A.R.Day B.Sc. Hons Phys ARCS
54, Waterside Court,
Paper Mill Lane,
Alton, Hants,
GU34 2PQ.
Tel 01420 542888
Mob 0791 256 0740
email anthony.r.day@hotmail.co.uk

8th March 2010

Dear Sirs,

1.4GW zero emissions carbon capture ready Energy from Waste multi-fuel Integrated Gasification Combined Cycle (IGCC) at Didcot Power Station and Sutton Courtenay landfill

I attach a brochure for the above scheme. In October 2009 I forwarded an earlier version of this scheme to several UK Government departments involved with the implementation of the UK's energy and waste policies. I received no replies, or acknowledgements. Being an integrated waste and multi-fuel power station, the scheme falls between different departments' core responsibilities.

During the intervening period of time, the amended scheme has been developed in order to optimise the Return on Capital Employed (ROCE). The earlier scheme used Synthetic Natural Gas (SNG) as the primary storable energy carrier. The attached scheme uses Synthesis Gas (Syngas) as the primary storable energy carrier. It will be possible to convert the primary energy carrier from Syngas to SNG at a later date. The scheme relies on the co-gasification of wastes and biomass to mitigate emissions from coal, and the additional income from hazardous, and non-hazardous, waste 'gate fees' to underpin the capital expenditure for the gasification plant, in order to attract investment for a carbon capture ready power plant. The 'headline' fundamentals are:

- Electricity output: 1.4GW base, or peak, load.
- Input solid fuel mix:38.5% coal : 23% renewables : 38.5% Natural Gas (base load operation)
  60.0% coal : 35% renewables : 5.0% Natural Gas (peak load operation)
- Total solid fuel input rate: Approx. 2.25m tonnes pa including on-site landfill mining.
- Solid fuel importation rate: Approx. 1.9m tonnes pa.
- Total existing consented solid fuel importation rate: Approx. 4.5m tonnes pa.

(Note. The proportion of renewables could theoretically be increased up to a maximum of 65% depending on fuel availability, and local rail transportation and Planning consents. The proportion of coal can be varied between 30% and 60% of the total solid fuel mix.)

- Gasifier solid fuel input calorific value: Average range 17.5 to 20.0 MJ/kg. (Gasifier simulations have demonstrated stable gasification over a wide range of solid fuel mixes)
- Solid fuel input costs: Approximately net zero.
- CCGT input gas mix: 56% Syngas : 44% Natural Gas (base load operation)
  approx. 95% Syngas : 5.0% Natural Gas (peak load operation)
- CAPEX: £2.5 bn. (Includes £0.25bn contingency on £1.0bn budget for gasifier/APC/ASU train)
- ROCE: Average 38% over 25 years. Profit enhancement and risk minimisation by the arbitrage of input fuel and output energy prices, and the use of daily Syngas storage.
- Zero emissions to air, soil or water.
- CO_2, CH_4 and N_2O emissions abated, compared to the simple combustion of coal and/or wastes, by: high overall energy efficiency; the co-gasification of wastes, coal and biomass; the displacement of coal by renewable solid fuels, and co-firing with Natural Gas.
- Carbon capture ready using proven pre-combustion carbon capture technology.
- Target energy efficiency for design purposes: Approx. 60%. Use process heat recovery; thermal mass store, and Organic Rankine Cycle turbine to recycle waste heat to electricity.
- Supports the restoration and Sustainable Development of the flood plain of the River Thames.

Didcot Power Station is a strategically important UK asset, which supplies approximately 6% of total UK peak electricity demand, and assists in maintaining the equipotential stability of the UK grid under peak load conditions. Didcot 'A' coal fired power station will be de-commissioned at the end of 2015. The combined sites of the power station and adjoining landfill comprise nearly 10 sq. kilometres of previously developed, and largely under-utilised, or derelict, land. There are four options for the future development of Didcot Power Station after the closure of Didcot 'A':

1 Do nothing. RWE npower, the owner of the power station, is a commercial enterprise. If HMG energy policy attracts commercial investment in the de-carbonising of the UK's energy market elsewhere, money will always run after the highest reasonable rate of return in a competitive market. The loss of Didcot 'A' would: reduce total UK grid standby capacity; place greater loads on generators located remote from Southern Central England; increase the risk of congestion on the grid, and increase long distance transmission losses with the associated loss of efficiency, and CAPEX and OPEX cost penalties.

2 Develop nuclear power. As the only existing major power station equidistant between the major conurbations around London, Southampton, Birmingham and Bristol, with a full range of existing strategic infrastructure services and transport connections, Didcot is uniquely well suited as a location for a large base load nuclear power station. This possibility was 'floated' by RWE npower a few years ago, and was then withdrawn in the face of concerted local and political opposition. Didcot is not on the current list of locations for nuclear power stations under the draft National Planning Statement on nuclear power.

3 Develop a conventional gas fired combined cycle gas turbine (CCGT) power station. This could be a profitable investment for RWE npower in the short-term, with known costs and returns, but would not the UK's growing dependence of imported gas, or to assist the de-carbonising of the UK's electricity supply. There would be uncertainty over the potential future investment requirement for the retro-fitting of carbon capture equipment.

4 Develop a multi-fuel carbon capture ready IGCC. Didcot is uniquely well suited as a location for an IGCC as it enjoys the benefit of both an existing coal supply infrastructure; a developing biomass supply infrastructure, and a large immediately adjoining waste disposal and landfill plant. The latter receives both local wastes, and wastes by rail from London, Bath and Bristol. IGCC with pre-combustion carbon capture is currently the most advanced and well-proven technology for carbon capture from fossil fuels.

The attached design scheme arose from a methodology based on an analysis of the molecular bonds in various waste streams, and the energy levels at which those bonds can be dissociated using the available forms of thermal waste processes. This approach led to the conclusion that the only technically and financially viable routes to a zero emissions Energy from Waste technology were:

- Anaerobic Digestion (AD) of clean 'wet' biological wastes, food, and the like.
- Plasma gasification of all other waste streams.

A study published in 2008 by Eunomia on behalf of the Greater London Authority (GLA) reached a similar conclusion by using whole life costing, including accounting for the social cost of carbon emissions. Mutual corroboration via different analytical methods is encouraging.

A number of different commercial plasma gasification processes are available. Several of these have the disadvantage that the plasma waste convertor consumes a large proportion of the electricity produced from the gasification process. The attached scheme is based on optimising the overall energy efficiency by minimising the mass input of 'tail pipe' wastes into the plasma waste convertor by maximising the removal of pollutants from the gas stream at the 'front end' of the process by the use of oxygen blown slagging gasification to capture pollutants in the inert vitrified slag aggregate produced by the gasifier.

Only one commercially and technically proven oxygen blown slagging gasifier exists for the co-gasification of solid mixed wastes, biomass and coal at industrial scale – the British Gas Lurgi slagging gasifier (BGL). This technology was fully developed and ready for commercialisation by 1985. The BGL gasifier has enjoyed the support at various times of the EU, UK and USA governments, but has not been developed consistently due to changes in energy and waste market policies. The BGL gasifier was used successfully at SVZ Schwarze Pumpe for the co-gasification of hazardous and non-hazardous wastes, biomass and coal to produce Syngas for power and Methanol. The BGL gasifier is now being developed by British engineers on a large scale in China for coal to liquid fuels, and is being manufactured in Taiwan. The ex-British Gas engineers who were responsible for the design and operation of BGL gasifiers at Westfield in Scotland, SVZ Schwarze Pumpe and the BGL plants in China, are still based at GLI Ltd in Loughborough and Envirotherm GmbH in Essen.

The last BGL gasifier in Europe was built in the late 1990's. Support for the BGL gasifier from HMG ceased around 2003. Building on the successful development of the BGL gasifier in China, and the emergence of the EU Zero Emissions Platform, I have been encouraging the businesses named below to attack the UK and EU markets for the co-gasification of wastes, biomass and coal, using the attached scheme at Didcot as the prototype for a modular multi-fuel Energy from Waste IGCC, with a minimum capacity of around 250 to 350,000 tonnes pa, up to a 5.0m tonnes pa co-generation based industrial complex.

Coal is the dominant solid hydrocarbon fuel worldwide. The market for gasifiers is driven primarily by coal interests. This has led to the predominance of pulverised coal entrained flow gasifiers. A 1.2GW multi-fuel IGCC is currently being developed at at nuon magnum at Buggenham in Holland. This, and the IGCC also being developed at Hatfield Colliery in Yorkshire, is based on the Shell pulverised fuel gasifier. The Shell gasifier can only support the gasification of a small proportion of pulverised biomass, and cannot, therefore, support the wider use of renewable fuels. The nuon magnum IGCC will achieve at best a fuel mix of 50% coal:10% renewables:40% Natural Gas.

The BGL gasifier was successfully demonstrated at SVZ Schwarze Pumpe to be capable of the stable gasification of a mixture of 80% renewables:20% coal. However, discussions with the engineers at SVZ suggest that a minimum of 30% coal, or other solid high carbon content fuel, is preferable in order to optimise the throughput of the BGL gasifier. The attached scheme at Didcot uses a lower proportion of renewable fuels. This is partly to give confidence to the operators of the power station, and partly to stay within the existing planning consents for the importation of wastes to the landfill site. Both the capacity for waste handling at Didcot, and the supply of wastes from London, Bath and Bristol, could support a higher proportion of renewables if some of the currently 'spare' coal importation consents at Didcot were to be re-used for the importation of wastes and biomass.

The plasma waste conversion plant developed by Tectronics Ltd initially in Oxfordshire, and now at Swindon, is well-documented, and has been supported by DTI, the Technology Strategy Board and Imperial College. In the attached scheme, the plasma plant is used for the vitrification of 'tail pipe' solid Air Pollution Control (APC) residues, running on a batch load basis on off peak power.

The final 'key' technology is the dual fuel CCGT developed by GE Energy. This uses multiple concentric injector dry can combustors and Nitrogen dilution to enable changes of fuel composition in use within acceptable Turbine Inlet Temperature and NO_x formation limiting criteria. The use of various 'fast start' and 'load following' methods ensures the maximum flexibility to respond profitably to varying market conditions on the grid with the minimum requirement for the maintenance of inefficient 'hot spinning' CCGT capacity, with associated carbon emissions.

The attached scheme is designed to maximise the benefits to be gained from the integration of these three 'key' proven technologies with conventional industrial process technologies with the opportunities provided by the unique combination of advantages provided by the conjunction of the power station and landfill sites.

Following the somewhat polarised debate over the last decade about the overall direction of UK energy policy, all the major UK political parties have signalled their support for the development of a mixed portfolio of energy resources, and sustainable power generation, consisting of: a diversified mix of nuclear, coal, gas and renewables, and a reduction in UK strategic dependence on imported gas. RWE npower has ruled out nuclear power at Didcot. The attached scheme will consume a mixture of diversified indigenous and imported coal, gas and renewable fuels, thereby complying with emerging UK energy policy. A combination of: the flexible multi-fuel capabilities of the BGL gasifier, Tetronics plasma waste convertor and the GE CCGT; the increasing availability of several different renewable waste and biomass fuels in Southern England; the possibility of importing biomass via Avonmouth Coal Dock, and the 'spare' rail transport capacity at Didcot Power Station and Sutton Courtenay landfill, will provide the operator with the flexibility to respond profitably to changing future market and regulatory conditions.

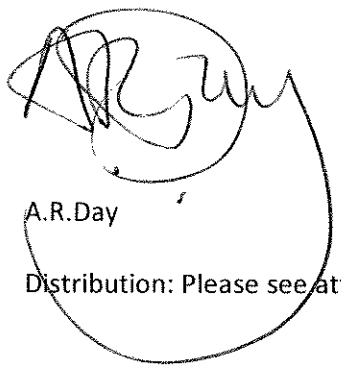
The operator of the landfill site is preparing a Planning application to develop a plant to process waste into Solid Refuse Derived Fuel (SRF). Defra supports the development of SRF schemes. This policy has its limitations, as SRF is a 'dirty' fuel with limited 'off take' opportunities. Defra has, via the WIDP waste PFI Round 4, identified Didcot 'A' Power Station as a major potential 'off take' for cross County border SRF disposal. This policy ignores the fact that Didcot 'A' will close within a few years. The attached scheme would comply with Defra policy, and have the benefit of ensuring a long-term zero emissions 'off take' for SRF from a variety of sources, including the adjoining landfill. The attached scheme will form a 'bridge' in time between the upcoming development of the landfill site, and the future re-development of the power station site.

The scheme has been developed by the writer with the benefit of policy, engineering and cost inputs from the following parties:

- Aker Solutions Ltd.
- Envirotherm GmbH
- GE Energy Corp.
- Germanischer Lloyd Industrial Ltd. (Formerly British Gas Technology)
- Kier Goup plc.
- RWE npower.
- Tetronics Ltd.
- Waste Recycling Group Ltd.

Engineers and managers from the above businesses have kindly provided their assistance in order to develope the attached cost benefit analysis to a sufficient degree of detail to provide reasonable confidence that the scheme is financially viable. My particular thanks go to Andy Williams of GLI for running numerous BGL gasifier solid fuel to Syngas simulations, largely in his own time. In order to progress the development of the scheme, a Front End Engineering and Design (FEED) study is now required. Please advise whether your organisation is able to assist with providing finance to support this development. Please acknowledge receipt of this letter to the above address.

Yours faithfully,



A.R.Day

Distribution: Please see attached list:

1 The Rt. Hon. E. Miliband MP
Ministerial Correspondence Unit,
Department for Energy and Climate Change,
3, Whitehall Place,
London,
SW1A 2AW.

2 The Rt. Hon. Lord Mandelson
Ministerial Correspondence Unit,
Department for Business Innovation and Skills,
1, Victoria Street,
London,
SW1H 0ET.

3 The Rt. Hon. Hilary Benn MP
Defra,
Nobel House,
17, Smith Square,
London,
SW1P 3JR.

4 Paul Leinster,
Chief Executive,
Environment Agency,
25th Floor,
Millbank Tower,
21/24, Millbank,
London,
SW1P 4XL.

5 The Rt. Hon. Charles Hendry MP.
6 The Rt. Hon. E. Vaizey MP.
7 The Rt. Hon. M. Wicks MP.
8 Lord Trefgarne.
House of Commons,
London,
SW1A 0AA.

9 Boris Johnson,
The Mayor of London,
Greater London Authority,
City Hall,
The Queens Walk,
London,
SE1 2AA.

10 Alistair Buchanan CBE,
Chief Executive Officer,
OFGEM,
9, Millbank,
London,
SW1P 3GE.

11 Lord Turner,
The Chairman,
Committee on Climate Change,
4th Floor,
Manning House,
22, Carlisle Place,
London,
SW1P 1JA.

12 Will Day
Chairman,
Sustainable Development Commission,
Room 101,
c/o 3 – 8, Whitehall Place,
London,
SW1A 2HH.

13 Sir Ian McAllister,
Chairman,
Carbon Trust,
6th Floor,
5, New Street Square,
London,
EC4A 3BF.

14 Jeff Chapman.
Chief Executive Officer,
Carbon Capture and Storage Association,
4th Floor,
Grosvenor Gardens House,
35 – 37, Grosvenor Gardens,
London,
SW1W 0BS.

15 Professor Jim Skea OBE.
Research Director,
UK Energy Research Centre,
Imperial College,
58, Princes Gate,
Exhibition Road,
London,
SW7 2PG.

16 The Editor,
The Times,
1, Virginia St,
London,
E98 1NW.

17 The Editor,
The Telegraph,
111, Buckingham Palace Road,
London,
SW1W 0DT.

18 The Editor,
Financial Times,
Number One,
Southwark Bridge,
London,
SE1 9HL.

19 The Editor,
The Guardian,
Kings Place,
90, York Way,
London,
N1 9GU.

20 The Editor,
The Independent,
2, Derry Street,
London,
W8 5EE.

21 John Tupper,
Managing Director,
IEA Clean Coal Centre,
Gemini House,
10 – 18, Putney Hill,
London,
SW15 6AA.

22 Dr. Graham Spittle,
Chairman,
Technology Strategy Board,
North Star House,
North Star Avenue,
Swindon,
SN2 1UE.

23 Jenny Maresh,
Chairman,
UK Climate Impacts Programme,
Oxford University Centre for the Environment,
Dyson Perrins Building,
South Parks Road,
Oxford,
OX1 3QY.

24 Professor John Patrick,
Chairman,
Coal Research Forum,
PO Box 154,
Cheltenham,
Gloucs,
GL52 5YL.

25 Dr. David Clarke,
Chief Executive Officer,
The Energies Technology Institute,
Holywell Building,
Holywell Park,
Loughborough,
LE11 3UZ.

26 Professor David Banister,
Acting Director,
The Environmental Change Institute,
University of Oxford,
School of Geography and the Environment,
South Parks Road,
Oxford,
OX1 3QY.

27 Barbara N. McKee
CSLF Secretariat,
U.S. Dept. of Energy,
FE-27,
1000, Independence Ave, S.W.
Washington, DC 20585,
U.S.A.

28 Gardiner Hill,
Vice Chair,
Advisory Council,
European Technology Platform for Zero Emissions Fossil Fuel Power Plants,
ZEP Secretariat,
Mauritskade 33,
2514 HD,
Den Haag,
Holland.

29 Johannes Lambertz,
Executive Committee,
European Technology Platform for Zero Emissions Fossil Fuel Power Plants,
ZEP Secretariat,
Mauritskade 33,
2514 HD,
Den Haag,
Holland.

30 Frederic Hauge,
President,
Bellona Europa,
Rue du Trone 61,
1050 Brussels,
Belgium.

31 Mr. N. Otter,
Chief Executive Officer,
Global Carbon Capture and Storage Institute,
GPO Box 828,
Canberra ACT 2601,
Australia.

32 Dr.-Ing. Jurgen Grossmann,
Chief Executive Officer,
RWE Group,
RWE AG,
Opernplatz 1,
45128 Essen,
Germany.

33 Volker Beckers,
Group Chief Executive Officer,
RWE npower plc,
Windmill Hill Business Park,
Whitehill Way,
Swindon,
Wilts,
SN5 6PB.

34 Kevin McCullough,
Chief Technical Officer,
RWE npower plc,
Windmill Hill Business Park,
Whitehill Way,
Swindon,
Wilts,
SN5 6PB.

35 Senor Falcones Jacquotot Baldomero,
Chief Executive Officer,
Fomento de Construcciones y Contratas,
Federico Salmon, 13,
28016 Madrid,
Spain.

36 Paul Taylor,
Chief Executive Officer,
Waste Recycling Group Ltd,
Ground Floor West,
900, Pavilion Drive,
Northampton Business Park,
Northampton,
NN4 7RG.

37 Pekka Paasivaara,
Germanischer Lloyd AG,
Steinhoft 9,
20459 Hamburg,
Germany.

38 Arthur Stoddart,
Chief Executive Officer,
GL industrial Services Ltd,
Holywell Park,
Loughborough,
Leics,
LE11 3GR.

39 Dr. Georg Daradimos,
Chairman,
Envirotherm GmbH,
Ruhrallee 185,
D – 45136,
Essen,
Germany.

40 Heinz Schimmelbusch
Chairman,
Allied Resource Corporation,
Building 200,
435, Devon Park Drive,
Wayne,
PA 10987,
U.S.A.

41 Jurgen Kremer
Chief Executive Officer,
Allied Resource Corporation,
Building 200,
435, Devon Park Drive,
Wayne,
PA 10987,
U.S.A.

42 Monsieur Jean-Pascal Tranie,
Aloe Environmental Fund,
34, Boulevard Malesherbes,
75008 Paris,
France.

43 Gavin Duke,
Aloe Private Equity,
Rosedale House,
Rosedale Road,
Richmond,
Surrey,
TW9 2SZ.

44 Stephen Davies,
Chief Executive Officer,
Tetronics Ltd,
A2, Marston Gate,
Stirling Road,
South Marston Business Park,
Swindon,
Wilts,
SN3 4DE.

45 Henry Lafferty,
InvestSelect plc,
Suite One,
Sackville St.
London,
W1S 3EJ.

46 The Managing Director,
GE Energy,
2, The Arena,
Downshire Way,
Bracknell,
Berks,
RG12 1PU.

47 Simon Lieungh,
Chief Executive Officer,
Aker Solutions ASA,
Aker Hus,
Snaroyveien 36,
1346 Fornebu,
PO Box 169,
N – 1325 Lysaker,
Norway.

48 Adrian Upton,
Director of Marketing,
Aker Solution ASA,
One Port Way,
Port Solent,
Portsmouth,
Hants,
PO6 4TZ.

49 Paul Sheffield,
Kier Group plc,
Tempsford Hall,
Sandy,
Beds,
SG19 2BD.

50 Nicholas Winser,
Kier Group plc,
Tempsford Hall,
Sandy,
Beds,
SG19 2BD.

51 Ian McChesney
ESD Biomass Ltd,
Overmoor Farm,
Neston,
Corsham,
Wilts,
SN13 9TZ.

52 Andrew MacFaul,
Consultation Coordinator,
Project Discovery,
OFGEM,
9, Millbank,
London,
SW1P 3GE.

53 Sir John Parker,
Chairman,
National Grid plc,
1 – 3, The Strand,
London,
WC2N 5EH,

54 Steve Holliday
Chief Executive Officer,
National Grid plc,
1 – 3, the Strand,
London,
WC2N 5EH.

55 Gaynor Hartnell,
Chief Executive Officer,
Renewable Energy Association,
7th Floor, Capital Tower,
91, Waterloo Road,
London,
SE1 8RT.

56 Dick Turner,
Chairman,
Bio-Energy Forum,
Renewable Energy Association,
7th Floor, Capital Tower,
91, Waterloo Road,
London,
SE1 8RT.

57 James M. Childress,
Executive Director,
Gasification Technologies Council,
4301, North Fairfax Drive,
Suite 300,
Arlington,
VA 22203,
U.S.A.

58 Professor Arthouros Zerros,
President,
Renewable Energy House,
Rue d'Arlon 63 – 67,
B – 1040, Brussels,
Belgium.

59 Claude Turmes MEP,
President,
European Forum for Renewable Energy Sources,
EUFORES Secretariat Brussels,
Renewable Energy House,
Rue d'Arlon 63 – 67,
B – 1040, Brussels,
Belgium.

60 Dirk Hazell,
Chief Executive Officer,
Environmental Services Association,
154, Buckingham Palace Road,
London,
SW1W 9TR.

61 Peter D. Ager,
Chairman Executive Committee,
Chartered Institute of Wastes Management,
9, Saxon Court,
St. Peters Gardens,
Marefair,
Northampton,
NN1 1SX.

62 Andy Holcroft,
Chief Executive Officer,
London Waste and Recycling Board,
City Hall,
Queens Walk,
London,
SE1 2AA.

63 Sir John Banham
Chairman,
Johnson Matthey plc,
40 – 42, Hatton Garden,
London,
EC1N 8EE.

64 Mr. Guy de Selliers,
Chairman of the Trustees,
21, John Adam Street,
London,
WC2N 6JG.

65 Philip Greenish CBE,
Chief Executive Officer,
Royal Academy of Engineering,
3, Carlton House Terrace,
London,
SW1Y 5DG.