GHG REDUCTION PROTOCOL FOR THE CANADIAN DAIRY INDUSTRY

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Process Overview

- Seed Materials / Key References
  - Quantification methods from Canada's National Inventory Report
  - Contribution by research scientists involved in National Inventory Report and participating in development of Holos
  - Alberta quantification protocols (Pork, Beef)
  - Preliminary work by ADFI and Dairy Farmers of Canada
  - Canadian Pork Council (Pork GHG Project Builder)
- Technical Review
  - Substantive external review conducted during preparation — Science Discussion Document, National Consultation Workshop, Alberta process
  - All reporting will be as required in Section 2.3.6 of the Specified Gas Emitters Regulation Offset Credit Project Guidance Document (February 2008)

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Project Scope and Description

- Quantification of reductions in greenhouse gas (GHG) emissions from dairy farms in Canada
  - Practice change to decrease CO_2, CH_4, N_2O emissions per unit milk.
  - Practices include increased milk productivity, diet modification, lower replacement rate, increased pasture, spreading of manure in spring
- Project boundary = the whole farm (barn, cattle, manure storage, feed production)
  - Some aspects simplified to acknowledge need for parallel protocols

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Project and Baseline Conditions

- Baseline Condition = the operating condition prior to the implementation of the GHG reduction project
  - Baseline Emissions are calculated using the protocol quantification method for the year prior to the project.

- Project Condition = the operating condition after the implementation of the practice changes
  - Project emissions are calculated using the protocol quantification method, according to the practices in place for the project condition

Basis for Reductions

- Functional Equivalence
  - Emissions calculated on the basis of kg of CO_2e divided by the kg of fat corrected milk produced (Project and Baseline)
- Emission Reduction Mechanism
  - Milk productivity — better genetics or husbandry to achieve equal milk with less feed
  - Diet modification — higher quality feed or supplements (edible oils or ionophores) to decrease enteric methane per unit feed
  - Replacement rate — fewer non-productive cows
  - Season of spreading — avoid storing manure in warm months
  - Pasture — avoid emissions associated with processing feed

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Applicability Criteria

- Protocol applies to:
  - Canadian dairy farms — farms producing milk for sale
  - Farms which can document ownership of GHG credits, if any aspect of the farm is contracted or leased (land, barn, cows, quota)
  - Projects that meet all applicable Alberta Offset System requirements

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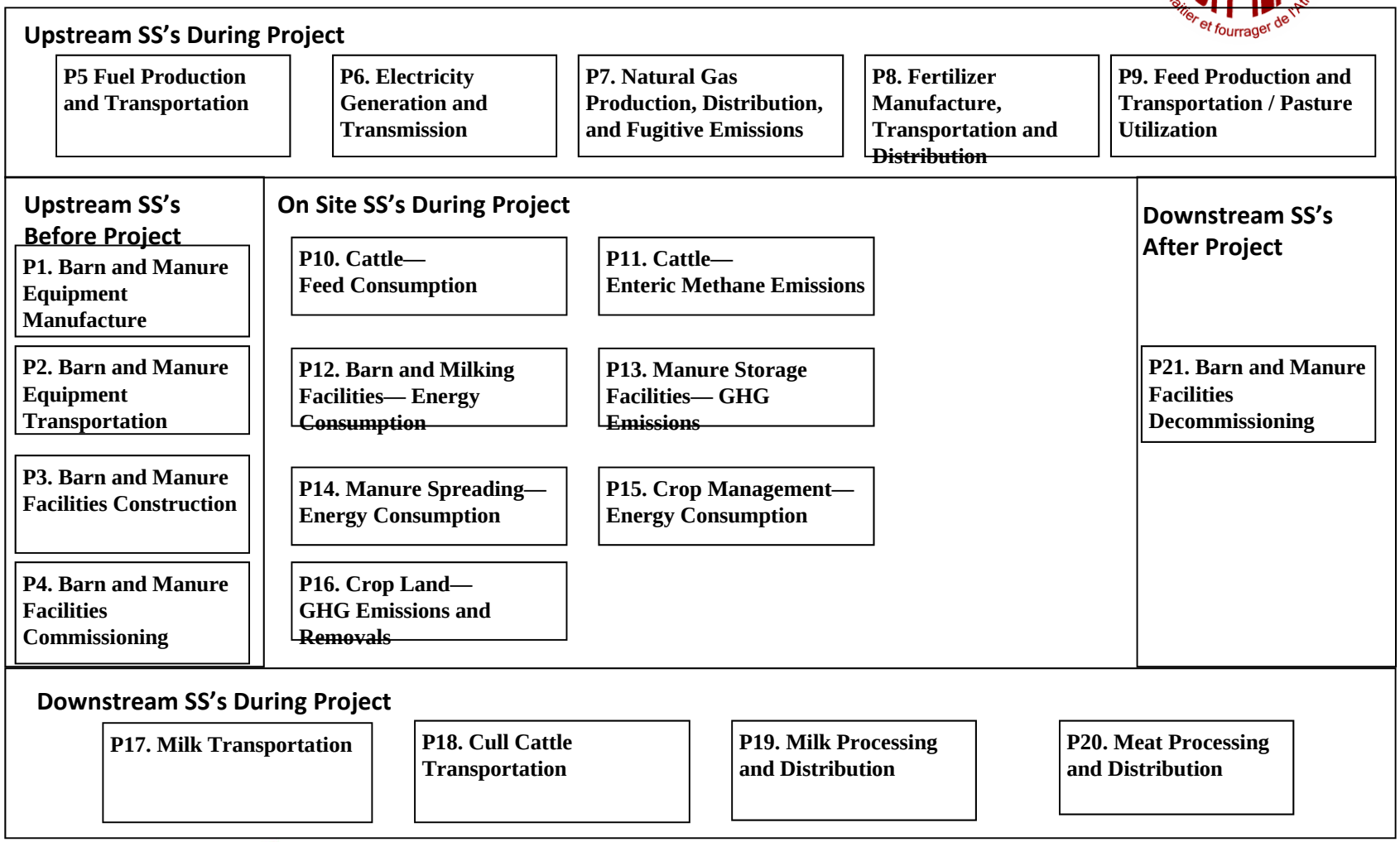
Flexibility Mechanisms

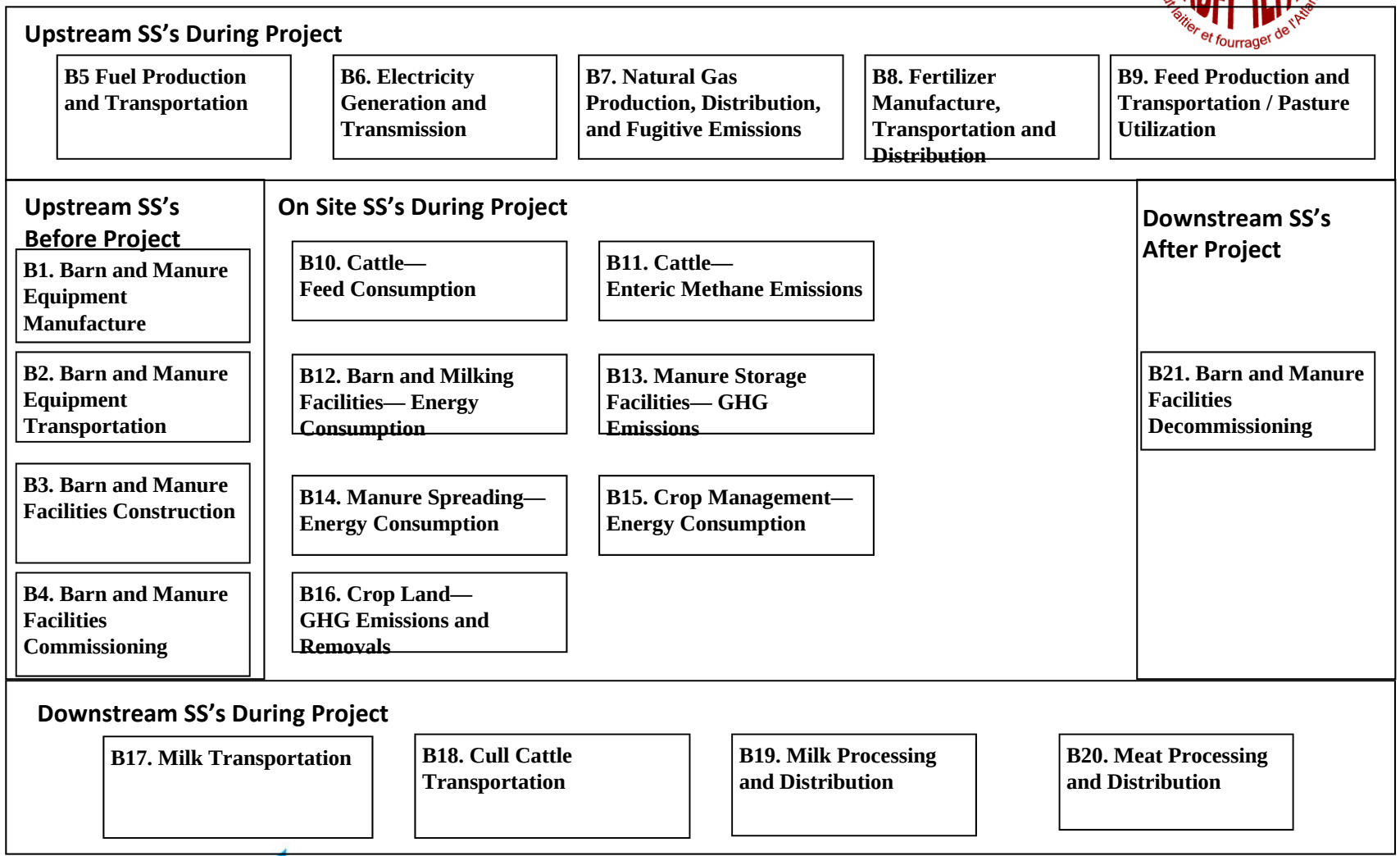
- Project developers may use Basic or Advanced approach
  - Basic uses default factors and generic equations (feed quality, methane emissions) — 80% of reductions
  - Advanced approach uses comprehensive monitoring to allow more farm-specific GHG estimations — 100% of reductions

- Project developers encouraged to implement parallel protocols such as energy efficiency, manure methane capture, etc.

Project Lifecycle Diagram



Baseline Lifecycle Diagram



Emission Reduction Calculation

$$\text{Emission Reduction} = [(\text{Emissions}_{\text{Baseline}} - \text{Emissions}_{\text{Project}}) * \text{Discount}] * \text{Milk}$$

$$\text{Emissions}_{\text{Baseline}} = \text{Emissions}_{\text{Enteric}} + \text{Emissions}_{\text{Stored Manure}} + \text{Emissions}_{\text{Feed}}$$

$$\text{Emissions}_{\text{Project}} = \text{Emissions}_{\text{Enteric}} + \text{Emissions}_{\text{Stored Manure}} + \text{Emissions}_{\text{Feed}}$$

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Calculation explained...

$$\text{Emission Reduction} =](\text{Emissions}_{\text{Baseline}} - \text{Emissions}_{\text{Project}}) * \text{Discount}] * \text{Milk}$$

$$\text{Emissions}_{\text{Baseline}} = \text{Enteric} + \text{Stored Manure} + \text{Feed}$$

$$\text{Emissions}_{\text{Project}} = \text{Enteric} + \text{Stored Manure} + \text{Feed}$$

Emissions $_{\text{Baseline}}$ = the sum of the GHG emissions under the baseline scenario (kg CO_2e / kg FCM)

Emissions $_{\text{Project}}$ = the sum of the GHG emissions under the project condition (kg CO_2e / kg FCM)

Discount = factor for Basic (0.8) or Advanced (1.0) approach

Milk = total kg of FCM produced under project condition

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Y_M Function— feed energy converted to enteric methane

- IPCC Default
  - $Y_M = 6.5 \pm 1.0$
- Karen Beauchemin & Alan Fredeen
  - $Y_M = 6.5$
  - Adjust Y_M according to feed quality and feed supplements
    - Low quality forage: $Y_M = 7.0$
    - High quality forage: $Y_M = 6.0$
    - Oilseeds (crushed): 5% decrease in Y_M for every 1% added
    - Ionophore (intermittent): 10% decrease in Y_M

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Embedded Emissions — Feed Production

- Desjardins, Rochette, Vergé
  - Proxy for farm-specific estimation of emissions from fertilizing, growing, harvesting, transporting, processing feedstuffs
  - Combine CO_2 and N_2O emissions
    - Nitrous oxide sources are from N-fertilizer application (chemical or organic), crop residues, leaching and volatilization. IPCC equations adapted for Canada by Rochette *et al*. (2008) were used.
    - Carbon dioxide sources are from fossil fuel use for field work, electricity, crop drying and fertilizer and machinery supply. The F4E2 model was used (Dyer and Desjardins, 2003, 2005).
  - For each province: four grains, four forages, pasture, others (DDGS)

Questions

- E.g.:
  - Baseline approach?
  - Emission factors?
  - Data requirements?
  - Practical considerations?
  - Other?