Programme Area: Bioenergy

Project: Characterisation of Feedstocks

Title: D8 Technical Briefing Approach to Contract Amendment 1

Abstract:

The primary objective of this Project was to provide an understanding of UK produced biomass properties, how these vary and what causes this variability. This deliverable is provided under the second phase (2016/17) of the Characterisation of Feedstocks Project. This report is a summary of the findings from the whole project, it complements the Final Reports from the first and second phases (D6 and D12) and is supported by the Excel dataset (D11). Some key findings from the report are: inclusion of leaves in biomass should be avoided. An exclusion might be conifer tops where the levels of most elements were sufficiently low to not exceed quality thresholds; harvesting time had a marked effect; while there were species differences between SRC willow varieties, no variety combined the best ranking in all parameters across all sites; there were major changes to Miscanthus quality during storage (decreasing fuel quality). For growers of Miscanthus, poplar SRF and spruce SRF, the key influences on many properties, i.e. season and storage, can be manipulated; SRC willow growers have a reasonable degree of control over some of the important feedstock characteristics by their choice of variety; for poplar SRF and spruce SRF, many properties can be adjusted by choice of plant part to market, and harvest time. Feedstock properties were relatively insensitive to the way spruce SRF as grown.

Context:

The Characterisation of Feedstocks project provides an understanding of UK produced 2nd generation energy biomass properties, how these vary and what causes this variability. In this project, several types of UK-grown biomass, produced under varying conditions, were sampled. The biomass sampled included Miscanthus, Short Rotation Forestry (SRF) and Short Rotation Coppice (SRC) Willow. The samples were tested to an agreed schedule in an accredited laboratory. The results were analysed against the planting, growing, harvesting and storage conditions (i.e. the provenance) to understand what impacts different production and storage methods have on the biomass properties. The main outcome of this project is a better understanding of the key characteristics of UK biomass feedstocks (focusing on second generation) relevant in downstream energy conversion applications, and how these characteristics vary by provenance.

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Forest Research

Biomass feedstock characterization Contract variations

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D8 TECHNICAL BRIEFING
APPROACH TO CONTRACT AMENDMENT 1
14th April 2016

Contract variations

Contract Amendment Number	Variations included within this amendment	Variation Title
1	Var001	IMPACT OF HARVEST TIME ON MISCANTHUS CHARACTERISTICS
	Var002	IMPACT OF HARVEST TIME ON WILLOW CHARACTERISTICS
	Var003	IMPACT OF VARIETIES ON WILLOW CHARACTERISTICS
	Var004	IMPACT OF STORAGE TIME ON MISCANTHUS CHARACTERISTICS

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Deliverables

Identity	Due Date	Funding (£)	Cumulative Funding (£)	Deliverables	Due Date
MS4	12th August 2016	£196,000	£573,000	D8 – Technical briefing meeting on approach	By 31st February 2016
				D9 – MS4 database	31st July 2016
				D10 – MS4 report (added sections to D6)	12th August 2016
MS5	14th October 2016	£50,000	£623,000	D11 – MS5 database	30th September 2016
				D12 - MS5 report (added sections to D10)	14th October 2016
				D13 – Updated whole Project Executive report	31st October 2016

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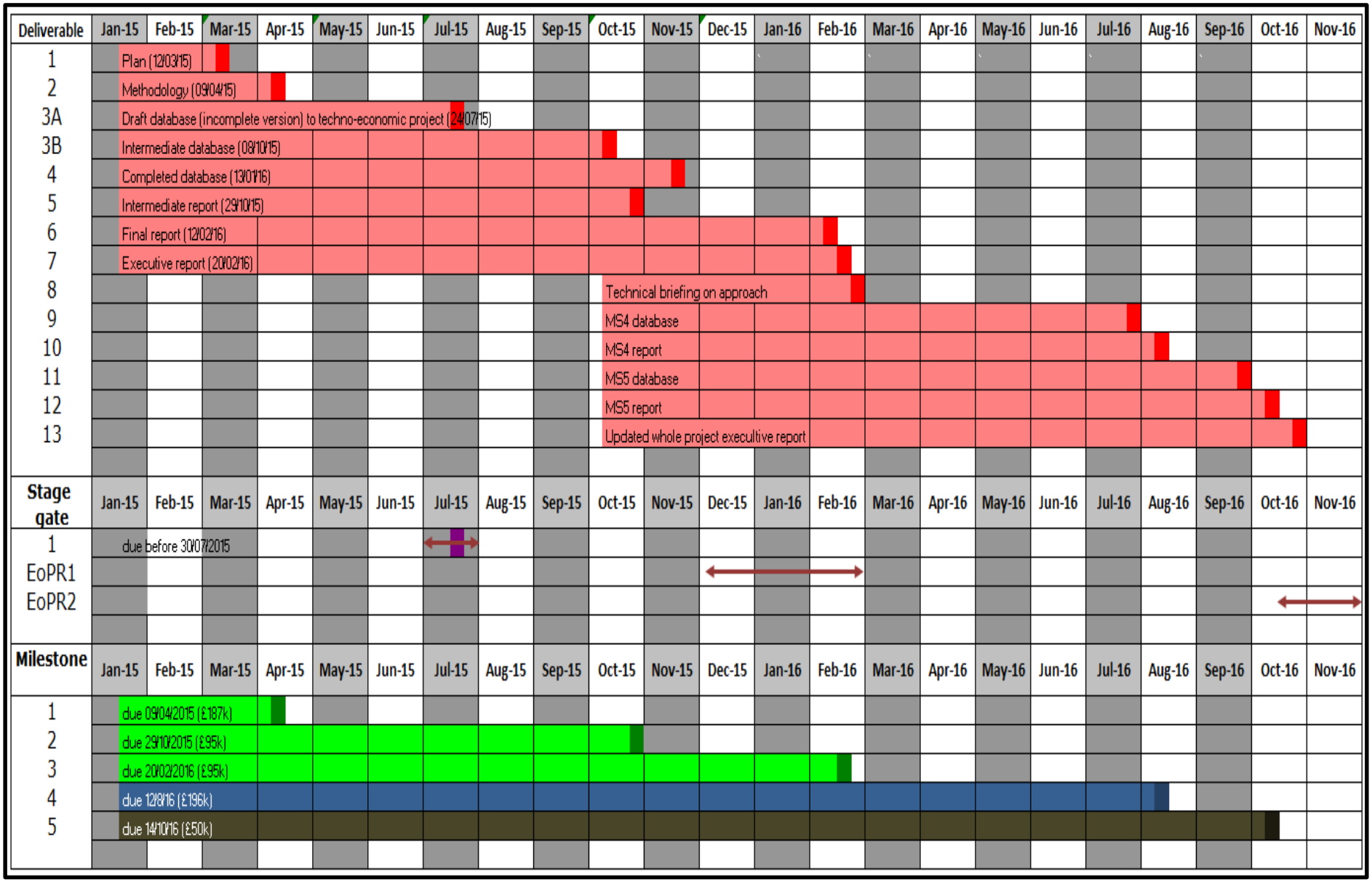

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VAR001 and VAR002

HARVEST TIME ON MISCANTHUS AND WILLOW CHARACTERISTICS

Key elements	***Miscanthus***	**Willow SRC**
Sampling times	3 virtual, 1 actual and 1 pre-baling	3 virtual
Climate zones	1	1
Soil types	2 (Data from original contract are still relevant)	2 (1 new composite soil sample from 10 random locations in each field)
Replicate sites	3	3
Samples per site	1 composite from 10 random locations in each field	1 composite from 10 random locations in each field

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Hypotheses and analyses

- H1: harvesting time affects some but not all feedstock characteristics in terms of statistical, analytical and operational significance.
- H2: there is significant year-to-year variation in feedstock characteristics.
- Data will be filtered for analytical and operational significance as described in D6, pending feedback on D6.
- Statistical analysis will be by ANOVA or REML depending on the balance of the dataset.

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IMPACT OF VARIETIES ON WILLOW SRC CHARACTERISTICS

Key elements	Detail
Sites (5)	Loughall (Co. Down, NI) Brook Hall (Londonderry, NI) Rothamsted (Watford) Long Ashton (Bristol) Aberystwyth
Varieties (6)	Endurance Tora Terra Nova Resolution Sven Nimrod
Sampling times (1)	End February, early March
Climate zones	To be determined
Soil types	Composite sample at each site collected for analysis

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Hypotheses and analyses

- H3: the genetic composition of willow grown as SRC affects feedstock characteristics in terms of statistical, analytical and operational significance.
- H4: the ranking of willow varieties is consistent across sites.
- Data will be filtered for analytical and operational significance as described in D6, pending feedback on D6.
- Statistical analysis will focus on the analysis of ranks.

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Progress on Var001, 2, and 3

- Sampling protocols for VAR001, 002 and 003 follow the agreed protocols in the main contract
- Risk assessments are still relevant
- Sites have been identified, samples collected, and sent for chemical analysis

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IMPACT OF STORAGE TIME ON MISCANTHUS CHARACTERISTICS

Part 1. Questionnaire to determine storage systems being used in commercial practice.

Part 2. Experiment to determine the effect on feedstock characteristics of the four most common storage systems over extended periods.

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Hypotheses and analyses

- H5: storage method affects feedstock characteristics.
- H6: length of storage affects feedstock characteristics.
- H7: movement of bales during storage affects feedstock characteristics.
- H8: there is an interaction between storage method and length of storage.
- Data will be filtered for analytical and operational significance as described in D6, pending feedback on D6.
- Statistical analysis will used repeated measures.

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Progress

- Questionnaire designed by Uniper and completed by Terravesta
- Findings returned in early April and being collated by Uniper
- New experimental protocols drafted by FR/Uniper (Wall, Hogan and Croxton) and reviewed for H&S issues
- Experimental site has been identified with facilities and trained personnel to manipulate bales for sample collection
- Corer for sample collection was ordered in October but is not ideal; an alternative is being developed

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Protocol Var004 (1)

Key elements	Current proposal – the objective is to quantify the impact of storage system
Experimental material	*Miscanthus* bales from one location (192 bales, ca. 100 fresh tonnes)
Location	Taunton
Age	<1 year beginning from time of baling
Storage systems (to be confirmed)	1. Outside uncovered 2. Outside covered by sheet 3. Outside covered by a roof but no sides 4. Inside storage.
Storage duration	Intended for up to 6 months *

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Protocol Var004 (2)

Key elements	Current proposal – the objective is to quantify any impact of repeated movement of bales
Treatments (2)	A. Unmoved Bales will be placed into storage and not moved again until the stack is dismantled. Samples will be taken at the start and end of the process. B. Moved monthly Bales will be placed into storage and dismantled each month for sampling.

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