit, it was impossible to take measurements at each controller • A sampling methodology was developed to take measurements at a representative sample of controllers and extrapolate over the entire population
Monitoring Plan	• Clearly defined plan on what data will be collected and stored to prove GHG emission reductions over the life of the project	• Monitoring and data collection requires coordination and organization from the corporate level, particularly if the project spans multiple basins and operational areas

70 randomly select sites were targeted for baseline testing

A HI-FLOW Sampler was used to take 70 randomly selected baseline emission measurements

Statistical analysis was used to establish a conservative estimate of baseline emissions

Results of Random Sampling (Number of Measurements within each Emission Band)

The 95% lower bound was selected to ensure that the project assumed a conservative baseline estimate

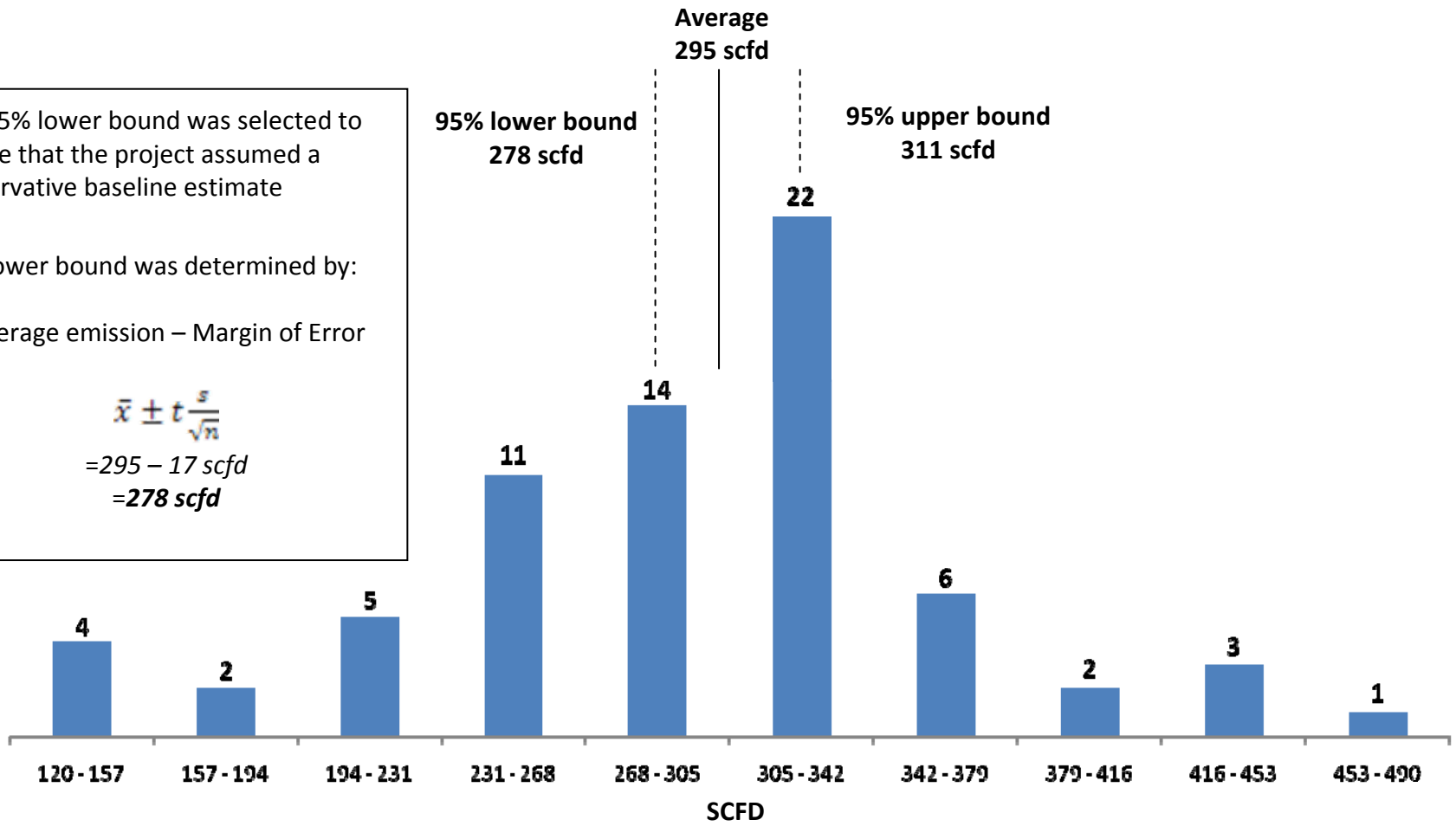
This lower bound was determined by:

Average emission – Margin of Error

$$\bar{x} \pm t\frac{s}{\sqrt{n}}$$

=295 – 17 scfd

=278 scfd



Project Execution – Retrofitting process

Field Communication

- Project impact and importance was communicated to the field through presentations and memos between corporate and field leadership

In-field Retrofit Process

- Retrofits performed by field operators
- Retrofits rechecked by foreman and QA/QC checklist completed

Field Support

- Field operators trained by Mizer valve manufacturers on retrofit procedure
- Retrofit procedure and QA/QC checklist supplied by EHS in route specific tranches to field team

Field Performance

- 40-45 retrofits per day
- 689 retrofits completed within 4 weeks
- Retrofits completed by route as operator visited well site
- QA/QC checklist completed by operator after retrofit and then by field foreman
- Date of retrofit and QA/QC checklist tracked in master inventory database

Hurdles experienced

- Weather – sites are remote and less accessible during winter

Verification requires a comprehensive pneumatic controller inventory to track and monitor retrofits

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Pneumatic Controller Inventory and Data Repository

* for snap acting controllers

Route	Controller Number	Basin	Well Site	Unique Identifier	Controller Manufacturer	Snap or Throttle	Application	Control Valve Manufacturer	Port Size*	LP Separator Pressure (psig)	HP Separator Pressure (psig)	Differential Pressure (psi)*	30d Avg Production Oil + Water (bbl/d)	Liquid Capacity (bbl/d)*	Actuation Time (%)*	Methane Composition (mol %)	Downtime (hours)	Total Hours	Operating Time (%)
403	1	WASHAKIE	ABBY FED 1C-17-15-92 (110538-001-S1)	ABBEY FED 1C-17-O	CEMCO	Throttle	Oil Dump	Kimray	0.375		153	153	0	450	1.18%	87.04%	0	720	100.00%
403	2	WASHAKIE		ABBEY FED 1C-17-W	CEMCO	Throttle	Water Dump	Kimray	0.375		153	153		450	1.18%	87.04%	0	720	100.00%
418	3	WASHAKIE	BALDY BUTTE 10-10-17-92 (111426-001-S1)	BBUTTE 10-10	CEMCO	Snap	Oil/Water Dump	Kimray	0.375	55	137	82	0	450	1.18%	87.04%	0	720	100.00%
418	4	WASHAKIE	BALDY BUTTE 10-2-17-92 (111587-001-S1)	BBUTTE 10-2-O	CEMCO	Snap	Oil Dump	Kimray	0.375		126	126	9	450	1.18%	87.04%	0	720	100.00%
418	5	WASHAKIE		BBUTTE 10-2-W	CEMCO	Snap	Water Dump	Kimray	0.375		126	126		450	1.18%	87.04%	0	720	100.00%
418	6	WASHAKIE	BALDY BUTTE 10-8-17-92 (111351-001-S1)	BBUTTE 10-8	CEMCO	Snap	Oil/Water Dump	Kimray	0.375	55	170	115	0	450	1.18%	87.04%	0	720	100.00%
418	7	WASHAKIE	BALDY BUTTE 11-8-17-92 (025525-010-S01)	BBUTTE 11-8	CEMCO	Snap	Oil/Water Dump	Kimray	0.375	55	170	115	7	450	1.18%	87.04%	0	720	100.00%
418	8	WASHAKIE	BALDY BUTTE 12-2-17-92 (111448-001-S1)	BBUTTE 12-2	CEMCO	Snap	Oil/Water Dump	Kimray	0.375	55	117	62	15	450	1.18%	87.04%	0	720	100.00%
418	9	WASHAKIE	BALDY BUTTE 13-4-17-92 (110691-001-S1)	BBUTTE 13-4-O	CEMCO	Snap	Oil Dump	Kimray	0.375		154	154	2	450	1.18%	87.04%	0	720	100.00%
418	10	WASHAKIE		BBUTTE 13-4-W	CEMCO	Snap	Water Dump	Kimray	0.375		154	154		450	1.18%	87.04%	0	720	100.00%
418	11	WASHAKIE	BALDY BUTTE 1-8 (110903-001-S1)	BBUTTE 1-8	CEMCO	Snap	Oil/Water Dump	Kimray	0.375	55	160	105	1	450	1.18%	87.04%	0	720	100.00%
418	12	WASHAKIE	BALDY BUTTE 2-2-17-92 (111586-001-S1)	BBUTTE 2-2	CEMCO	Snap	Oil/Water Dump	Kimray	0.375	55	117	62	6	450	1.18%	87.04%	288	720	60.00%
418	13	WASHAKIE	BALDY BUTTE 3-8-17-92 (110692-001-S1)	BBUTTE 3-8	CEMCO	Snap	Oil/Water Dump	Kimray	0.375	55	161	106	4	450	1.18%	87.04%	0	720	100.00%
418	14	WASHAKIE	BALDY BUTTE 3A-8-17-92 (025523-010-S01)	BBUTTE 3A-8	CEMCO	Snap	Oil/Water Dump	Kimray	0.375	55	146	91	43	450	1.18%	87.04%	0	720	100.00%
418	15	WASHAKIE	BALDY BUTTE 4-14-17-92 (111415-001-S1)	BBUTTE 4-14	CEMCO	Snap	Oil/Water Dump	Kimray	0.375	55	1,000	945	0	450	1.18%	87.04%	720	720	0.00%
418	16	WASHAKIE	BALDY BUTTE 4-2-17-92 (111447-001-S1)	BBUTTE 4-2	CEMCO	Snap	Oil/Water Dump	Kimray	0.375	55	109	54	3	450	1.18%	87.04%	0	720	100.00%
418	17	WASHAKIE	BALDY BUTTE 7-10-17-92 (111425-001-S1)	BBUTTE 7-10	CEMCO	Snap	Oil/Water Dump	Kimray	0.375	55	132	77	6	450	1.18%	87.04%	0	720	100.00%
																87.04%	0	720	100.00%
																87.04%	0	720	100.00%
																87.04%	0	720	100.00%

Retrofit QA/QC Tracking Sheet

Well Site	Unique Identifier	Date of Retrofit	Retrofitter (name)	No De
BLUE GOOSE 4-6-13-92 (110722-001-S1)	BLUEGOOSE 4-6			
BLUE GOOSE 8-5-13-92 (110711-001-S1)	BLUEGOOSE 8-5			
CHAMPLIN CHAMBERS 1A-10-14-92 (110483-001-S1)	CH CHAM 1A-10-O			
CHAMPLIN CHAMBERS 1A-10-14-92 (110483-001-S1)	CH CHAM 1A-10-W			
CHAMPLIN CHAMBERS 2C-10-14-92 (110484-001-S1)	CH CHAM 2C-10-O			
CHAMPLIN CHAMBERS 2C-10-14-92 (110484-001-S1)	CH CHAM 2C-10-W			
CIGE FED 1A-30-14-92 (MV) (110487-002-D2)	CIGE FED 1A-30-14-92-O			
CIGE FED 1A-30-14-92 (MV) (110487-002-D2)	CIGE FED 1A-30-14-92-W			
CIGE FED 1A-32-14-92 (110488-001-S1)	CIGE FED 1A-32-14-92-O			
CIGE FED 1A-32-14-92 (110488-001-S1)	CIGE FED 1A-32-14-92-W			
CIGE FED 1C-25-14-93 (110493-001-S1)	CIGE FED 1C-25-14-93-O			
CIGE FED 1C-25-14-93 (110493-001-S1)	CIGE FED 1C-25-14-93-W			
CIGE FED 2A-31-14-92 (110496-001-S1)	CIGE FED 2A-31-14-92			
HANGOUT RIDGE 4-36-14-93 (016092-010-S01)	HANGOUT RDG 4-36			
HANGOUT RIDGE 5-25-14-93 (016128-010-S01)	HANGOUT RDG 5-25-O			
HANGOUT RIDGE 5-25-14-93 (016128-010-S01)	HANGOUT RDG 5-25-W			
HANGOUT RIDGE 9-1-14-93 (117498-001-S01)	HANGOUT RDG 9-1			
ROBBERS GULCH 10-33-14-92 (117560-001-S1)	ROBBERS GLCH 10-33			

Baseline Sampling Data Tracking Sheet

Site:			Instr.Serial#	Date	Sample Time (	Temp. (F)	Barometer(ini	Leak(cfm)	SCFM	SCFD	Gas Supply Pressure
Cige	Fed	2A-31-14-92	PS1009	12/14/2009	5	14	23.65	0.248	0.196	282.28	25
Wildhorse		18-Oct	PS1009	12/14/2009	5	14	23.65	0.266	0.21	302.77	25
Robbers	Gulch	27-Jan	PS1009	12/14/2009	5	16	23.65	0.298	0.236	339.19	24
Puckett	Fed	1C-11-W	PS1009	12/14/2009	5	20	23.65	0.367	0.29	417.73	25
Puckett	Fed	1C-11-O	PS1009	12/14/2009	5	20	23.65	0.224	0.177	254.96	25
Blue	Gap	II	PS1009	12/14/2009	5	23	23.65	0.248	0.196	282.28	25
Peach	Orchard	Flat	PS1009	12/14/2009	5	22	23.65	0.247	0.195	281.14	26
Mexican	Flats	22-Feb	PS1009	12/14/2009	5	24	23.65	0.222	0.175	252.69	25
Mexican	Flats	27-Feb	PS1009	12/14/2009	5	22	23.65	0.295	0.233	335.78	29
Cige	Fed	1A-32-14-92-O	PS1009	12/14/2009	5	22	23.7	0.262	0.208	298.85	25
Mexican	Flats	1-26-O	PS1009	12/14/2009	5	22	23.7	0.202	0.16	230.41	26
Mexican	Flats	13-24-W	PS1009	12/14/2009	5	22	23.7	0.232	0.184	264.63	25
Getty	State	1-C-16-O	PS1009	12/15/2009	5	5	23.7	0.251	0.199	286.3	30
Flat	Top	12-May	PS1009	12/15/2009	5	7	23.7	0.178	0.141	203.03	26
Flat	Top	10-Jul	PS1009	12/15/2009	5	7	23.7	0.277	0.219	315.96	25
Flat	Top	10-Nov	PS1009	12/15/2009	5	9	23.7	0.3	0.238	342.19	26
BSU	18-1		PS1009	12/15/2009	5	10	23.7	0.13	0.103	148.28	23
BSU		13-Nov	PS1009	12/15/2009	5	10	23.7	0.273	0.216	311.4	27
BSU		1-Nov	PS1009	12/15/2009	5	10	23.7	0.249	0.197	284.02	27
BSU	16-1-W		PS1009	12/15/2009	5	10	23.7	0.282	0.223	321.66	30
BSU	40-6-O		PS1009	12/15/2009	5	10	23.7	0.124	0.098	141.44	27

An independent third party will be used to verify baseline and project emissions and all reductions

Potential Independent 3rd Party Verifiers could include:

FIRST ENVIRONMENT

TÜV SÜD America

Choose certainty. Add value.

DNV MANAGING RISK

RMA Ryerson, Master and Associates, Inc.

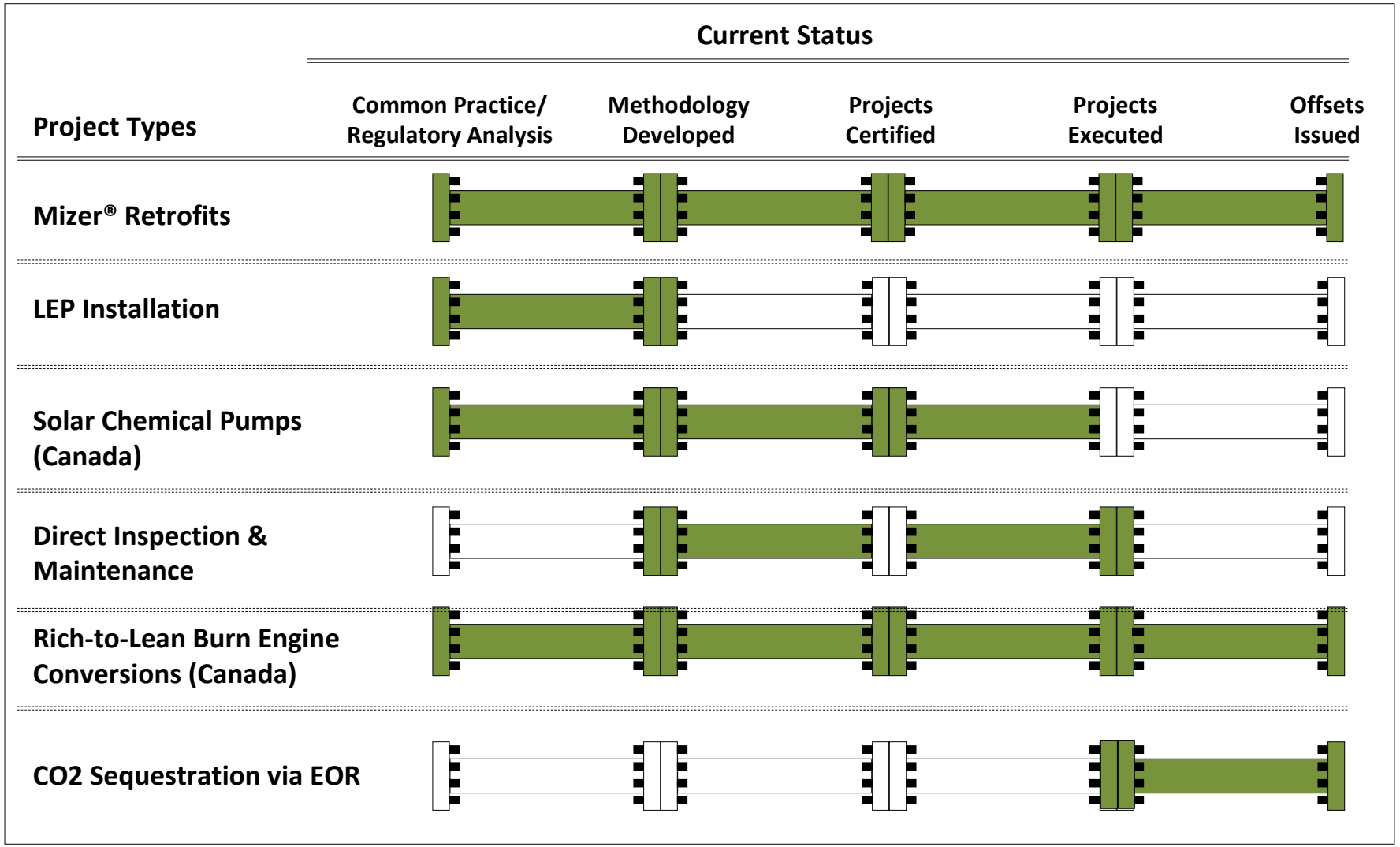
SCS SCIENTIFIC CERTIFICATION SYSTEMS *Setting the standard for sustainability™*

Scope of Verification

The 3rd party verifier will:

- Visit the project site to:
  - Observe retrofit completion
  - Audit documentation
  - Interview project participants
- Verify baseline emissions
  - Sampling data
  - Calculations and analysis
- Verify post retrofit emissions
  - Sampling data
  - Calculations and analysis

Multiple types of Gas STAR project types may be eligible for carbon offsets



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