

C-AGG Meeting Summary

Tuesday-Wednesday, July 14-15, 2015

TheWit Hotel

Chicago, IL – USA

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Executive Summary

C-AGG held a pre-meeting field trip to Fair Oaks Farm, a working dairy and education center in Fair Oaks, Indiana to kick-off two days of meetings focused on opportunities for the dairy sector and broader challenges facing the agriculture offset market. At Fair Oaks, meeting participants received a tour of the dairies anaerobic digester and separation technology. The digester is currently managing waste from 15,000 cows and producing multiple value added co-products including compressed natural gas (CNG), liquid fertilizer, electricity, and “cakes” used as solid fertilizer on their feed crops.

C-AGG’s Executive Director, Debbie Reed, opened the 2-day meeting, the themes of which included a focus on short-lived climate pollutants, specifically methane from dairies, farmer engagement strategies, emerging climate mitigation programs in Canada, and possible

approaches to assessing the potential for US agriculture to reduce GHG emissions. Participants expressed excitement over the opportunities emerging in Canada, possible linkages with the California (CA) market and the continued opportunity to stack credits from the water quality trading markets with those for the carbon markets. Additionally, with the Rice Cultivation Offset Protocol having been adopted by the CA Air Resource Board, many in attendance are hopeful that CA will take up a nutrient management protocol in the coming year.

Roger Johnson from the National Farmers Union (NFU) started the formal presentations with an overview of farmer's perspectives on GHG mitigation. Speaking as a farmer, he provided the group with insights into how farmers view conservation and, therefore, the best strategies for approaching them to discuss opportunities in the carbon market sector. He emphasized the importance of empathy. Farmers all want to leave their land to the next generation in a better state than they received it and would never knowingly waste resources or intentionally implement practices that degrade their land and their livelihood. This understanding can help project developers and others interacting with farmers to frame the conversation in a way that will provide added value to existing operations and not be interpreted as an attempt to tell the farmer what to do. The group shared some of their strategies for farmer engagement, which have mainly focused on discussing the economics and business case for engaging in practices that will result in the development of carbon offsets.

After this very informative and constructive discussion, the group switched focus from the field level to the policy landscape to discuss the emerging market opportunities in Canada. Katie Sullivan from IETA started the panel with a broad discussion of the current carbon market landscape across the country. Quebec and Ontario are the two provinces with the biggest potential for linkages with the CA market. Quebec has already formally linked with the CA market and Ontario is in the process of developing their market framework, which will likely be designed with an eye to linking with CA and Quebec. Alberta and British Columbia are the two other large players in Canada with a compliance market and tax, respectively. However, these systems were not designed with linkages in mind, so at present do not provide opportunities to link with the US markets. Rick Saines from Baker and McKenzie followed Katie with a short overview of the US Environmental Protection Agency's (EPA) Clean Power Plan and the potential for offsets under this rule. Unfortunately, he does not see a role for agriculture offsets, but did not dismiss the idea of having EPA allow for them if a state included them as part of their state reduction plan. Jean Nolet with Coop Carbone closed the presentations with a discussion of the status of agriculture offsets in Quebec. The largest potential for agricultural offsets in Quebec can be captured by improving nitrogen management on farms. These emissions represent close to 50% of the emissions from the agriculture sector.

After a robust discussion about the Canadian market, the meeting's focus turned back to the US to discuss the potential for agriculture mitigation in the US agriculture sector. Many groups have been trying to establish country level absolute reduction goals for the agriculture sector in the absence of robust science to accurately establish these targets. Marty Matlock from the University of Arkansas and Allison Thompson with Field to Market discussed how their organizations are addressing this issue or planning to address it in the next year. Marty

provided a case study from the soybean industry on how the industry was able to set absolute goals for GHG emission reductions using the outputs of an LCA. Allison provided an update on the goals FTM has set for GHG emissions and their strategy for setting an absolute target, which will involve undertaking a research effort to develop absolute reduction goals based on the best available science.

The day concluded with an update from two of the voluntary carbon registries – the American Carbon Registry (ACR) presented by Lauren Nichols and the Climate Action Reserve (CAR) presented by Max DuBuisson. ACR’s rice protocol has been approved as an early action methodology for the CA market and already has 3 rice cultivation projects registered under it. ACR will also be updating its fertilizer management methodology to make it model agnostic. CAR recently released an avoided conversion of grassland to cropland methodology and is looking forward to participating in three Conservation Innovation Grant (CIG) projects focused on increasing participation in three of their agriculture methodologies: avoided conversion of grasslands, nitrogen management, and rangeland management.

The second day of the meeting, aptly nicknamed “Dairy Day,” opened with a recap of the Fair Oaks tour and thoughts and reactions to the information presented on day one. While Fair Oaks is a unique dairy given its size and investment abilities, it can be used as a testing ground for technologies that can be modified for other farm scenarios. The discussion of the farm tour led the group into a discussion around the possibilities for smaller dairies that do not have the economies of scale to support such a large and expensive technology. Representatives of the Innovation Center for U.S. Dairy (Innovation Center) provided a few examples of smaller dairies that have been able to use “digesters in a box” to successfully manage their waste at a smaller scale. Another big theme from day one that emerged again during this discussion is the challenge of dealing with trade-offs between economic, social, and environmental outcomes. Some technology solutions like nitrogen inhibitors can work very well to solve one problem, GHG emissions, but can be detrimental to the biology of the soil. While there are very few silver bullets, it is important to fully understand the trade-offs and unintended consequences of these emerging technologies so farmers and advisors can make the best decisions based on the best available science and research.

Ryan McCarthy with CA’s Air Resources Board provided an update on the state’s short-lived climate pollutants concept paper introduced at C-AGG’s Sacramento meeting in March. ARB released the draft concept paper at the beginning of May for public comment and has since held workshops to discuss the elements of the paper with key stakeholders. The results of these discussions will be incorporated into the larger strategy document set for release at the end of August. The strategy’s focus on reducing methane emissions from dairies will be the major agriculture issue addressed in the plan.

The remainder of the day was focused specifically on the new technologies emerging in the dairy industry to mitigate GHG emissions. The Innovation Center’s Jerry Bingold and Chad Frahm provided updates on the Dairy Innovation Center’s sustainability priorities, the Cow of the Future project to mitigate enteric emissions, and a new company, Newtrient, started by the Center to focus on developing markets for anaerobic digester outputs. The Innovation Center is

currently focused on developing key indicators for the industry covering all three pillars of sustainability, incorporating these indicators into an online Farm Smart tool and working to implement strategies that will help the industry achieve the voluntary goals that emerged from the Life Cycle Assessment commissioned in 2010.

Action Items/ Key Takeaways

- C-AGG is accepting nominees for its Steering Committee for seats in the agriculture and investment sectors. Please email nominations to Debbie Reed (dreed@drdassociates.org).
- C-AGG will develop a Case Study of the process undertaken by C-AGG participants to effectively engage a state agency in the generation of an agriculture offset protocol to share with other sub-nationals as a best in class example.
- C-AGG will work with the National Farmers Union on producer engagement to support the success of the next round of USDA NRCS GHG and water quality CIGs.
- Many new documents and resources were shared during the meeting. Please see below for links to the documents:
 - Water Quality Trading Program: Options and Considerations - <http://www.wri.org/sites/default/files/buiding-a-water-quality-trading-program-nn-wqt.pdf>
 - Climate Action Reserve Grassland Protocol - <http://www.climateactionreserve.org/how/protocols/grassland/>
 - Short-lived climate pollutants concept paper - http://www.arb.ca.gov/cc/shortlived/concept_paper.pdf
 - Emerging Nutrient Recovery Technology report – <http://csanr.wsu.edu/wp-content/uploads/2014/07/ICUSD-Emerging-NR-Technology-Report-Final.121113B.pdf>
 - Consideration and Resources on Feed and Animal Management - <http://www.usdairy.com/~media/usd/public/considerationsresourcesonfeedanimalmgt.pdf>
- C-AGG has formed a working group to continue collaboration between meetings! If you are interested in joining the working group please contact Monica McBride (monica@c-agg.org).
 - **Working Group:** Project Implementation and Credit Delivery
 - **Chair:** Alastair Handley (alastair@carboncreditsolutions.ca)
 - **Focus:** Identify agricultural offset marketplace challenges, prioritize them, and work to collectively develop solutions to overcoming them in order to better enable agricultural offset project development and implementation at scale. For example, voluntary GHG registries in N. America have different contractual requirements for growers. Clarity regarding these requirements could help project developers create contractual templates to speed project implementation.

Day 1 - Tuesday, July 14, 2015

Welcome and Introductions: C-AGG Overview and Updates

Debbie Reed, C-AGG's Executive Director, opened the meeting by reviewing C-AGG's team and its goals and priorities, including how it operates, its focus on advancing the development and adoption of science-based policies, methodologies, protocols, projects, tools and decision support systems for GHG emissions reductions and carbon sequestration within the agricultural sector. Debbie explained that C-AGG's origins stemmed from the threat of national legislation for climate change in an effort to help position the agriculture sector as a player in a national cap-and-trade market. When C-AGG started, USDA had limited tools to help the agriculture sector measure, manage, and monetize the ecosystem services provided on their land. With help from C-AGG's multi-stakeholder group, USDA has made great strides over the past 7 years in the development of tools and funding mechanisms to reward the agriculture sector for their management decisions. The opening session concluded with a review of the major topics and themes to be covered during the meeting, which included:

- An increasing focus on dairies and short-lived climate pollutants with a focus on opportunities in California;
- Understanding the state of technologies related to methane controls for the dairy sector and an update on a new nutrient separation technology;
- A renewed focus on farmer engagement through collaboration with the National Farmers Union (NFU); and
- Investigating the true mitigation potential of the agriculture sector to help inform national level goals.

Assessing the Landscape: A C-AGG Discussion of Critical Issues and Trends in Agriculture and Climate Change

The discussion on current trends started with an acknowledgement that while national-level markets in North America have been slow to develop many sub-nationals are eager to explore markets and linkage opportunities. The week before the C-AGG meeting, Canada hosted a Climate Summit of the Americas to discuss carbon pricing, sub-national momentum and cooperation. The meeting provided an opportunity to present the sub-national and national governments with effective models for consideration given Ontario and Mexico are looking to establish markets by 2017 with linkages in place by 2018. Mexico's recent submission of its UN Framework Convention on Climate Change (UNFCCC) Intended Nationally Determined Contributions (INDC) hints at the potential for a market in the near future.

An update was provided on the status of the water quality markets and the discussions related to stacking credits, which have been a theme at the C-AGG meetings over the past several years. The National Network on Water Quality Trading (WQT) released their final report on options for consideration when establishing a WQT market. The document highlights significant overlaps between the carbon and water quality markets, which should make stacking easier, but

limited stacking has occurred in practice. Water quality market participants encouraged C-AGG to review the document to see where additional overlaps exist between the two markets and how these could be leveraged. USDA/EPA will be hosting a workshop in Lincoln, NE that will bring together players from the water quality and carbon markets to discuss opportunities. These ideas need to be put into practice to see where the major sticking points are for various stakeholders when the money finally flows through the market.

Those participants looking at the international markets and the newly created Green Climate Fund believe the tools and learnings C-AGG has accumulated over its tenure could be very valuable to the climate finance sector. The fund is currently trying to develop its strategy for how to allocate funds for resilience and mitigation activities, to track and measure progress, and to ensure the investments achieve real environmental benefits. Many of the tools the agriculture sector has built are transferable to the financial sector. The Fund is looking to accept their first project proposals in the coming months, with funding anticipated at years' end.

This segued into a discussion around resilience related financing, which is being reframed at many climate change conferences. The focus of conversations seems to be shifting from addressing climate mitigation to discussing resilience and adaptation.

Attendees were very excited that the rice protocol had finally been accepted by CA's Air Resources Board (ARB). The protocol and approval for early action methodologies will be officially adopted in the fall and as a result carbon registries have seen the development of numerous early action projects that can be converted to compliance offsets in the future. The registries are hoping to have more interaction with ARB around the early action projects to ensure concerns of project developers and farmers are heard and incorporated into the next version of the protocol. EDF is hoping to put together a workshop this fall with ARB to discuss the next protocol ARBE will work on.

The group agreed that sub-nationals will be a key to making progress on climate adaptation and resilience. California can be used as a model for how to effectively implement policies that can bring about positive changes in the land use sector. ARB and CA acknowledge in the SLCP Concept Paper a plan for CA to take on more of a leadership role at the sub-national level to scale activities and impacts elsewhere. It will be important to keep in mind the farmer's perspective when discussing scale, understanding that there is a lot of skepticism from some who think this could just result in more regulations.

The discussion shifted from policy to capital. Secretary Vilsack recently committed large amounts of funding to a re-capitalization campaign in the agriculture sector to make the US a leader again in sectors where they have been lagging. It was noted that the capital is not the biggest issue when talking about making the system more resilient, it is a lack of projects and technologies that can make it through the approval process to be viable options for investing. USDA needs to take a look at the policy landscape to ensure that it does not prohibit progress towards resiliency. However, in order to measure progress and to put in place effective strategies, access to the appropriate data is necessary. Access to data from USDA continues to be a barrier to research and informed decision making. C-AGG has been working with other

organizations to arrange a roundtable workshop with USDA that would highlight the major data and data access issues and develop solutions to address them.

Finally, the group briefly discussed farmer concerns around producing more “sustainable” products, which requires more work on their behalf, often with no remuneration, such as a price premium or other monetary incentive for their efforts. Non-GMOs and organics are two examples of practices that have allowed for differentiation and rewards. However, in order to take advantage of some of these programs farms must be located close to a facility that has the ability to segregate products. These markets are still developing, and while farmers are interested in participating, it is not always feasible.

Based on the rice process, multiple parties in the group encouraged C-AGG to develop a white paper documenting the engagement process with ARB. The white paper would be an excellent case study to share with other markets looking to develop agricultural based offsets.

Engaging Farmers in Climate Change Solutions

Roger Johnson, President of the National Farmers Union (NFU), presented NFU’s current priorities and discussed collaboration opportunities between NFU and C-AGG. Roger spent most of his life on a diversified farm in the middle of North Dakota and has personally seen the changes in the landscape as a result of a changing climate and changing technology. Where his family had planted grains and oats, there is now corn and soy. Working as a farmer and as the agriculture commissioner in ND for 12 years prior to joining NFU, Roger has a deep understanding of how farmers think and act.

If there is anything true about farmers they pay attention to weather and climate. When Roger was growing up, he remembers the most important part of the day was listening to the weather forecast. Farmers must have an understanding of the weather to make daily decisions about how to manage their crop. When asked if farmers believe in climate change, he looks to 1993 as the line of demarcation on this debate. Farmers had gone through a difficult time in the 1980s characterized by a deep drought. In 1993, ND saw the best wheat crop across the eastern half of the state in years, but tragically most of the crop went up in flames. It was also the third consecutive year with excess moisture at the wrong time of the year. It was the perfect storm: wheat scab destroyed the wheat kernel, excess moisture was destroying the crops, and farmers were left with nothing to harvest. The climate patterns have changed so much in this area that you now see very little wheat being grown due to the changes in the annual precipitation cycle. The wheat cannot handle a lot of moisture during their development period, which is what the region is starting to encounter. As agriculture commissioner, he would attend meetings with farmers and would ask two questions – (1) how many of you think of yourselves as conservationists? Most hands would go up; (2) how many of you are environmentalists? Maybe one hand would go up. Word choice with farmers is very important.

NFU was organized over 100 years ago in TX to address chronic poor market access for farmers. The problem was most farmers only had one buyer for their output and one seller for their agricultural product inputs. The farmer was forced to compete in a perfectly competitive

market, when everyone they were interacting with was competing in an imperfectly competitive market. This meant that industries along the supply chain could extract more of the money from the perfectly competitive market. To address this issue, NFU organized business cooperatives – larger entities owned by all the members. COOP profits were funneled back to members. This has made farmers acutely aware of market abuses and the role of government regulations.

There is an opportunity in the agriculture sector for GHG reductions, which this group is well aware of. The ND Farmers Union was one of the largest aggregators of offset projects through the former Chicago Climate Exchange (CCX) before climate legislation failed to move through Congress. The union organized farmers in a highly efficient manner in the mid-2000s, registering farmers electronically to make transaction costs low and allowed for a more efficient verification process. NFU expanded the effort nationwide, successfully engaging 3900 farmers in no-till and some wetland restoration practices. There are still credits on the books from the CCX projects and the farmers are still honoring the contracts even in the absence of the market and exchange. Roger thinks there is an innate drive within farmers to put in place good practices especially when there are additional financial returns on the line.

Agriculture is changing very rapidly. Farmers as a group are typically rapid adopters of new techniques and technologies. Roger took over his family's farm in the late '70s and converted it primarily to no-till, but still had to do some tilling for weed control. He learned how to successfully implement these practices from NRCS, ARS, and other USDA experts who were doing research in the field. He participated in their field days to try to figure out what the latest and greatest was. This is where a lot of farmers go to get their information. The greatest folly by the government today with respect to agriculture is to think they can keep cutting research budgets and still stay ahead of the curve. Most farmers plan for long-term horizons, so it is important for them to see results before making any dramatic changes.

As a progressive, risk-taking farmer, Roger was often a first adopter. Other farmers, seeing his results, wanted to know what he was doing. Farmers learn from their peers, extension staff, and county agents, all third party generalists who can give unbiased advice. At the end of the day, these practices cost money and if you make mistakes this will cost you money. Providing a safety net for farmers who experiment is the rationale behind some of the current farm bill incentive programs that help mitigate the early learning curve risks.

When Roger was in school, soil was viewed more as dirt with chemical needs, but now the focus has shifted to emphasize soil biology. A lot of research has emerged on this topic, and a lot of farmers are making this shift in their own operations.

NFU was heavily involved in supporting the 2009 cap-and-trade legislation, just around the time Roger was assuming NFU leadership. As an organization, leans more left and tends to be more environmental and conservationist focused than some other agricultural organizations. NFU's mission includes advancing environmental objectives including biofuels, renewable energy development – NFU has invested money in wind projects, early ethanol products, and sunflower oil - and agricultural offsets within carbon markets.

NFU promotes climate-smart practices including rotational grazing, wetland creation, precision fertilizer applications, no-till, cover crops, and diversified production. Successful farmers take advantage of geographic competitive advantages, so it is important to understand these and leverage them. For example, no till does not offer universal benefits all over the country, and should only be promoted in areas that are suited for it.

When drafting new policies for farmers it is important to make actions voluntary, provide incentives, make science-based decisions, and ensure the benefits of participation covers early actors and adopters. The Waxman-Markey climate bill penalized early adopters, which was a problem with that legislation. Policies must balance the non-additional nature of some early adopters' practices with the level of risk these adopters take. Roger hypothesized that programs outside of the markets could be used to reward early adopters.

Roger invited C-AGG participants to present their "sales pitch" inviting farmers to engage in climate friendly activities. Participants pitches focused more on economics and water impacts than carbon, but it was noted that applying a little more fertilizer is always a better decision economically, so all stakeholders need to understand the trade-offs, assumptions, and facts behind recommendations for practice change. It was acknowledged that NFU can help bridge the language gap with C-AGG participants and stakeholders. NFU agreed to help engage farmers on behalf of C-AGG and our stakeholder to make the next round of USDA GHG and water quality CIGs more successful.

The agriculture landscape and sector are changing quickly as new science and new threats emerge, but it was pointed out that all new technologies must be evaluate for trade-offs in impacts and potential unintended consequences. N-inhibitors are a great tool for managing GHG emissions, but these inhibitors can kill the soil biology. The industry needs to put more investment into developing solutions that have minimal unintended consequences, and that maximize multiple beneficial impacts.

Climate Change Programs of the Provinces of Ontario and Quebec, Canada: Possible Linkages to CA, Implications for Offsets, Agriculture

A panel of experts from the US and Canada discussed the current landscape in Canada and the potential for linkages with US programs. Katie Sullivan of the International Emissions Trading Association (IETA) North America, began the panel discussion. IETA is a multi-sector global business association that represents the interest of businesses across the value chain from project developers to buyers and emitters. The Canadian government, similar to the US, has had a very uncertain policy landscape over the past few years. There was some hope for a national federal regulation put on the oil and gas sector, but that has not materialized. As a result, the provinces are now taking the initiative to enact their own forms of regulations. While the national government has been against markets, the recently released INDC allows for the acceptance of international offsets with regulations likely for the natural gas sector, methane, and fertilizer emissions. Specifics are still taking shape and more will likely come out during the Paris UNFCCC negotiations in December.

Fragmented policies across Canadian Provinces create hardships for businesses, investors, and stakeholders. British Columbia has a tax on carbon of \$30 per ton and has their own protocols developed by the British Columbia Carbon Trust for fuels except natural gas. Alberta was the first to have a compliance GHG market in place in North America. They have an intensity based baseline system with over 30 offset protocols including numerous agriculture protocols. The Albertan government recently announced an increase in the price of carbon out to 2017. Saskatchewan does not have a policy yet, but will likely match Alberta's. Manitoba does not have a system, but will likely try to link with Ontario and Quebec and large potential agriculture opportunities.

Ontario had no interest in developing a system until last year and has recently decided to develop a cap-and-trade credit system. They will produce a draft document outlining the components of the system by the end of this year with a final document next year and a launch date of 2017. In some respects, the system will have to follow CA and Quebec's if the three are to be linked. The document will need to cover the proposed cap, scope and coverage (80% likely including power and transport fuels), allowance distribution, carbon revenue/fund design, offset program design, protocols, and early action.

Rick Saines, an attorney with Baker and McKenzie, discussed the current landscape in the US, specifically CA. He touched on the history of climate policy in the US with a discussion of the current rule making by EPA known as the Clean Power Plan (CPP). While the CPP does not explicitly allow offsets from sectors outside the electricity generation industry, if a state puts forth a plan to meet their state target that includes offsets from other sectors as one of their mechanisms it will be tough for EPA to deny the plan. This will be especially true if the plan includes all other emission reduction options as primary mechanisms and must rely on the offsets to achieve the final reductions. Rick also described the prolonged process for approving the rice cultivation offset protocol in CA, which had the NGO community torn between reducing GHG emissions and preserving bird habitat. In the end, a compromise was reached that still allows for some reductions in emissions while maintaining habitat in key flyways.

Jean Nolet with Coop Carbone discussed the state of the carbon market in Quebec and the potential for agriculture offsets. Coop Carbone was founded in September 2014 by a few industry partners in Quebec that wanted to see a greener economy in the province. They are currently buying offset credits in CA to sell to emitters in Quebec and using the revenue to finance offset projects in Quebec. Only the largest emitters in Quebec are interested in buying offsets to meet their obligations. The smaller emitters are more focused on buying the necessary allowances. Coop Carbone is also in the very early stages of putting in place a carbon fund to finance projects in North America.

Jean is currently working on a pilot project for Quebec dairy farmers, investigating project aggregation approaches to lower transaction costs. The project kick-off date is September. Right now Quebec has one protocol for methane from manure storage facilities, but no projects or credits are yet registered. The biggest barriers are small project sizes, small average farm sizes, biogas utilization that does not lead to carbon offsets, and biogas utilization that is not profitable given the absence of feed-in tariffs and low energy costs.

The biggest potential for agriculture emission reductions in Quebec is from nitrous oxide (N₂O) reductions, which have been increasing since 1990 and are currently higher than methane emissions from manure. Additionally, the international precedence and development of a protocol by the Canadian Fertilizer Institute makes this a very attractive opportunity. Quebec is also considering agroforestry, no till, and enteric fermentation protocols. They are looking for partners in other states and provinces who can share learnings that can be applied to Quebec.

The Quebec market currently has a credit reserve system, so every project gives back 3% of the credits generated to the reserve. Unfortunately, the regulations in Quebec are a big black box making it very challenging for industry players to understand what the government is thinking. He believes offsets are harder to achieve in Quebec because the government was seeing financial leakage from their allowance market.

Right now the challenges with agriculture offsets in some of the provinces in Canada are the size of the farms and the inability to reach a scale that will make these profitable. Jean is looking at the whole dairy sector (supply chain) to make the business case more attractive.

Assessing the GHG Mitigation Potential of the US Agricultural Sector

Debbie Reed set the stage for a panel discussion on the current mitigation potential of the US agriculture sector. Recently, C-AGG along with other participants, including Field to Market (FTM), have been grappling with understanding the mitigation potential of the agriculture sector in order to set realistic science-based absolute reduction goals at the national level. Allison Thomson, Research and Science Director at FTM, presented an update on FTM's goals and three major programs: the national indicators report, the FieldPrint Calculator (FPC), and projects in the field that apply the FPC algorithms and metrics.

The FPC currently tracks 8 metrics including GHG emissions. The GHG metric accounts for the total (direct and embedded) GHG emissions from crop production, but does not include residue burning, lime, and carbon sequestration. For N₂O emissions, FTM is currently using a Tier 1 IPCC emissions factor. Over the next year, the FTM metrics development working group is undertaking efforts to improve the N₂O calculation in an attempt to capture the 4Rs, to add sophistication to the rice methane metric, to incorporate new science from the USDA GHG guidelines report into existing algorithms, to incorporate methods to capture residue burning, lime, and carbon sequestration, and to align with the Farm Smart tool developed by Dairy Management Inc. to capture impacts from feed production.

FTM is following the ISEAL certification process to develop a system to make claims related to the outputs of the FPC. The claims will ideally roll up to an aggregate number to track progress against FTM's goals, which were adopted by the board at the end of 2014. The most relevant goal for C-AGG is the GHG goal, which currently is based on sustained reductions per unit of output. FTM strives for a more concrete absolute goal, and at the last FTM meeting in June, a subgroup of members and staff were tasked with investigating the state of the science to support an absolute emission reduction goal.

Marty Matlock, professor at the University of Arkansas, presented a case study from the soybean industry that demonstrates how producer groups are establishing GHG emission reduction goals. To engage producers, he emphasized the need to focus on shared values and not telling producers how to do their job differently. Using the FTM calculator to tell the story of how farmers compare to their peers has been a successful strategy.

Marty worked with the soybean industry to develop a soybean sustainability assurance protocol, which identified what improvements are technologically possible today with implementation of best management practices (BMP). The group performed a gap analysis using publically available data for each practice to determine what the size of the opportunity for each BMP could be based on the difference between the average implementation rate and the range. This information was then used to develop goals for land use, soil erosion, energy use, and GHG emissions. It took the group 2 years to finalize an absolute GHG emission reduction goal. While the process was a struggle, the current goal provides the group with a roadmap for how to most efficiently invest their money. During this process, Marty found that it takes 5 years minimum to build trust in a collaborative process.

Participants engaged in a short discussion around the challenges with funding for conservation research and pilot projects given the steady decreases in USDA funding. It was agreed that this will continue to be a challenge since funding will likely never reach 1980's levels again. The group also grappled with outcomes versus practice based goals. If you have outcomes based goals how do you help the farmers achieve them without prescribing practices? Marty is confident that arming the farmers with the necessary tools and allowing them to make their own decisions will result in the desired outcomes. Allison reiterated that FTM is very focused on taking an outcomes based approach, but this is not to say that programs that have come before them, which have been practice based have been ineffective.

Voluntary Carbon Registry Updates and Discussion

Lauren Nichols of the American Carbon Registry (ACR) provided an update on the current protocols under development by ACR. ACR became a certified CA ARB registry two years ago. ACR's rice protocol was recently approved as an early action methodology under CA's program. ACR is hopeful that the protocol will assist farmers who have been working to implement acceptable practices to claim credit for them. ACR now has 3 rice cultivation projects listed, including 21 farmers, 253 fields, and 22,213 acres. The registry expects the methodology to be adopted in full this fall.

ACR has been developing a CA wetland restoration protocol that will soon open for public comment. Based on ACR's Michigan wetlands protocol, it intends to capture emission reductions from the accretion and carbon accumulation on peat soils in the delta and Suisun Marsh. ACR is also reopening its fertilizer management methodology developed 5 years ago to enhance flexibility around the models that can be used to meet protocol requirements.

Max DuBuisson, Climate Action Reserve (CAR), described recent developments at CAR related to agriculture protocols. The reserve currently has 58 listed or registered livestock projects, which are their major source of agriculture offsets. CAR submitted 3 CIG proposals to increase the uptake of their protocols for avoided grassland conversion, nitrogen management, and rangeland management.

The avoided conversion of grassland to cropland is a recently developed protocol that has used some of the lessons learned from the previous agriculture protocols to reduce transaction costs and enhance ease of use. The protocol allows for ownership of GHG reduction rights to be established separate from the land, which is a big departure from other protocols. CAR is allowing for “cooperatives” as a means to arrive at economies of scale through combined efforts to monitor, report, and verify. The protocol is applicable to all 50 states so long as enrolled lands meet the financial additionality threshold – land must be worth at least 40% more as cropland than pastureland. The quantification has been streamlined and relies on a model with default factors generated using DayCent to capture the baseline emissions from avoided loss of belowground organic carbon, avoided N₂O from fertilizer, avoided CO₂ from crop cultivation, and avoided loss of aboveground shrub biomass. The baseline scenario is then assumed to be what would happen to a specific stratum in reality using the US GHG inventory.

Project verification requires an initial verification of one reporting period, up to 24 months, with no site visit requirement. However, a higher reversal risk rating will be assigned to a project that does not include a site visit. After a site visit has been performed, the risk rating will decrease and additional credits can be generated. CAR is accepting project submittals immediately and has applied for a 2-year CIG to help develop additional tools, perform outreach to landowners and project developers, develop and verify 2 pilot projects, and update the protocol based on lessons learned.

Day 2 - Wednesday, July 15, 2015

Highlights of Fair Oaks Dairy Tour

On Monday, a group of C-AGG participants traveled to the Fair Oaks Dairy to tour their manure management operation. The manure management system handles the waste from 15,000 dairy cows using an anaerobic digester followed by a separation technology that strains out more of the moisture from the digester output concentrating the solids into a cake that can be applied to fields. The cakes have a known nutrient quantity and can be easily shipped to other farms making this an attractive fertilizer and potential source of revenue for the farm. They are currently producing both energy and compressed natural gas from the digester’s methane. The CNG fuels the 48 milks trucks in Fair Oaks’ fleet, and includes renewable identification numbers (RIN) and low carbon fuel (LCF) credits, adding another revenue stream to the waste. Ryan McCarthy with CA’s ARB mentioned that this is the model of the future since it significantly helps with the business case for anaerobic digesters.

Thoughts and Reactions to Tuesday's Session

During a discussion of key themes presented on Tuesday and the group's reactions to the Fair Oaks tour, Jean Nolet commented that the scale of the farm was fabulous, but policies in Canada seek to maintain smaller family farms which are not able to use many new expensive technologies. This is another example of trade-offs in the agriculture sector between economics, environment, and social issues. While bigger may be better for efficiencies and implementing technology, detrimental social impacts to family farms need to be considered.

While trade-offs are challenging, it was noted that there are ways to optimize all three sustainability pillars through better management. The dairy LCA proves that management matters and can make a big difference on environmental impacts. For example, there are small digester technologies that are designed for farms with 50-200 cows, which would be more appropriate for the Canadian context.

When taking a step back and thinking about improvement opportunities for C-AGG and its participants, three topics were highlighted by the group coming out of Tuesday's discussions: a need to address the early adopter issue, a strategy for when and where to use absolute versus intensity metrics, and a methodology for capturing GHG improvements from integrated cropping systems since these are the future of agriculture.

CA Air Resources (ARB) Scoping Strategy on Short-Lived Climate Pollutants

Ryan McCarthy provided an update on CA's recently released scoping document on short-lived climate pollutants (SLCP). Governor Brown has taken a very aggressive climate stance and is seen as a leader on the international stage. One of his 5 climate goals is focused on reducing SLCP. The legislature is currently debating the 5 goals and will vote soon to codify the three energy goals. The state has been having workshops related to all of the goals to develop roadmaps for implementation. The SLCP plan includes many actions in the agriculture sector, which will eventually be pulled into the state's updated scoping plan.

ARB released a concept paper in May to start meaningful discussions with stakeholders. The document serves as a starting point for workshops to focus on key areas of concern for the state. The concept paper outlined the vision and the scope of the final strategy with some initial targets for each pollutant, which are aligned with the science of keeping the temperature below the 2° C mark. The initial strategy document is set to be released at the end of August with a final version sent to the legislature by the end of the year.

While the SLCP concept paper focuses on multiple pollutants, the pollutants and eventual strategies most relevant to the agriculture sector are methane and black carbon. Methane accounts for 40% of global warming to date. A 70% reduction in SLCP would prevent sea level rise, so it is a big near term focus and opportunity for the state, the country, and the world. For CA, SLCP represent 20% of the state's emissions on a 100-year horizon and 44% on a 20-year horizon using the 4th IPCC assessment numbers.

The concept paper includes 5 overarching principles:

- To prioritize actions with multiple benefits;

- Put organic waste to its most beneficial use;
- Identify practical solutions to overcome barriers and invest in technologies;
- Improve understanding of SLCP sources and emissions; and
- Invest in SLCP emission reductions.

These key principles will help the state reach their SLCP goals of a 50% reduction in black carbon by 2020 from the transport sector and from all sources by 2030 and a 20% reduction in methane emissions by 2020 and 40% by 2030 below forecasted levels. The remainder of Ryan's presentation focused on the plan for reducing methane emissions in the agriculture sector given they represent over 50% of methane emissions (manure – 26%, enteric – 29%, rice – 3%). For the remaining sources of emissions, the state will target leaks in oil and gas pipelines and divert additional organics from landfills along with other regulations to reduce the methane produced from landfills.

Turning to the agriculture sector, the main focus will be on building the carbon content in soils and significantly cutting emission from dairies. The state has engaged the CA Department of Food and Agriculture along with other stakeholders to develop their dairy strategy. The group has been discussing the state of the technology, the investment requirements, and realistic reductions that can be expected. The outcomes of these discussions will feed into the strategy document that is released in late August. One likely inclusion will be a strategy for improving the ease of transporting gas to pipeline and pricing this gas appropriately. Many digester owners are becoming very adept at navigating the process of cleaning up gas to distribute to the pipeline, so this represents a huge opportunity if they can work out the economics.

Enteric emissions have been less of a focus for CA since the industry believes the opportunity is small given the current feed rations used. However, no state level report has investigated this issue specifically, so it would be a valuable exercise in the future. The concept paper does acknowledge that if the head of cattle in the state grow the state will not be able to meet their enteric targets given the potential lack of improvement potential of this emission source.

While black carbon is an issue for the agriculture sector, the majority of black carbon in CA stems from wildfires. Forest management will thus be the biggest focus for reducing sources of black carbon. Little has been discussed in terms of the agriculture sector since the plan is deferring to other air quality standards for continued management of emissions from tractors and other on-farm mobile sources of emissions.

Anaerobic Methane Digesters & Nutrient Separation: State of Technologies and Sustainable Nutrient Management

Chad Frahm and Jerry Bingold, Dairy Innovation Center, presented for the remainder of the day on the exciting sustainability projects coming out of the dairy industry. Chad began the discussion with an overview of the dairy industry in the US. 47,000 licensed dairies housing 9.2M cows are located across all 50 states with the largest majority located in CA (20%). The herd has been steady in recent history with all increases in production resulting from improved

efficiencies. 15% of the milk is exported due to rising demand abroad and declining demand domestically. DMI is fully funded by dairy check-off programs.

Innovation Center is a program connected to Dairy Management Inc. (DMI) led by 32 major companies in the dairy sector with a mandate to work on pre-competitive topics. The center is focused on the health and well-being of consumers, the heifers, and the planet. Programs encompass the provision of nutritious, safe, and high quality food, good animal care with a good environmental impact, and continuous improvement on key environmental indicators. The US continues to lead the world in having the smallest footprint per gallon of milk produced. However, after the release of an FAO report pointing to animal's large impact on GHG emissions the dairy sector came under scrutiny. The center needed to understand their actual impact, so they commissioned a Life Cycle Assessment (LCA) of their industry.

The learnings from the LCA helped the Innovation Center set voluntary reduction goals for the dairy sector aimed at reducing emissions from feed and milk production. The Innovation Center is now in the process of determining how to track progress against these goals. In addition to uncovering reduction opportunities, the LCA demonstrated that management on the dairies is one of the biggest drivers of emissions. When broken down by processing stage, the most important management decisions on farm are related to feed efficiency and manure management. During processing, reduced electricity use, consolidated distribution networks, and alternative packaging make the biggest difference. Routine truck maintenance and better route design are additional opportunities that can be applied to all dairies.

Emerging Nutrient Recovery, Mitigation, and Partitioning Technologies for Treatment of Dairy Manure

The Innovation Center recently turned their research on dairy digesters and the business case for all of the digester outputs into a new business, Newtrient. Jerry Bingold discussed the formation and emerging strategy of the new business. The business case the Innovation Center developed shows that renewable energy credits (REC) and the electricity from digesters was enough to pay for digester operations, so the real added value comes from organic substrates, nitrogen (N), phosphorus (P), nutrient enriched fiber, and GHG offsets. Newtrient will work on valuing and developing markets for all organic outputs of the digester, with a goal to turn manure into a product almost as valuable as milk. They are also working on including food waste in the digesters since it can increase energy production 2 to 4 times.

Additional processing is required to retrieve N and P from the digester output. Jerry explained the technologies needed to retrieve the elements from the water and solids left after the manure runs through the digester. The bedding and fiber, which is not digested by the cow, can be separated from other solids and turned into bedding of which 40% is typically used on farm leaving 60% to sell in the market. 80% of the P remains suspended in the liquid and can be recaptured by introducing a polymer coagulate to the liquid to turn the P into a solid that can be screened out. This process can capture 80-90% of the P. The new company will be responsible for introducing these technologies to farms.

N is also dissolved in the liquid and if released into the lagoon would be off gassed as ammonia. To recover the N, dairies can perform ammonia stripping, which pumps air into the liquid and liberates the ammonia. The ammonia laden air is then passed through an acidic shower to produce ammonium sulfate, which can be used as a liquid fertilizer on farms with 40% N. Today, this technology is break even at best with a large installation. Newtrient will work to determine how to add value to this product and increase uptake on farms.

Newtrient will also continue investigating commercialization opportunities for the fiber and other solids. Some of the solids are currently being used as compost and potting soil and they are investigating options for using the fiber as a replacement for peat moss.

Financing is still a challenge for these large projects. Traditional project financing is not a viable option since investors who are willing to take on some of the project risk are still needed and the returns do not meet the requirements of this class of investor. Since traditional outlets were not viable, the Innovation Center started investigating government options and came across the Rural Electrification Act. The digester projects met all of the criteria for financing, so they have clearance that they can use this government financing for digesters and are currently waiting for their first funding to officially come through. Combining this low interest source of financing with the revenue from all of the outputs, the Innovation Center and Newtrient are confident they can develop a profitable system.

Cow of the Future and other Dairy Innovation Center Tools and Resources

Chad Frahm presented on the Innovation Center's Cow of the Future project to reduce enteric methane emissions. The original focus of the project was solely GHG mitigation, but has grown to accommodate consumers seeking better quality milk that is safe and nutritious. The project is focusing on both proactive – sustainable food supply – and reactive – mitigation of GHG emissions – measures to meet their goals.

The project has acted as a catalyst for the academic and research community to focus and accelerate the science around feed and herd management to better understand the optimal solutions that balance milk quality and quantity with the three sustainability pillars. One of the first research areas of focus was on the competition between feed for cattle and food for human consumption. Forages, mainly corn and alfalfa, make up over 53% of a cattle's diet. It was found that only 0.9% of this feed is of a quality that could be consumed by humans.

Another big area of study is on the perfect ration. Cows produce better milk if their diet is kept constant. Therefore, very precise science goes into optimizing the feed ration for each stage of development with a focus on quality and quantity of milk that can be produced. As part of this project, the Innovation Center released a document on Considerations and Resources on Feed and Animal Management that provides details on the tools and opportunities to reduce enteric emissions. The report focuses on both improving the economics on farm and the sustainability story making it appealing to multiple audiences.

Additional research priorities for the center include determining if feed storage impacts digestibility, optimizing the concentrate portion of the ration, and optimizing herd management

so the cows are rotated through the system with a focus on minimizing the number of days not producing milk.

There is no silver bullet for enteric emissions, but a good list of the practices has been developed to optimize impacts, though there is currently no way to quantify the impact of the management decisions. Also, there is currently no system in place to track the uptake of these practices by dairies, so the Innovation Center will perform another LCA in 2018 to capture the changes.

The Innovation Center is also developing a Stewardship and Sustainability Guide for the US dairy industry that includes indicators to measure and track progress of the industry. The indicators currently cover GHG emissions, energy, and animal care with waste management, water, soil health, and biodiversity to be added soon. The Innovation Center recently signed an MOU with FTM to coordinate and align their water quality metric and to seek to align other metrics. These indicators form the basis of the Farm Smart 2.0 online database that stemmed from the 20 page questionnaire sent to LCA participants. The new questionnaire for the online database is much shorter hitting on the most important impacts on the farm. The online tool will help with reporting and communicating the outputs of the indicators to suppliers and other interested stakeholders similar to the output of FTM's FPC.

A major DMI goal moving forward is alignment with other sustainability initiatives that overlap with any part of the dairy supply chain. They have partnered with FTM to better understand the impacts of feed given FTM's main focus is on row crops; and are working with USDA to promote dairy exports to Europe. DMI is participating in a global dairy agenda, which puts forth a series of 11 guiding principles for all members to follow. Finally, DMI participates in the Sustainability Council primarily led by the Innovation Center, which brings stakeholders together to discuss issues facing the industry.

In the coming months, the Innovation Center will be focusing on the following key areas:

- Consumers – consumer relevant sustainability benchmarks to demonstrate ongoing continuous improvement;
- Nutrition and sustainability – releasing new metrics based on nutrition as a functional unit; and
- Manure management – creation of Newtrient and exploring nutrient trading and nutrient recovery technologies.