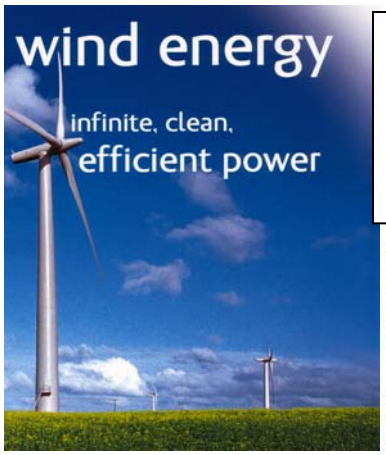
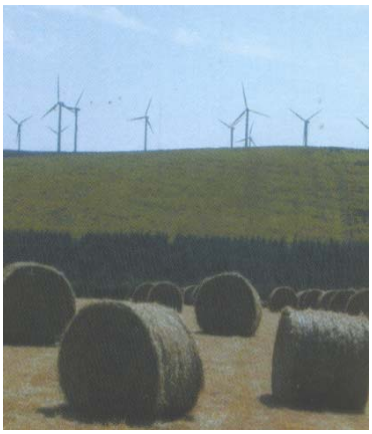
Hampshire Natural Resources Initiative

Hampshire County Council & Local Council's Resource Ownership Concept & Renewable Energy proposals for Major Development Areas (MDA's) in Hampshire





Your Energy
Our Future

ECO SECURITIES

Illustration of a Local Centre Gateway:
Based on the Option 2 layout

ATKINS West of Waterlooville Major Development Area : Masterplan Framework Options

7.4 Local Centre

The local centre is intended to act as a focal point for the new community. It is expected to provide a limited range of shops and services, including a small convenience store and community facilities, to serve the needs of residents of the MDA.

INTERNATIONAL MERCANTILE Group

International Agenda 21 Ltd

& IMGroup

Sustainable Development Consultants Renewable Energy

IMGroup :
London Offices: 35 Grovenor Square, London SW1.

Clean City

bp solar

Contents

1. EXECUTIVE SUMMARY

Hampshire County Council's Renewable Energy Resource Ownership is the concept recommended to the Hampshire Natural Resources Initiative (HNRI) as a means of the promotion of Renewable Energy project developments in the County of Hampshire and to create revenues streams back into County Environmental Strategy programmes.

No Blue Print exists for delivering Sustainable Development, however the Resource Ownership is seen as a possible contender for Sustainable Energy use in Hampshire County Communities.

In the South East of England there are currently fourteen schemes for delivering 38 GWh of Renewable Energy of Electricity and by 2010 the potential currently identified for exploitation is one hundred and forty schemes with Solar PV which could generate 2019 GWh. The potential Renewable Energy deployment by 2010 for Hampshire & the Isle of Wight - installed capacity is estimated as the following: Biomass Combustion up to 60MW, Biomass Anaerobic Digestion - 2.5 MW, Onshore Wind 49 MW and Solar PV set at 3.1 MW - Total deployment being 115 MW by 2010.

It is proposed that HCC establish a Limited energy company - possibly called Hampshire Energy Ltd. This company could obtain funding from International Mercantile Group Ltd (IMGroup) in order to develop and own Renewable Energy Technologies such as: WIND Turbines, Solar Photovoltaic's, Energy Crop Energy Plants fuelled from Miscanthus Grass and Coppiced Willow.

The reasons for HCC to Own Renewable Energy Resources are four-fold: a) Compliance with the EU - Renewable Energy Directive which sets out a 10% gross electricity consumption & production by 2010, b) to comply with and promote the HCC Structure plan policies E3-E5, c) to control Renewable Energy Developments in the County and d) obtain long-term financial revenues from the Renewable Energy Technologies.

The Sustainable Energy programme example of Woking Council and the work of Allan Jones from 1992 onwards has resulted in Energy consumption savings of 43.8% (170,170,665 KWh), Carbon Dioxide Emission Savings of 1.5% (96,588 Tonnes).

Woking and more recently Essex County Council have set a precedence for other Councils to follow as the Council has established an Energy Company called Thameswey, which has been funded by Dutch Pension funds. It is once more recommended to HCC to establish a similar Energy Company - to be funded from UK funds arranged by IMGroup.

The HNRI have formed a Renewable Energy Consortium of over twenty eight Environmental Based companies who can come to the aid of HCC and all other Councils in the County and offer Renewable Energy Technologies, Sustainable Development products and services together with Private financial packages.

The HCC Structure plan indicates for between 1996 - 2011 a Baseline Housing development in the Major Development Areas (MDA's) of 80,290 homes and a Reserve provision for a further 14,000 homes in the period between 2001 - 2011. It is proposed that each of these new homes should have Solar PV & Hot Water systems, Renewable Energy supplied by Wind Turbines, Energy Crops fuelled by Miscanthus Grass & Coppiced Willow. As a result of the HNRI Energy Network development since it's launch in September 2001 twenty Farmers in the North of Hampshire have expressed keen interest in the HNRI programme and wish to grow mainly Miscanthus & some Coppiced Willow and it may be possible to supply RAF ODIUM with this Renewable Energy supply with the Gasification Energy Plant on Land owned by Robert Benfold - a local Landowner and Farmer.

The introduction of Renewable Energy Technologies and Energy Efficiency measures into the Havant Borough Council Ecohome development in New Lane resulted in an additional cost of 10% over and above that for normal build dwellings.

A further recommendation is made that developers of the MDA's should consider using Recycled Construction Waste, SoilBind products for Roads and Pathways which could result in savings in costs and aggregates between 40% & 60%.

Case Studies of Renewable Energy projects indicate project costs of £12,880,000 for an 11MW Biomass Energy Plant and a payback period of 3.8 years is possible indicated by project two case study. Case study Six the EYE Energy Limited project indicates a possible structure plan for HCC to adopt in any ownership establishment.

The Waterlooville MDA will see the development of over 2,000 homes - the average wind speed in the area is between 4 & 5 m per s and a case study seen indicates revenues to be expected from a wind farm in Scotland - Spurnes - Orkneys. This project indicates a Cumulative nominal cash flow over 25 years of £38,603,000 and a payback period of between 4 & 7 years.

Hampshire County Council Resource Ownership

1.1 HNRI - Concept:

(i) International Agenda 21 Ltd & HNRI – Renewable Energy consortium member companies would like to propose to Hampshire County Council (HCC) and Hampshire Natural Resources Initiative (HNRI) that HCC and all Councils in Hampshire Consider Owning Renewable Energy Resources within their boundaries of Authority.

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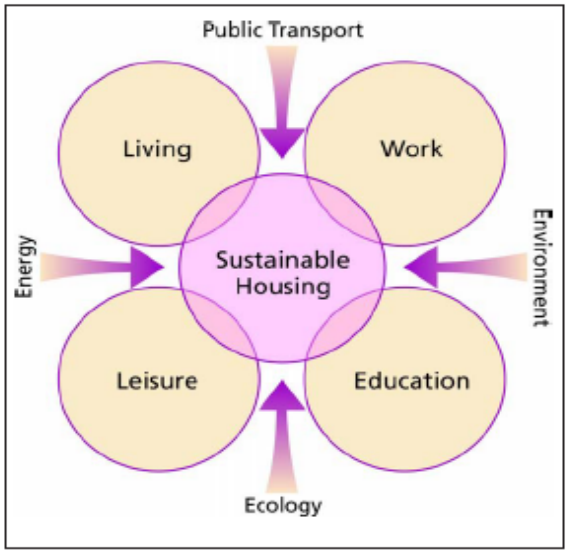
(ii) HCC & HNRI & each respective Council consider the financial aid that can be given to them from the IMGroup with reference to Renewable Energy Project funding provision. This will enable the respective Councils to ensure that each Major Development Area (MDA) within their boundary can be provided with the funds to incorporate Solar PV & Solar Hot Water systems, Wind Turbines, Biomass & Energy Crop - Energy Plants and District Heating within the MDA's.

Renewable Energy Resources under consideration are as follows:

Solar
Biomass
Wind
Energy from Waste

FIGURE 2.1
Key Relationships in Sustainable Housing



Governance

There is no one blue-print for delivering Sustainable Development. It requires different strategies in different societies. But all strategies will depend on effective, participative systems of governance and institutions, engaging the interest, creativity and energy of all citizens. We must therefore celebrate diversity, practice tolerance and respect. However, good governance is a two-way process.

We should all take responsibility for promoting Sustainability in our own lives and for engaging with others to secure more sustainable outcomes in society.

The following four tables & diagrams were obtained from the South East England Regional Assembly publication:

“Harnessing the Elements”

MAY 2003 - Supporting Statement to the Proposed Alterations to Regional Planning

Guidance, South East – Energy Efficiency and Renewable Energy

In order for Hampshire County Council (HCC) and the Hampshire Natural Resources Initiative (HNRI)

To consider “Ownership of Renewable Energy Resources” existing and potential total Renewable Energy available for Electricity Generation is depicted in table one.

1.2 Regional Potential for Renewable Energy Generation by 2010

Table 1.1

Regional Potential for Generation of Electricity from Renewable Energy Sources by 2010

Renewable Energy Type/ Indicative Size	Existing Situation			Prospective Total by 2010[24]		
	No. Schemes	Capacity (MW)	Output (GWh[25])	No. Schemes	Capacity (MW)	Output (GWh)
Large CHP / Electricity Plants Fuelled by Biomass Waste/Residues and Energy Crops (15+MW)	0	0	0	5	75	562.5
Small CHP Plants Fuelled by Biomass Waste/Residues and Energy Crops (5-10MW)	0	0	0	5	35	262.5
Anaerobic Digestion Fuelled by Farm Waste, Sewage and/or Biomass Waste (0.5MW)	7	4.4	37.4	36	12	102
Offshore Wind Farms (50-75MW; 20-30 Turbines)	0	0	0	3-4	200	640
Wind Farms (50-75MW; 20-30 Turbines)	0	0	0	1	50	429
Small Wind Clusters (6MW; 4-10 Turbines)	0	0	0	16	96	
Single Large Wind Turbines (1.5MW)	1	1	n/a	16	24	
Single Small Wind Turbines/Chargers (0.03 MW)	2	0.55	0	50	1.5	4
Small-Scale Hydro Power (0.1MW)	0	0	0	5	0.8	3.7
Domestic PV Installations (1.5-3kWp)	4	0.005	n/a	3200	8.4	15.3
Commercial PV Installations (50kWp)				105	5.3	
Motorway PV Installations (160kWp/km)				20	1.6	
Total	**14**	**6**	**38**	**140 + PV**	**510**	**2019**
Landfill Gas[26]	26	54	405	51	108	809

FOOTNOTES

[24] *The categories of technology type and size shown are indicative. In practice the nature and size of actual schemes may differ. In particular, there may opportunities for biomass at scales smaller than those shown.*

[25] *GWh = Gigawatt-hour. A unit of energy used to show how much energy is actually generated from a scheme (1GWh = 1000MWh = 1,000,000kWh). 1MWh is the amount of electrical energy generated by a 1MW generator running at full output for one hour.*

[26] *Landfill gas is not considered to be a renewable source by the Regional Assembly and is excluded from the targets in the proposed amendment to RPG9 (see paragraph 2.41). However, landfill gas was included in the assessment of potential conducted by AEA Technology and FPD Savills.*

1.3 Hampshire & Isle of Wight Potential for Renewable Energy Deployment

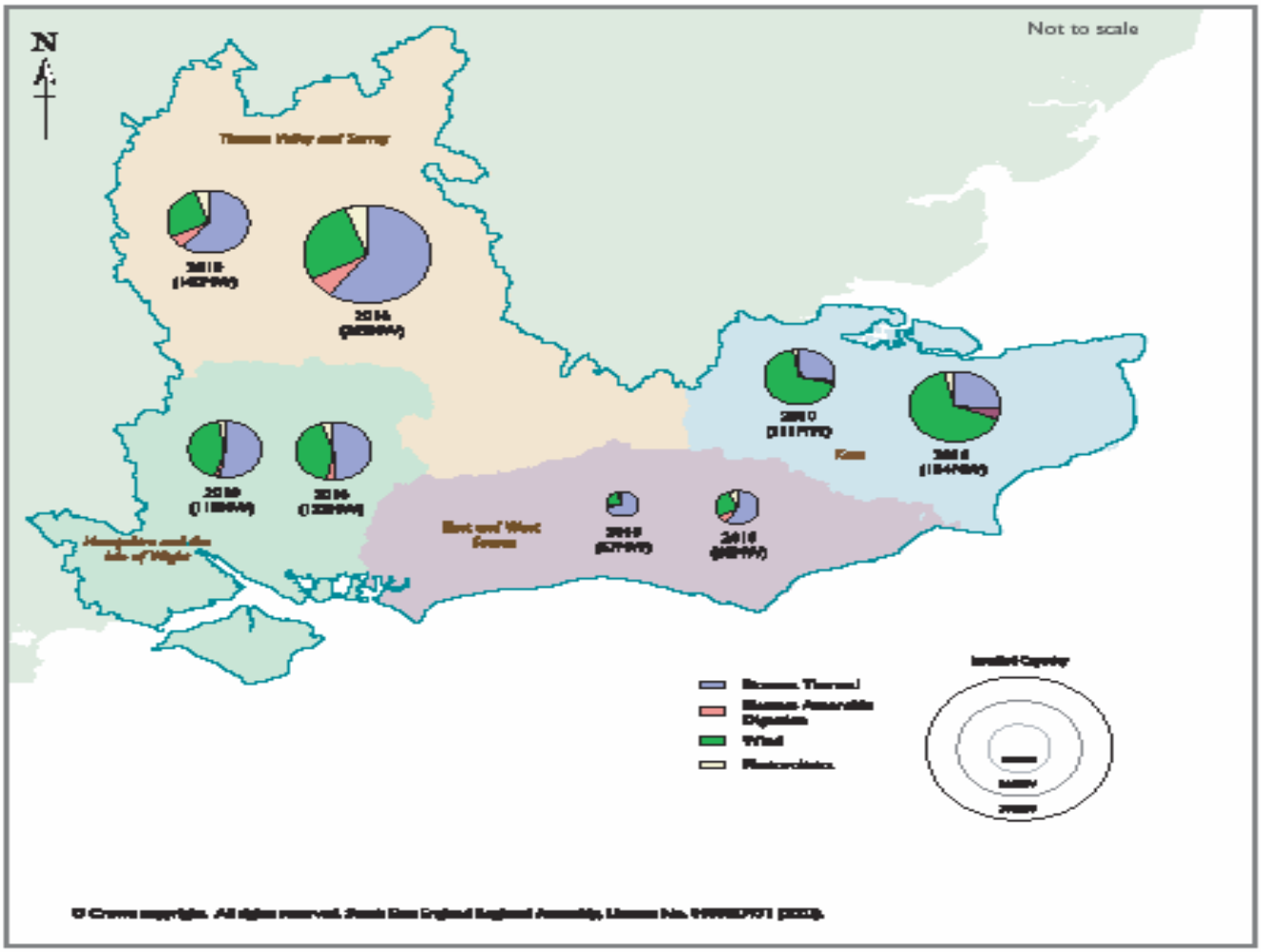
Table 1.2: Hampshire & Isle of Wight Potential Renewable Energy Deployment by 2010 and 2016

Hampshire and Isle of Wight

3.54 Potential renewable energy deployment by 2010 and 2016 (MW):

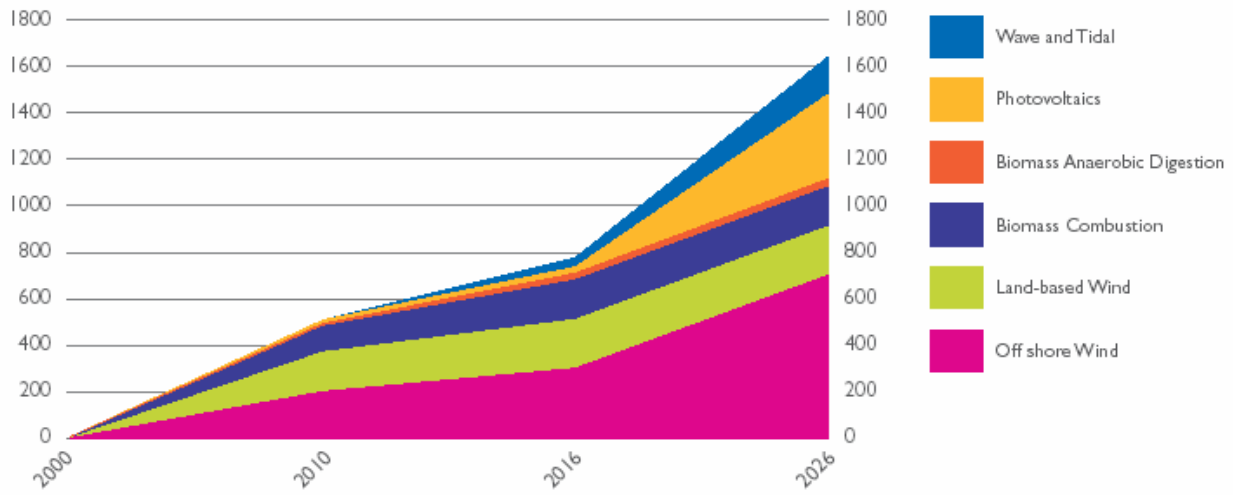
	Biomass Combustion/ Thermal	Biomass Anaerobic Digestion	Onshore wind	PV	Total
Installed Capacity (MW)					
2010	up to 60	2.5	49	3.1	115
2016	up to 60	4.5	52	5.6	122

Table 1.3: Sub Regional Land Based Renewable Energy Potential 2010 - 2016



1.4 Potential – Major Technologies to Regional Renewable Energy Generation

Table 1.4:
Indicative Potential Contribution by major Technologies to Regional renewable Energy Electricity Generation



Note – Excludes the contribution from landfill gas which was included in the assessment of potential undertaken by AEA Technology and FPD Savills for the Regional Assembly.

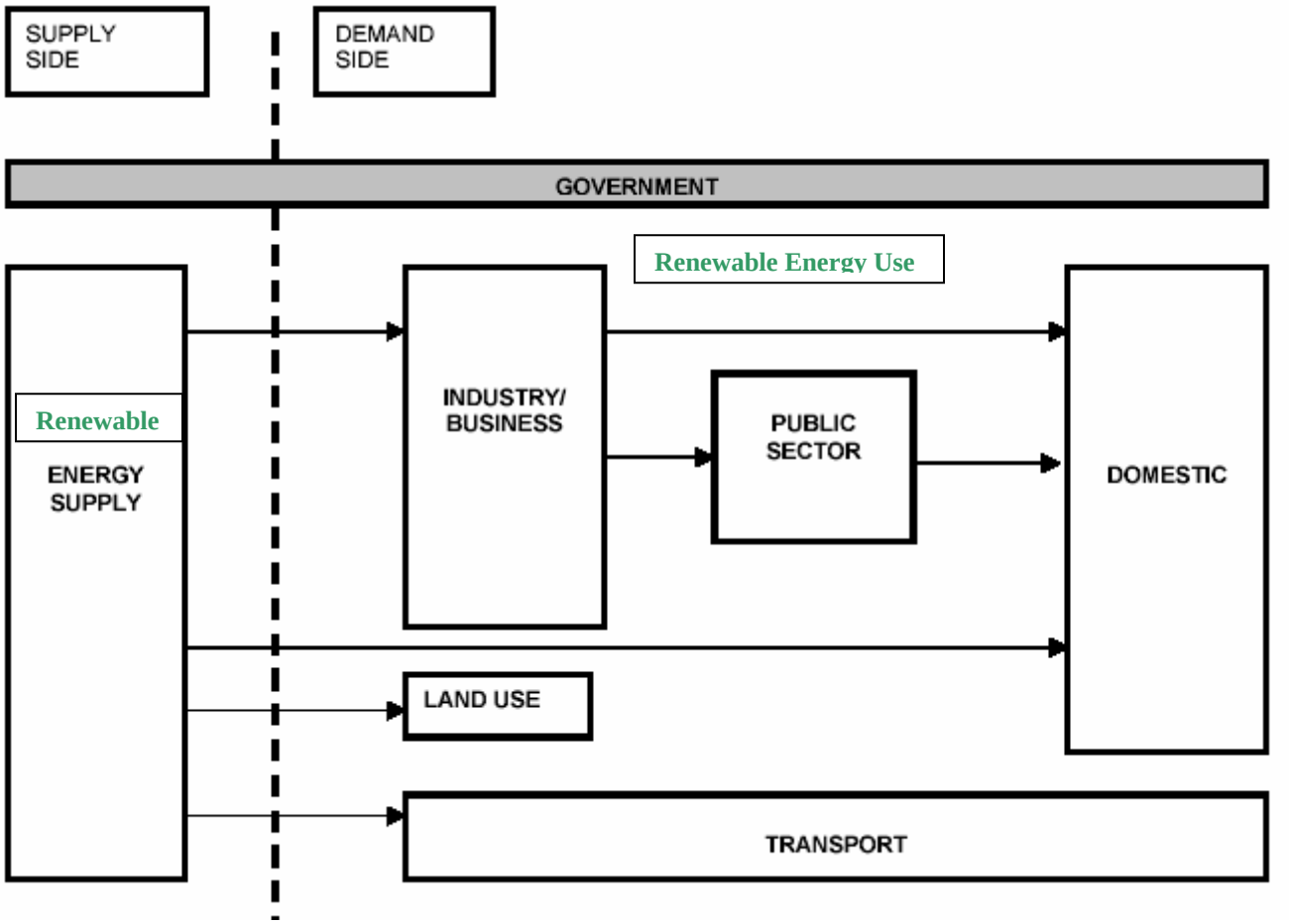
FOOTNOTES

[23] *Advice from AEAT Future Energy Solutions (February 2003). Estimates of electricity output from current power stations in the South East and from renewable energy technology mixes proposed in regional targets to 2010, 2016, 2026.*

1.5 Energy Supply & Demand Diagramme

Hampshire County Council and each of the Council's in Hampshire could decide to follow the recent example of Essex County Council & Woking Borough Council in planning and promoting the establishment of Ownership of Resources and Generating Electricity & Heat for it's own use and for that of it's communities.

ECCM
The EDINBURGH CENTRE *for* CARBON MANAGEMENT Ltd



Adapted from:

Policy Audit of
UK Climate Change Policies and Programmes

Report to the
Sustainable Development Commission

JANUARY 2003

1.6 Power Generation, Growth, Energy Demand and CO2 Emissions

Table 1.6 :Power Generation Growth, Energy Demand and CO_2 Emissions
Source: Cambridge Econometrics and EP68

Power generation	January 1997			EP68 (2000)						July 2002		
				CL		CH						
Consumption growth % pa, 2000-10	1.2			1.2		0.8				0.8		
	2000	2005	2010	2000		2005		2010		2000	2005	2010
				CL	CH	CL	CH	CL	CH			
Generation, TWh	386.6	401.0	425.6	345	343	370	360	390	371	389.2	403.0	405.0
of which %												
Coal	25.3	23.7	16.0	30.4	30.3	14.6	26.7	9.7	22.4	26.3	23.4	21.4
Oil (plus other CE02)	2.2	1.8	0.5	0.3	0.3	0	0	0	0	9.5	7.7	7.5
Gas (non-CHP CE02)	41.3	46.7	63.0	38.8	38.5	53.0	39.4	60.5	46.6	30.2	31.5	34.1
CHP	na	na	na	na	na	na	na	na	na	6.0	6.8	10.4
Nuclear	24.1	20.4	13.2	23.2	23.3	23.2	23.9	16.9	17.8	21.9	22.4	14.3
Renewables (non-CHP CE02)	2.9	3.3	3.4	3.2	3.2	5.9	6.1	11.0	11.1	2.6	5.6	9.8
Imports	4.2	4.1	3.9	4.3	4.7	3.2	3.6	1.8	2.2	3.7	2.7	2.6
CO_2 emissions, mtc	40.8	42.8	43.9	40.5	40.0	33.5	38.0	33.5	37.6	41.7	40.1	40.9
% compared to 1990	-25.0	-21.3	-19.3	-25.1	-26.1	-38.1	-30.0	-38.1	-30.5	-23.0	-25.6	-25.0
of which												
Coal	20.7	20.2	14.4							26.0	23.3	22.4
Oil	2.6	2.1	0.6							0.7	0.8	0.9
Gas	17.5	20.5	28.9							14.8	15.8	17.4

Source	Carbon Abatement cost (£/tC), 2020		Potential contribution to carbon abatement (MtC)
	Minimum	Maximum	
Domestic EE	-300	50	15
Business EE	-80: -260	30:50	13
Transport EE	Not clear		14
CHP	-630:-190	-110:110	4
Renewables	-80: 520	50:1250	12
Nuclear	70	200	7
Sequestration	80	280	small

Table 1.7 Projected marginal costs of emission abatement

[16] See the various technical papers underpinning the Climate Change Programme (DEFRA, 2000).

Table 1.8
Effective Carbon price from Fiscal Measures

Fiscal Measure	Cost	Effective Carbon Price (£/tCO_2)
CCL electricity	0.43p/kWh	9.96[17] (& recycled)
CCL gas	0.15p/kWh	7.90 (& recycled)
CCL coal use	1.17p/kg	5.15 (& recycled)
Renewable Obligation Buy Out Price	Up to 3p/kWh	Up to ~70
Vehicle Fuel Duty (ULSD Petrol/Diesel)[18]	45.82p/litre	158[19]
Biodiesel	25.82p/litre	198[20]
JET A fuel	0p/litre	0

Tables 1.6, 1.7 & 1.8 from the Report – Edinburgh Centre for Carbon Management Ltd to the Sustainable Development Commission JANUARY 2003

Clearly the above tables have indicated the availability of Renewable Energy in the County of Hampshire and the S/E of England.

The HNRI Energy Network consortium currently formed to aid both Hampshire County Council and Hampshire Natural resources Initiative has within it's membership several technologies:;

1. **Solar**
2. **Wind**
3. **Gasification & Incineration plants**
4. **Resource Recycling Centres**
5. **Construction waste plants**

If the above technologies were to be adopted by HCC & HNRI together with all other Council's in Hampshire

2. WHY should the Council consider Ownership of Resources?

Consider the following in the case for Resource Ownership:

2.1 EU Policy -COMPLIANCE WITH THE RENEWABLE ENERGY DIRECTIVE 2001/77/EC

Article 3 - National Indicative Targets

Targets

The UK's indicative target under the Directive is set at 10% gross electricity consumption by 2010 (national electricity production, including auto-production, plus imports minus exports). The British Government has set a target of 10% electricity eligible for the Renewables Obligation to be supplied by 2010**.**

2.2 The following section was taken from the current HCC Structure Plan

Energy

The location and design of new development should take account of the opportunities to reduce energy consumption and maximise energy efficiency. Development for renewable energy is encouraged, subject to its impact on the landscape and on areas of ecological, cultural, scientific, historical and archaeological significance.

Policies E3 - E5 Energy

319. The **production** and **consumption** of energy is a vital part of the daily life of all Hampshire residents. Currently most energy needs are met through the burning of fossil fuels, either coal, gas or oil, the great majority of which is currently imported to the county. A by-product of burning these fuels is the production of carbon dioxide and other gases.

320. A rise in the level of carbon dioxide in the earth's atmosphere is, together with rising concentrations of other gases, contributing to the increase in average global temperatures on the earth's surface. There are also health concerns, such as the rising incidence of asthma.

321. Planning policies can contribute towards the long-term reduction of energy consumption by locating new development closer to the people it serves and where it can use existing and planned future infrastructure, including public transport.

E3 When considering development proposals and in the preparation of local plans, local planning authorities will take into account the contribution that the relationship between land uses and transportation can make to reducing the demand for energy.

322. One of the most significant uses of energy is travel by the private motor vehicle. By locating new development close to trip-generating uses, and to public transport routes, movements by foot, cycle and public transport should be encouraged, which should lead to a decline in the growth of the number of private car movements, thus reducing the growth in demand for energy.

323. The implementation of measures to meet modal split targets within integrated transport strategies and transport plans associated with development proposals can contribute towards reducing energy use.

E4 In considering the sitting, design, layout and orientation of new development, local planning authorities will take account of the need to maximise energy efficiency.

324. Minimising the energy needs of buildings is an important way of reducing the consumption of energy. The energy efficiency qualities of a development will be a material consideration for local planning authorities in determining a planning application.

E5 In considering proposals for energy generation from renewable sources, which make a material contribution towards meeting Hampshire's energy needs, particular attention will be paid to:

(i) the immediate and wider impact of the proposed development on the landscape;

(ii) the need to protect features and areas of natural beauty, and sites of ecological, cultural, scientific, historical and archaeological significance;

(iii) the measures that would be taken, both during and after construction, to

(iv) the local and wider benefits that the proposal might bring.

325. Renewable energy is defined as energy generated from naturally regenerating sources - from the sun, wind, oceans, plants and water. It also includes energy available from wastes and from within the earth.

326. The authorities support the Government's policy to **stimulate the development of new and renewable energy sources** wherever they have prospects of being economically attractive and environmentally acceptable in order to contribute to:

- **secure and sustainable energy supplies;**
- **a reduction in the emission of pollutants; and**
- **the encouragement of internationally competitive industries.**

327. **New and renewable energy sources can potentially contribute to energy needs in a significant way. Renewable energy sources offer the hope of increasing diversity and security of supply and of reducing harmful emissions to the environment. The best opportunities for renewable energy projects currently lie with energy from waste, biomass (including short rotation coppicing), sewage sludge and small-scale wind schemes.**

328. There are, however, local environmental consequences for all renewable projects, which must be weighed against the national interest of producing clean energy. Proposals for developing renewable energy sources will therefore need to consider the immediate impact of such projects on the local environment while having regard to Government policy and to the fact that renewable energy schemes can have particular locational constraints (since, in many cases, the resource can only be harnessed where it occurs).

"After considering the above Structure Plan and the related advise given to the use and promotion of Renewable Energy developments in Hampshire then the recommendation is made that HCC, HNRI & all other Councils in Hampshire develop Renewable Energy projects as suggested in this report.

Hampshire Energy Ltd (HEL) could be an Energy and Environmental Services Company or EESCO wholly owned by Hampshire County Council which enters into public/private joint ventures with other Councils and member companies of the HNRI consortium to deliver its energy and environmental strategies and targets (primarily green energy, tackling fuel poverty, water, waste and green transport). Local authority grids and the Memorandum of Articles and Articles of Association of the EESCO could enables Hampshire Energy Ltd., to participate in energy services projects both inside and outside the county of Hampshire.

Ownership of resources will enable a controlled Sustainable Development of Renewable Energy projects in Hampshire and enable both environmental gains to be made in reducing the impact of the County on Climate Change and also provide a significant financial revenue streams to be utilised for the progression of HCC & HNRI and other Council's Environmental Strategy programmes."

2.3 WOKING BOROUGH COUNCIL: LOCAL SUSTAINABLE COMMUNITY ENERGY

by Allan Jones MBE IEng., FIIE
Energy Services Manager, Woking Borough Council

WOKING: LOCAL SUSTAINABLE ENERGY COMMUNITIES

In order for Hampshire County Council & the HNRI to understand the principals of Ownership and the advantages of generating their own electricity & heat the following paper summarises a practical strategy for a sustainable energy society deriving its initial energy needs from energy efficient low carbon energy resources whilst at the same time establishing a sustainable community energy infrastructure to enable future energy needs to be derived from wholly renewable energy resources via a hydrogen economy within the Royal Commission on Environmental Pollution[1] timescales to reduce CO_2 emissions by 60% by 2050 and by 80% by 2100. These concepts can be applied to any community in the UK or indeed in the world.

Woking Borough Council, like International Agenda 21 Ltd & the IMGroup with its unique experience and expertise in local sustainable community energy systems has been able to tease out the real issues and barriers to a sustainable energy future through the actual implementation of such systems, including sustainable and renewable energy systems, fuel cell technology and low carbon transport systems.

2.4 WOKING: ENERGY SERVICES FOR THE NEW MILLENNIUM

Background

Woking Borough Council has implemented a series of sustainable energy projects in the past 11 years, including the UK's first small-scale combined heat and power (CHP)/heat
fired absorption chiller system, first local authority private wire residential CHP systems,
largest domestic photovoltaic/CHP installations, first local sustainable community energy
systems, first fuel cell CHP system and first public/private joint venture Energy Services Company or ESCO.

The Council is recognized as the most energy efficient local authority in the UK having already achieved an average National Home

Energy Rating of NHER 8.13 towards it's target to improve the energy efficiency of the Council's own public sector housing stock to

NHER 9 as well as maintaining accreditation under the Institute of Energy's Energy Efficiency Accreditation Scheme since 1995.

In recognition of this pioneering work the Council gained the **Queen's Award for**
Enterprise: Sustainable Development 2001 in respect of its Energy Services
activities in the development of Local Sustainable Community Energy Systems, the only local authority ever to receive a Queen's Award for Enterprise.

2.5 Summary of Energy, Environmental and Financial Savings

Since the Council implemented it's energy efficiency and environmental policies in 1990/91 (the base year), it achieved it's target to reduce energy consumption by 40% in

1. Royal Commission on Environmental Pollution's Report: Energy – The Changing Climate – June 2000.

10 years from 1991/92 and 2000/2001, as follows:-

Energy Consumption Savings	***170,170,665 kWh***	***43.8% Saving***
Carbon Dioxide CO_2 Emissions Savings	***96,588 Tonnes***	***71.5% Saving***
Nitrogen Oxides NO_x Emissions Savings	***319.1 Tonnes***	***68.0% Saving***
Sulphur Dioxide SO_2 Savings	***976.6 Tonnes***	***73.4% Saving***
Water Consumption Savings	***340,011,000 Litres***	***43.8% Saving***
Savings in Energy and Water Budgets	***£4,889,501***	***34.3% Saving***

The above savings are for corporate property and housing stock, where the Council pays the energy and water bills, and exclude Council tenant and private sector savings brought about by the Council's Housing energy conservation and CHP/renewable energy programmes.

The Council's innovative energy efficiency recycling fund, where financial savings achieved by energy and water efficiency projects are ploughed back into the capital fund creating an ongoing recycled capital fund (ESCO finance model) has led to a total investment of **£2.7M** over the previous 11 years from the original capital fund of **£0.25M** established in 1990/91 which has enabled savings of nearly **£4.9M** over the same period to be made resulting in current annual savings of over **£885,000 a year**.

2.6 Climate Change Strategy

In December 2002, the Council's energy efficiency policy was replaced by the Climate Change Strategy for Woking, not just for Council buildings and transport but for the Borough as a whole, shifting the focus from savings in kWh's of energy to savings in tonnes of CO_2 as well as adapting to a changing climate. The key three principles of the Strategy are:-

- ***Adopting an overall target to reduce Woking's CO_2 equivalent emissions to 80% of its 1990 level by 2090 in steps of 10% up to 2050 and 5% from 2050 to 2090;***
- ***Adopting the concept of an Environmental Footprint for the Borough which has as its base 1,060,000 tonnes of CO_2 equivalent emissions of greenhouse gases; and***
- ***Declaring itself Climate Neutral and setting up a Climate Change Fund.***

As part of a number of action plans the Strategy adopts targets for purchasing 20% of the Council's electrical energy requirements from renewable sources and 100% of the Council's electrical and thermal energy requirements from sustainable energy (including CHP) sources by 2010/11.

By 2001/02 the Council had already reduced CO_2 equivalent emissions by 8.01% of the whole of the Borough's CO_2 emissions in 1990 through its own actions alone.

2.7 Home Energy Conservation Act

The Council's achievement against its Home Energy Conservation Act target from 1 April 1996 to 31 March 2002, was as follows:-

Energy Efficiency Savings Achieved ***643,919 GJ pa Saving-178,866,690 kWh pa savings***

Reduction in CO_2 Emissions Achieved ***66,806 Tonnes pa Saving***

Improvement in Energy Efficiency Achieved ***18.97%***

1.5 Innovative Projects

Innovative projects implemented by the Council include:

(i) The first small-scale CHP/heat fired absorption chiller system in the UK which provides heating, hot water services, air conditioning and electricity to the Civic Offices without the use of CFC's, HCFC's or HFC's as water is used as the refrigerant. As the absorption chiller is in effect a heat load this has the effect of increasing the base heat load available to the CHP unit all year round leading to increased energy savings.

(ii) The Thameswey Condensing Boiler Scheme offers a condensing boiler for the same or lower price than a conventional boiler with an exclusive further discount of at least £50, as part of an energy conservation package to householders. A joint public/private partnership was established with British Gas to run the scheme which has since been extended to 14 other local authorities. Entry to the scheme costs the participating Council £150 plus an annual fee of £150 with scheme publicity and marketing material being provided at cost + 15%, and will incorporate the participating Council's name and logo. Councils also receive HECA data for use in their annual HECA reports.

(iii) The Council installed the first (and still the only) local authority private wire residential combined heat and power and renewable energy systems in the UK to provide heating, hot water services and electricity directly to it's sheltered housing residents. The savings for residents have been substantial reducing residents total energy bills to only 6% to 7% of state pension income, well within the Government's affordable warmth criteria of 10% of income for heating only. The Council now has 7 private wire residential CHP schemes and is committed to implementing one new CHP scheme a year.

(iv) Woking, with the support of the Energy Saving Trust, incorporated in 1999 the UK's first Energy and Environmental Services Company or EESCO called Thameswey Ltd., and Thameswey Energy Ltd., a public/private joint venture Energy Services Company or ESCO. Again, like the condensing boiler scheme Thameswey will be able to provide energy services to other local authorities, public bodies and the private sector both within and outside Woking to enable green energy projects to be implemented in their area to serve their buildings directly with green energy.

(v) Thameswey Energy Ltd., completed the first phase of the first sustainable community energy system in the UK in Woking Town Centre, comprising combined heat and power, thermal storage and absorption cooling with heat, chilled water and HV/LV private wire networks serving the Civic Offices, two hotels (including a new 161 bedroom Holiday Inn Hotel), conference and events centre, leisure complex and bowling alley, nightclub and multi-storey car park. The HNRI Consortium of Environmental companies could provide a similar service to HCC & the HNRI together with the thirteen other Councils in Hampshire.

The application of the mixed green technologies achieves a 130% sustainability in electricity which enables island generation to be provided making the buildings connected to the system self sufficient in electricity and able to be provided with energy services in the event of an external power cut for prolonged periods. The surplus electricity is exported to other Council sites, including sheltered housing with the potential to pass on affordable energy benefits to more residents in addition to those residents already served by private wire residential CHP.

(vi) The first integrated CHP and photovoltaics system in the UK comprising photovoltaic roof and CHP system at Brockhill. The reverse winter/summer electricity profile has the potential to achieve 100% sustainability in electricity.

(vii) The first fuel cell CHP system in the UK at Woking Park providing heating, cooling and electricity to a swimming pool and leisure complex. Hydrogen is chemically reformed from natural gas and oxygen is extracted directly from outside air to fuel the fuel cell. Due to the electrochemical process virtually no harmful pollutants are produced and 100% pure water is produced as a by product.

2.8 TACKLING FUEL POVERTY

Benefits for Social Tenants

The Council has the most energy efficient public sector stock in the UK with an average energy efficiency rating of NHER 8 being part way through to achieving its target of NHER 9. Most of the traditional energy conservation measures have already been installed with most of the effort now concentrated on external wall insulation (as part of overcladding planned preventative maintenance works) and private wire residential CHP and renewable energy systems to provide affordable heating to all Council tenants, where the Council provides heating, by 2010/11.

2.9 Benefits for Fuel Poor Households

Although the greatly increased energy conservation grants and the inclusion of heating for low income over-60's, chronically sick and the disabled in the New HEES (Warm Front) are to be welcomed there are some fuel poor households that now fall outside the eligibility criteria for New HEES/New HEES Plus.

In developing its fuel poverty strategy the Council recognised that some fuel poor households in the private sector needed top measures over and above the old HEES maximum grants to provide them with full energy conservation measures (eg., draughtproofing, cavity wall and loft insulation) which it funded through SRB for Sheerwater and Maybury and the CRI for the remainder of the Borough up to 1999/2000. The Council has included further funding in its HIP for 2000/01 to 2005/06 to address top up measures to Warm Front and for fuel poor households that fall outside of Warm Front, taking advantage of EESoP, EEC and other grants where it can to tackle fuel poverty in the Borough.

Out of 32,500 private sector households in Woking, over 10,000 households have so far taken advantage of the Council's energy conservation schemes from 1996 to 2002, of which nearly 3,000 households have been provided with grant aided energy conservation scheme grants to provide full insulation measures.

2.10 THAMESWEY ESCO - SUSTAINABLE ENERGY SYSTEM

Introduction

As part of the DETR funded Energy Saving Trust ESCO Programme, the Council obtained leading counsel's opinion on local authority vires with respect to forming or participating in ESCO's. The outcome of this work was the formation of the UK's first EESCO and ESCO, called Thameswey, to take forward the innovative and unique green energy services concept that Woking Borough Council had so successfully employed over the last 10 years at a small-scale level using local authority finance to a large-scale level using primarily private finance. The Council owns the intellectual property in Thameswey and the Thameswey registered trademarks. In the case of Hampshire this Energy Company might well be called Hampshire Energy Ltd.

Thameswey Ltd., is an Energy and Environmental Services Company or EESCO wholly owned by Woking Borough Council which enters into public/private joint ventures to deliver its energy and environmental strategies and targets (primarily green energy, tackling fuel poverty, water, waste and green transport). The local authority vires and the Memorandum of Articles and Articles of Association of the EESCO enables Thameswey Ltd., to participate in energy services projects both inside and outside the Borough of Woking. Thameswey Energy Ltd., is a public/private joint venture Energy Services Company or ESCO between Thameswey Ltd., and ESCO International A/S owned by Miljo-Sam Holding APS. Miljo-Sam Holding APS is owned by Pen-Sam (a Danish pension fund) and Hedeselskab who also own Hedeselskabet Miljo og Energi A/S, a Danish green energy company. Projects are financed with shareholding capital and private finance with project development carried out jointly between the Council and Hedeselskabet Miljo og Energi A/S who also own DDH Contractors UK Ltd., who act as the turnkey contractor on large scale district energy schemes. Hedeselskab is a foundation committed to environmental projects whose patron is Her Majesty Queen Margare the II of Denmark.

In the Case of Hampshire Energy Ltd being formed then the funding of the Renewable Energy projects could result from the funders associated with International Mercantile Group Ltd (IMGroup).

The formation of Thameswey has so far enabled the Council to increase its embedded generation capacity by 750%.

Thameswey is not an energy supplier but an energy services provider. The production and use of energy and their cost implications involves several things, including the cost of new or replacement primary energy plant (boilers and chillers), their eventual replacement in say 15 to 20 years time, the related inflation, consultancy and financing costs, their maintenance and the consumption of energy.

2.11 Energy Services Concept

The energy services concept is not the provision of electricity and gas but the services that energy provides, ie., heating, cooling, lighting, power, etc., and intrinsically includes the primary energy plant. Thameswey approach to energy services is to use the customer's own brown energy costs (including their primary energy plant costs) to calculate and provide them with a green energy services proposal in place of their brown energy supplies. Green energy is more expensive than brown energy because of the higher cost of the plant but Thameswey is able to provide green energy services for similar costs as brown energy services for most customers through the payback on the green energy plant by the sale of heating, cooling and electricity directly to the customer.

Thameswey provides a potential customer with a breakdown on how this is worked out. The normal approach is for Thameswey to match a customer's current electricity unit price and to assimilate the energy services costs into the heat and chilled water unit prices. The customer's electricity consumption will be reduced since electricity will no longer be needed to generate cooling and where residential customers or small to medium enterprises are provided with energy services by Thameswey savings can be achieved against their brown energy suppliers. The energy services prices agreed at the commencement of the long term contract are indexed linked annually so the customer maintains the benefits of the contract throughout the length of the contract.

There are further benefits to the customer in that there is a transfer of risk from the customer to Thameswey of the primary energy plant. Thameswey will be responsible for the design and implementation of the plant, inflation, financing, maintenance, etc., as well as the green energy and stand by and top up supplies which offers customers further security of supply. There is also the additional benefit of 'green kudos' by being a customer of Thameswey, particularly if a customer's site becomes a catalyst for a local sustainable community energy system serving the local community. This may or may not be of importance to an organisation but many companies, organisations and residents are beginning to recognise not only the importance of environmental performance but also symbiosis with the local community who are after all customers or potential customers (in some shape or form) of the companies or organisations concerned and these customers are becoming increasingly environmentally aware.

2.12 Thameswey

Thameswey as a concept could be drawn upon by the HNRI & HCC and the green energy services that it offers is unique being based on the Council's own innovative green energy projects, including CHP, absorption cooling, renewables and private wire or grid. The advantage to customers is that they actually receive a green energy supply as well as exemption from the Climate Change Levy through their requirement for heat and/or cooling, not some 'notional' green electricity that can never reach them plus the transfer of risk from the customer to Thameswey of the primary energy plant.

Instead of the customer being responsible for their own primary energy plant Thameswey provides its own primary green energy plant which takes into account the customer's capital cost of replacement or new plant as well as the maintenance costs, consultancy fees, inflation and financing costs. This is the difference between an energy services contract and an energy contract since energy services contracts take all of these other factors into account.

2.13 Thameswey Sustainable Energy System

Energy services contracts are long term contracts since the costs of providing, maintaining and eventually replacing plant has to be financed from the payback of providing the energy services which will be at Thameswey's risk. Thameswey would become a customer's energy services supplier providing electricity, heating and cooling (where applicable) plus being responsible for primary energy plant instead of just gas and electricity from the utilities. All plant will be green energy plant:-

CHP - Combined heat and power recovers the heat as well as generates electricity providing efficiencies of up to 90% instead of the central power stations/national grid system which can be as little as 22% efficient at the point of use as most of the energy in the form of thermal energy is wasted through power station cooling towers, electricity losses through the grid transmission and distribution systems and the inefficiencies of separate boiler heating systems. Conventional brown energy systems in the UK wastes more energy than the entire North Sea annual gas output, enough energy to heat every home in the country. The worldwide waste of energy arising from central power stations/national grids is about the same as the total amount of energy consumed by the global transport sector[2].

In the UK, the Regulator – the Office of Gas and Electricity Markets) Ofgem) estimates that nearly $1billion worth of electricity is lost each year in the UK distribution networks alone[3].

CHP is connected to the local distribution network to provide standby and top as well as spill export of electricity. All CHP is designed to comply with the CHPQA scheme to achieve Climate Change Levy exemption.

Absorption Cooling - Chilled water is generated by hot water through a process of absorption at very low pressure which causes the water to boil at 2^{o}C. Heat is provided by the CHP and green electricity is therefore generated from the requirement for cooling as well as heat. No CFC's, HCFC's or HFC's are used as water is used as a refrigerant in a sealed system. Absorption cooling is unaffected by the Montreal Protocol or the EC CFC Phase Out Programme so the occupants of a customer's buildings can feel particularly 'green' as well as more comfortable.

Private Wire - Private wire or Grid enables green electricity to be sold directly to customers rather than exporting the electricity to the grid and incurring unnecessary use of systems and losses charges since under the laws of physics electricity will always flow the nearest load, ie., the local community. Woking is unique in that it is the only local authority in the UK to sell electricity as well as heat to local residents on its CHP/renewable energy private wire sustainable energy networks.

New and Renewable Energy - Woking's Thameswey concept enables these technologies to be much more commercially viable than they would otherwise be but they will still require a capital or revenue top up from the customer if they want to be particularly green and in many cases this top up may be cheaper than voluntarily paying extra for a 'green electricity tariff' whose 'green electricity' can never reach the customer. Thameswey's approach is much better since a green customer can actually enable a green project to happen and to directly serve their own buildings. If a customer is interested in new and renewable energy technologies such as photovoltaics or the fuel cell CHP in Woking Park, this can also be supplied.

2. World Alliance of Decentralized Energy (WADE) – 1 November 2002.
3. International Power Generation – February 2003.

2.14 Green Air Conditioning/Refrigeration

The energy services proposal would cover absorption cooling deriving its heat input from the CHP or district heating network but not the provision of absorption chillers or the provision or conversion of a customer's air handling or refrigeration plant since there will be no payback. However, customers can be provided with a price for any new or conversion of air conditioning/refrigeration systems which can be paid for as a capital sum or added to a customer's energy services prices, whichever a customer prefers.

2.15 Local Sustainable Energy Systems

If other associated sites can also be brought onto the green energy supply network a local sustainable community energy system could be developed which would further enhance a customer's environmental/Local Agenda 21 agenda and green kudos. This would be of particular benefit to new housing and commercial developments where the impact on the local community and the environment of such new developments can be offset or even eliminated by the new development acting as a catalyst to a local community energy system displacing conventional, inefficient and polluting brown energy systems.

2.16 WOKING TOWN CENTRE CHP - PHASE 1

Introduction

The buildings connected to Phase 1 of the sustainable community energy network comprise the Civic Offices, Victoria Way Car Park (where the CHP station is located), a new 4 star 161 bedroom Holiday Inn Hotel (with no boiler or chiller plant, since the hotel derives its energy services from the CHP station), the Metro Hotel, the Big Apple (Bowling and Diner), Chameleon Bar, Quakes Nightclub and the HG Wells Conference and Events Centre. Surplus power is exported to other local buildings and sheltered housing over public wires via an enabling agreement for exempt supplier operation which also receives the benefit of exemption from the Climate Change Levy. The project was supported with an Energy Saving Trust grant.

The CHP system in Woking Town Centre will be developed organically taking a distributed embedded generation approach.

Project Description

The installation utilises distributed CHP, large scale thermal storage, heat fired absorption cooling, standby and top up boilers and 11kV/400V private wire, heat and chilled water distributed energy system networks. All buildings are interconnected with heat mains and high voltage/low voltage private wire networks with a single connection point to the local distribution network at the CHP station.

As an exempt generator/distributor/supplier the ESCO is able to achieve the true value of green energy by selling the electricity (as well as heat and chilled water) directly to customers on the network rather than to a licensed supplier. This approach enables the ESCO to increase its income to fund the investment whilst at the same time providing competitive electricity to customers by cutting out high transmission/ distribution losses and use of system charges.

The combination of the green technologies connected to the sustainable community energy system (with reverse winter/summer thermal profiles) enables the CHP to be much bigger than conventional CHP achieving 135% minimum sustainability in electricity (ie., makes the site self sustainable in electricity with a minimum of 35% available as export off site over public wires to other local customers). This sustainability also enables island generation to be provided so that the buildings connected to the system can be supplied at full load in the event of a failure in the grid which is very attractive to customers, particularly in the event of a prolonged external power cut, egg., the 1987 Hurricane and the 2000/01 flooding, when buildings on the network can continue in operation for as long as a gas supply is available.

The surplus CHP power is exported over public wires under an enabling agreement for exempt supplier operation to other Council buildings to reduce the Authority’s exposure to the Climate Change Levy, giving real meaning to the efficiency and attractiveness of CHP, and to some local residents but as the system grows other local businesses and residential customers will be supplied in this way within the limitations (and barriers to green energy and local competitive supply) of the Exempt Licensing regime.

This project is the first sustainable community energy system, operating in a competitive energy market, of its type in the world and has important implications for future sustainability and how to supply local green energy rather than outdated inefficient national energy systems which have no future in a declining fossil fuel world.

2.17 WOKING PARK - FUEL CELL CHP

Introduction

The sponsors of the project are the Department of Trade and Industry (DTI), Adventism Technologies Ltd (formerly BG plc), the Energy Saving Trust and the US Department of Defence (via the US Department of Energy) under the USA Climate Change Program with the balance of funding being provided by the host organisation Woking Borough Council via the Council's innovative Thameswey Energy and Environmental Services initiative.

How the Hydrogen Fuel Cell Works

The principle of hydrogen fuel cells (**www.utcfuelcells.com/fuelcell/how_fl.shtml**) was first demonstrated by a British scientist and judge Sir William Grove in 1839. He discovered a relatively straightforward electro-chemical process where hydrogen and oxygen interact within a cell to generate electricity and heat.

The fuel cell contains an anode and a cathode with an electrolyte sandwiched between them, separating the two. Hydrogen is supplied into the anode and oxygen into the cathode. The two gases want to join but are prevented from doing so by the electrolyte which causes the hydrogen to split into a proton and an electron. The proton passes freely through the electrolyte whilst the electron is forced to take a different route around it, creating an electric current before re-combining with the proton to make hydrogen again and combining with oxygen through a catalyst, creating a molecule of water.

There are several different types of fuel cell that work on this principle, each using a different material for the electrolyte (alkaline, phosphoric acid, molten carbonate, solid oxide and proton exchange membrane or solid polymer). Each operates at a different temperature and is suitable for a different application for stationary or portable power or transport.

Since Grove's experiments, the technology has been developed intermittently facing opposition from the prevailing Hydrocarbon Economy, and it was not until the 1960's space programme that fuel cells were used in a real practical environment. UTC International Fuel Cells (who make the alkaline fuel cells for the NASA Space Programme) produced the first commercial stationary phosphoric acid fuel cells in the early 1990's and more recently other manufacturers have produced commercial fuel cells for the emerging residential CHP and transport markets.

Project Description

The cost of the fuel cell CHP was diluted by integrating the project into a larger green energy project as part of the Thameswey concept to demonstrate how such technologies can be implemented in the deregulated energy market in the UK.

The project comprises a 200kW$_e$ fuel cell CHP, together with reciprocating engine CHP, existing 150 kW$_e$ CHP, solar shading photovoltaic systems, heat fired absorption cooling and large scale thermal storage located in Woking Park interconnected together by heat and chilled water mains and private wire.

The quad generation fuel cell CHP system was commissioned on 21 December 2001 and supplies low grade heat to the hot water services system and high grade heat to the district heating systems and chilled water to cooling and air conditioning systems via the heat fired absorption chillers, electricity and 100% pure water via a water recovery system. The high grade heat is recovered twice, once through the high grade heat circuit and again through the low grade heat circuit supplementing the low grade heat.

As water from a fuel cell has never been recovered and utilised as a water supply in this way before (other than in spacecraft) the recovered clean exhaust water will be subject to testing prior to utilisation. Some of the generated water is utilised to cool the fuel cell but approximately 1,000,000 litres of surplus 100% pure water will be generated each year demonstrating that the sustainable water resources attributes of fuel cells may be as, if not more, important than the sustainable energy attributes of fuel cells.

The combined system will not only meet the energy demands of Woking Park but also generate surplus electricity which will be exported to other Council sites to mitigate the authority's exposure to the Climate Change Levy but in conjunction with other Thameswey CHP projects in Woking Town Centre and elsewhere be supplied to local sheltered housing residents and businesses under the Exempt Licensing regime to maximise income but still supply cheaper green energy to the local community demonstrating how such integrated green technologies can be made commercially viable.

Sir William Grove Statue/Technology Information/Sponsorship Display

In commemoration of the fuel cell as a British invention a statue to Sir William Grove ('Father of the Fuel Cell') was erected in the Grove Garden adjacent to the fuel cell CHP. The Grove artist was Ulli Knall.

The fuel cell CHP is visible to the public and is provided with a technology information mural/display and viewing area for education purposes which includes the history of the fuel cell, how the system works in Woking Park and how renewable energy can be integrated with the Hydrogen Economy to provide continuous renewable energy for the world's electrical, thermal and transport energy needs. The official biography for Sir William Grove, sponsored by the World Fuel Cell Council and the Royal Institution of Great Britain, is also included in the display.

Associated DTI Monitoring Project

Another DTI supported project is tracking the project from beginning to end, including the original conception, planning, development, procurement, financing and installation, as well as the subsequent operation and maintenance. This monitoring should provide industry with detailed information on how such technologies can be successfully implemented. In essence, how Woking, as the most energy efficient local authority in the UK, achieves project 'firsts' through the monitoring of one specific project which is in itself another project 'first'. This project has important implications not just for the implementation of the UK's first fuel cell CHP but also how the UK's leading local authority in energy efficiency can achieve such project 'firsts' and how other local authorities and private sector organisations can learn from the way Woking does things.

The associated DTI monitoring project is being carried out by Advantica Technologies Ltd., with specific research and reporting being carried out by Professor Martin Fry. The Phase 1 report is due to be published in 2003.

Further Hydrogen Projects

Further hydrogen projects are being considered or planned in the Borough, including RHEBaTE – a Renewable Hydrogen Energy for the Built and Transport Environment scheme based on large scale photovoltaics/hydrogen generation via electrolysers and hydrogen fuel cell transport and SWERVE - a Sustainable Waste to Energy Recycling Versatile Envirosystem scheme based on anaerobic digestion/gasification plant and molten carbonate fuel cell technology.

2.18 DOMESTIC CHP

Residential CHP

Woking Borough Council is the only local authority in the UK with experience in supplying both heat and electricity from CHP/renewable energy directly to residents. The Council has gained valuable experience not only in the profiling and embedded generation back up systems for residential CHP but also with trading and other non technical issues. The smallest CHP used by the Council so far is 15kW_e (as part of a 45kW_e modular CHP system) and the smallest private wire local community energy system is supplied by a 22kW_e CHP shortly to be integrated with a 67.7kW_p photovoltaic roof system this year to achieve an electrical as well as a thermal embedded generation balance.

The Council is interested in both Stirling engine and fuel cell domestic CHP and has exchanged confidentiality agreements with suppliers of both technologies. However, the approach to and the utilisation of these technologies will be different for a number of reasons leading to different applications for public and private sector housing.

Public Sector Domestic CHP

Local authorities with their own housing stock, in common with other social and private landlords, are legally required to carry out annual gas safety inspections and servicing on gas fired boilers. Not only are the maintenance and whole life cycle costs per dwelling for individual gas fired boilers more expensive than the costs per dwelling for community heating boilers, individual boiler systems also incur additional costs and resources in overcoming the lack of access or refusal to access to carry out the annual gas safety inspections/boiler servicing.

Access problems can amount to typically 10% of the housing stock each year, depending on the nature of the community concerned. In Woking's case access problems have been reduced by incorporating several access visits at different times and by out of hours appointments but there is still a rump access problem that has to be dealt with by the Council exercising its legal authority as a landlord to avoid the risk of prosecution through failing to comply with annual gas safety inspection legislation.

One of the Council's policy objectives for community energy is to replace individual boilers with community heating or energy systems so that the maintenance and life cycle costs are reduced and the access problems and costs eliminated. Domestic CHP by its nature would replicate the problem of individual boilers for social and private landlords so is unlikely to be used on Council housing.

Private Sector Domestic CHP

Domestic CHP for owner/occupiers would be supported and encouraged by the Council as part of its Home Energy Conservation Act activities. In a place like Woking where 90% of the housing stock is in the private sector domestic CHP has by far the greatest potential and could make a significant contribution to the Council's annual energy conservation target. In support of these activities the Council may well develop a Thameswey Domestic CHP Scheme similar to its Thameswey Condensing Boiler Scheme for private sector homes when domestic CHP becomes commercially available. Thameswey may also consider an ESCO type approach to domestic CHP if the domestic export metering issues can be resolved.

Domestic CHP Technologies

The two domestic CHP technologies that the Council is considering are Stirling engines and fuel cells. The former because of its base load application and potential for trickle heating for private sector housing and the latter because of its fuel cell stack flexibility to enable bespoke designs not for individual domestic CHP but for small scale private wire residential community energy systems for both public and private sector housing. Domestic fuel cell CHP is particularly attractive for ESCO projects providing the manufacturers design their systems not as stand alone individual boxed systems but as stackable systems with flexible enclosure designs.

2.19 BRIGHTON CHP – NEW ENGLAND QUARTER DEVELOPMENT

Sustainable Energy Development

Thameswey Ltd., is working with a number of local authorities and developers on projects outside the Borough of Woking and the first of these projects has been granted planning permission subject to conditions. The New England Quarter Development comprises a mixed development of residential, food store, hotels, students accommodation and other community facilities and will be the first local sustainable community energy system for a completely new development in the world.

The new system incorporates large scale CHP, thermal storage and a private wire district energy network delivering distributed heat and power to buildings with local heat fired absorption chillers for air conditioning and refrigeration. The complete system, to be developed over 3 years, will see a reduction of 24,650 tonnes of equivalent carbon dioxide CO_2 emissions pa than the project would have otherwise produced with a conventional centralised grid supply system, demonstrating the significant environmental benefits of distributed embedded generation.

2.20 RENEWABLE ENERGY

Introduction

Although generally too expensive to implement as a stand-alone technology on conventional payback criteria without grant support or subsidy renewable energy is included in the Thameswey EESCO concept where dilution economics and the advantages of private wire technology can be applied by integrating renewable energy with sustainable green technologies such as CHP, as applied to the photovoltaics for the Woking Park - Fuel Cell CHP project. The cost of renewable energy technologies should reduce in time, particularly if there is increased activity in this area by way of integrated green technology best practice.

Off-Grid Photovoltaics

The Council implemented 14 off-grid photovoltaic pay and display machines in Woking Town Centre in 1997 demonstrating that off-grid photovoltaics was more economical both in capital and running cost terms than conventional grid connected pay and display machines just by simply including the cost of grid connection with the tender for the supply and installation rather than carrying out these two activities separately. The alternative off-grid photovoltaic system was cheaper both in capital and running cost terms when the high cost of grid connection is taken into account, even in a highly urbanised town centre location. The off-grid photovoltaic system with solar batteries has not failed once in the last 5 years compared to several grid supply interruptions to other street furniture in the same period.

Following the success of this project the Council has implemented further off-grid photovoltaic pay and display machines in other parts of the Borough and is also in the process of developing an intelligent off-grid photovoltaic/wind turbine street lighting system with a renewable energy manufacturer to provide continuous night-time illumination, even during the darkest months of winter, for a rural footpath scheme.

Integrated CHP and Photovoltaics

The Council has installed the largest domestic photovoltaic systems in the UK and the first such system integrated with CHP on private wire networks. Woking now has the largest concentration of solar energy photovoltaics in the UK amounting to $0.5MW_p$ with plans to increase this still further to over $1MW_p$. These systems are unique in that they do not dump their electricity into the grid but supply customers directly on private wire networks extracting the true value of green energy.

Further photovoltaic projects are planned, including the Victoria Way Multi-Storey Car Park photovoltaic roof system interconnected to the Woking District Energy Station private wire system as phase 1 of a proposed zero emission transport system.

Biomass CHP

Biomass CHP is being evaluated for the utilisation of biomass products and the sustainability of providing energy to local communities.

A Sustainable Waste to Energy Recycling Versatile Envirosystem (SWERVE) scheme based on anaerobic digestion/gasification plant and molten carbonate fuel cell technology is also planned for the Borough as part of the Council's Waste Management Strategy.

The SWERVE research and demonstration project will combine source and central waste separation, materials recovery facility, anaerobic digestion (for the organic waste stream), gasification (for the non recyclable inorganic waste stream) and molten carbonate fuel cell technology generating combustion free energy by an electro-chemical process. This approach should achieve a recycling rate in excess of 66% and reduce the residual element of waste to landfill to some 2% to 10% of its original weight.

2.21 GREEN TRANSPORT

Transport Strategy

The Council's transport strategy is part of the Climate Change Strategy for Woking and includes:-

- Setting improved standards for taxi and private hire vehicles licensed to operate in the Borough incorporating a low carbon strategy to be achieved by 2010/11;
- Revising the Council's Transport Plan with a view to all Council owned vehicles, lease cars and cars used on Council business being low carbon vehicles by 2010/11;
- Promoting the use of low carbon vehicles and introducing from April 2004 a carbon offset charge for the use of the Council's car parks and the hypothecation of the carbon offset charge to the Climate Change Fund;
- Promotional campaign with fuel station operators in the Borough to encourage the provision of alternative fuels (LPG, LNG, CNG, hybrid, hydrogen) at local filling stations;
- Promotional campaign through Council publications to raise awareness of alternative fuel vehicles.

Natural Gas Vehicles

The Council replaced its diesel refuse fleet with liquified natural gas (LNG) vehicles as part of its new waste management contract in 2000 (www.lng-cng.com/lng/woking.htm). The LNG station is not connected to the gas grid demonstrating that an alternative fuel transport fleet can be operated independently of a grid infrastructure and how a future hydrogen transport system can be developed, particularly for these large niche markets. The natural successor to the Council's LNG refuse fleet on completion of the waste management contract would be a hydrogen refuse fleet in the Council's drive to further reduce CO_2 emissions.

Further Council vehicle contracts have been let for alternative fuelled vehicles, primarily based on liquefied petroleum gas (LPG) vehicles, to comply with the Council's Climate Change Strategy for Woking.

Liquified Petroleum Gas (LPG) and hybrid LPG/petrol vehicles that comply with the Council's emission standards will also be permitted under the proposed taxi and private hire vehicles licensing scheme.

Electric Vehicles

A solar electric vehicle scheme is included in the Council's Energy Services Service Plan but may be overtaken by a hydrogen vehicle scheme, depending on the availability of hydrogen vehicles.

Electric/petrol hybrid vehicles that comply with the Council's Emission standards will also be permitted under the Council's transport strategy.

2.22 WATER

Water Efficiency

The Council has implemented a range of water conservation and efficiency measures, including cistern dams, tap regulators, flow controls, waterless urinals, water recycling, etc., run in conjunction with the energy efficiency programme reducing its water consumption by 43.8% over 10 years.

Waterless Urinals

Conventional urinals use an automatic flushing system using expensively produced potable or drinking water. Each urinal uses 9 litres of water per flush and flushes 4 times per hour consuming 25,000 litres of water a month. This water cannot properly treat the malodour connected with urinals caused by bacteria growth in the salts deposited from water which causes scale build up requiring regular treatment and maintenance.

Waterless urinals use a low cost replaceable fragrant bactericidal detergent rod, pad or cartridge, which is replaced as part of the normal cleaning regime instead of using water for flushing. 100% savings in water consumption is achieved as well as savings in scale treatment and pipe maintenance. Waterless urinals are installed in the Civic Offices, Pool In The Park, Leisure Centre and various other Council buildings.

Pool In The Park Re-circulation of Water

Conventional swimming pools chemically treat and heat mains water, circulate the treated water in the pool and then backwash the water to the sewerage drains. Backwashing is necessary to remove contaminants and can be performed several times a day depending on the number of people using the pool.

In Woking's Pool In The Park 50% of the cooling water is returned back to the break tank and 50% back to the balance tank instead of automatically backwashing to drain. The recovered water is then diluted with the incoming mains water and treated and heated again to the water quality requirements of the swimming pool saving both water and energy.

Water Conservation in the Private Sector

In addition to the various water efficiency technologies installed in its own buildings the Council has sold 1,540 subsidised home water butts to the Borough's residents.

Woking Park Fuel Cell CHP – Water Recovery

When Woking Park's – Fuel Cell CHP water recovery system is completed, approximately 1,000,000 litres of 100% pure water will be generated every year as the clean exhaust of the fuel cell CHP. Once tested and certified the water will be evaluated for utilisation in the swimming pool complex or Woking Park but may well have a greater value as pure water in the drinks or pure water industries.

Water Recovery

To achieve its sustainable water resources objectives it will be necessary to employ the Thameswey concept for major water recovery schemes if the Council can find a suitable private sector partner. The first phase of a water recovery project in Woking Park, where the Council has three swimming pools and a large leisure complex, is in the course of development in conjunction with a water ponds project.

2.23 WASTE AND RECYCLING

Background

The Council recycled 17.2% of household waste in 2001/2002. The Council has 29 mini and 3 major recycling centres throughout the Borough. Each site has a range of facilities for the recycling of colour separated glass, newspapers and magazines, drinks cans and textiles. In addition, the major recycling sites have facilities for the collection of plastic bottles, books and cardboard and facilities for the collection of aluminium foil have been introduced at 7 sites and oil banks have been introduced at 3 sites. The Council also operates a kerbside collection recycling system and has sold 10,200 subsidised home composting units to residents.

The Government's recycling target for Woking is 26% by 2003/04 and 36% by 2005/06. In order to achieve a higher recycling rate and significant reduction of waste disposed to landfill the Council undertook a holistic review of reduction, recycling and recovery for both household and commercial waste regardless of who currently collects and disposes of the waste.

Waste Management Strategy

The Waste Management Strategy was approved by the Council in December 2002 with a view to reducing the requirement for landfill to less than 15% of its original weight in the context of the Council's Climate Change Strategy incorporating the following:

- A Zero Waste Strategy of 'an active programme of education and information to prevent the creation of waste;
- Complimentary action to minimise the levels of waste with a view to stemming the annual increase;
- Recycling the non organic materials where environmentally advantageous and where viable markets exist;
- Recycling the organic material through anaerobic digestion for use as compost;
- Reducing the volume of residual waste through gasification and promoting the re-use of the resultant material in the construction industry;
- Recovering energy where possible through combined heat and power thereby using it in the most environmentally advantageous way;
- A 'first stage' public consultation exercise to be undertaken in respect of the Zero Waste Strategy.

In determining the Strategy NGO's (including Friends of the Earth, Green peace, National Society for Clean Air, Forum for the Future, Green Alliance, etc), political parties (including the four main political parties, The Green Party and European Union), local regional and government regional offices (including Surrey County Council, Woking Local Agenda 21 and the Greater London Authority), the media (including The Times, The Guardian, The Telegraph, Washington Post, etc), think tanks (including The Institute of Fiscal Studies, etc) and commercial organisations/trade associations(including Thames Waste Management, Department of Health, Environmental Services Association, etc) were consulted. A number of issues, including the application of fuel cell technology, arising from the consultation exercise have been incorporated into the Strategy.

One of the first phases of the Strategy will be to implement a twin alternate weekly collection pilot scheme in six areas of the Borough, commencing in June 2003.

Sustainable Waste to Energy Recycling Versatile Envirosystem

The SWERVE research and demonstration project will combine source and central waste separation, materials recovery facility, anaerobic digestion (for the organic waste stream), gasification (for the non recycable inorganic waste stream) and molten carbonate fuel cell technology generating combustion free energy by an electro-chemical process. This approach should achieve a recycling rate in excess of 66% and reduce the residual element of waste to landfill to some 2% to 10% of its original weight.

2.24 LOCAL SUSTAINABLE COMMUNITY ENERGY SYSTEMS

Sustainable Energy

Sustainable energy is anything that enables energy supplies to be made sustainable, either now or in the future, by putting in place such energy systems or infrastructures necessary to achieve a renewable energy future. A prime example of this is combined heat and power where the fuel may initially be a low carbon fuel such as natural gas which can be replaced later by a renewable fuel such as biogas, biomass or even hydrogen as used in fuel cells. The important issue here is the heat, chilled water and private wire networks serving buildings on local sustainable community energy systems which enables the easy replacement or refueling of the primary energy generators some time in the future when fossil fuels become scarce or non-existent. Combined heat and power is particularly important since 70% of the UK's non transport energy needs are thermal and most renewable energy technologies are intermittent electricity generation only.

Climate Change

The Royal Commission on Environmental Pollution study of energy and the environment commenced in August 1997 and culminated in the publication of its report 'Energy – The Changing Climate'. The main implication of the study was that atmospheric carbon dioxide CO_2 concentration of 550 parts per million by volume (ppmv) should be regarded as a limit which should not be exceeded if the risks of catastrophic alterations in the Earth's climate is to be avoided. The current concentration is some 370 ppmv. For the UK, an international agreement along these lines which prevented carbon dioxide CO_2 concentrations in the atmosphere from exceeding 550 ppmv and achieved convergence by 2050 could imply a reduction of 60% from current annual carbon dioxide CO_2 emissions by 2050 and perhaps of 80% by 2100. This would mean that these targets would have to be met before fossil fuels ran out, ie., the utilisation of zero or low carbon emission energy technologies being of primary importance over the need for sustainability from renewables since the Earth's climate could be irretrievably altered before the need for 100% sustainability in energy resources would be necessary.

Key amongst the Royal Commission's 19 key recommendations is the large scale construction of district heating networks, so that advantage can be taken of larger scale CHP schemes.

Local Sustainable Community Energy Systems

The distributed energy approach using mixed technologies and private wire for mixed communities is unique to Woking and can be found nowhere else in the UK. As part of its energy efficiency programme the Council implemented its first CHP system in 1992 and the UK's first small scale CHP/heat fired absorption chiller system in 1994 followed by a series of private wire residential CHP systems (the first and still the only systems of
their type in the UK) and renewable energy systems. What marks these systems out from
any other CHP system in the UK is the direct sale of cogenerated heat and green electricity to local customers at the same or lower price than for brown energy.

Local community energy systems can provide the full range of continuous energy services that customers would expect from an Energy Services Company or ESCO and achieve a substantial reduction in CO_2 emissions through a fully supported local sustainable community energy system.

Local community energy systems can be made viable by combining the non-residential and residential parts of the community together on a predominantly thermal energy system making use of thermal storage, heat fired absorption cooling for air conditioning/ refrigeration and other waste heat rather than using gas or electricity for heating and cooling. Electricity consumption can also be significantly reduced by eliminating electric air conditioning and refrigeration as well as cogenerating more electricity from the 'heat to cool' process via CHP/heat fired absorption cooling. With the right mix of residential and non-residential buildings and the different types of energy usage and duration, sustainability in electricity with surplus export available can be achieved as has been accomplished in Woking. Such sustainability in electricity will enable island generation to be provided (but only on private wire networks, since this is not possible on public wire networks) which means the energy stations can continue to operate independent of the national grid in the event of a failure of the national grid, even for prolonged periods, unlike conventional CHP/renewables which have to be automatically disconnected from the grid to prevent reverse power flows into a 'dead' grid. This security of supply and independence from the national grid in the event of disruption of the grid due to bad weather, damage or technical interruption is particularly attractive to customers and a practical embodiment of what sustainable energy can achieve. Of particular importance is the proximity of the new and existing industrial/commercial sites to each other. Hence the need to take a community led approach to such projects and the importance of the local authority understanding this concept and proactively assisting in delivering such projects.

Sustainable Energy Future

Even with a local sustainable community energy system grid connection (in practice the local distribution system, not the national grid) would be required to provide standby and top up supplies to guarantee energy supply to customers 24 hours a day all year round and to export surplus power over public wires to other customers.

This concept is also important to the future development of sustainable energy stations in the licensed distribution area since energy stations can be configured to supply standby and top up to each other under an enabling agreement for exempt supplier operation. With the development of further sustainable energy stations in the future it would be possible for such island networks to be completely independent of the national grid relying only on the interconnection between sustainable energy stations via the local licensed distribution system which would enable the CHP units to be replaced by renewable cogeneration systems (most likely fuel cells because of the renewable fuel flexibility) in the future when the cost of such systems will be economically viable by the time the generation prime movers require replacing.

In this way, substantial reductions in CO_2 emissions and full independence of the national grid with local communities trading surplus power with each other on local lower voltage public wire distribution systems can be achieved with any shortfall in the residential/SME sectors being achieved by domestic CHP and/or renewable energy systems.

Security of Supply

By making use of a series of overlapping island networks customers are unaffected by power cuts in the national grid since embedded generation can continue to operate on private wire islanded networks. Although the UK already has a small amount of embedded generation, when the grid is down CHP/renewables are also down unless they have been set up as private wire island networks. Island generation able to supply full load in an isolated environment for prolonged periods of time provides additional security of supply taking advantage of distributed embedded generation that does not rely on the efficacy of the grid.

2.25 THE RENEWABLE HYDROGEN ENERGY ECONOMY

The Renewable Hydrogen Energy Economy Blueprint for Woking

Most renewable energy technologies are intermittent electricity generators only and even biomass has its practical and physical limitations. Government and most green groups tend to focus on renewable electricity only and yet 70% of the UK's building energy needs is thermal and transport energy is overlooked!

Nuclear energy cannot practically provide the nation's thermal and transport energy needs but renewable energy can provide continuous generation for the nation's electrical, thermal and transport energy needs through the application of the Hydrogen Economy. There is more than enough renewable energy resources to achieve this and the intermittent generation problem can be overcome by making use of biomass reforming and electrolysers enabling electricity to be stored in the form of hydrogen and the same process applied for fuelling hydrogen fuel cell transport, dispensing with the need for on board reformers. Hydrogen can also be used for fuel cell CHP systems, thereby achieving the renewable thermal energy as well as electricity aims.

2.26 Future Energy Strategy for the UK

Although Woking has avoided grid and NETA penalty costs by utilizing private wire networks and a local trading system the existing regulatory regime limits the size of the local sustainable energy system and more importantly substantially limits the number of domestic customers than can be supplied with low cost green energy.

The embedded generation industry is capable of providing all of the country's energy needs and what is needed now is a progressive move towards this goal in parallel with using the existing centralised systems until they are no longer needed. Much of the national grid system would have to be replaced or refurbished within the Royal Commission's timescale for action in any case and it would be folly to replicate the existing national system which plainly would not be suitable for renewable energy which is of a much smaller scale than centralised power stations. The need will be for many thousands of renewable energy stations where electricity flows will be dissipated at the nearest loads and not lost in heating up the wires and transformers in the national grid.

Micro and mini scale embedded generation systems such as domestic CHP and/or renewable energy systems will play a valuable role in filling in generation gaps at the local domestic level (typically owner/occupier, small business units, isolated rural locations, etc.). These smaller systems, which may be small individually but large collectively, will be backed up by other local larger scale CHP/renewable energy systems, such as Woking is developing, where the electricity flows will be local and balanced out as part of a mixed technology local embedded generation system approach and not backed up from the grid and centralised power generation which will become more unsustainable or non existent in the future.

Government can take an easy first step to encourage the development of CHP, renewables, fuel cells and local sustainable community energy systems at the stroke of a pen – simply by increasing the supply limits for exempt generators/suppliers so that they are not burdened with centralised losses and use of system charges that unnecessarily increases the cost of green energy and which they are not making use of in any event. This will increase the value of green energy and put it on a competitive footing with brown energy by taking away all those unnecessary charges that are added to electricity supplied from embedded generation.

The current regulatory regime for exempt generators and suppliers should be changed to allow more customers to benefit from private wire systems. At the moment operators of stations as large as 100MW are exempt from generation licence requirements. However, of that 100MW only 1MW is allowed to be supplied to domestic customers on private wire per generation site and only 5MW (of which only 2.5MW can be supplied to domestic customers) in aggregate export over public wires for all of its sites together!

Although more fuel poor households could be provided with affordable energy this is prevented by this regulation. Given the interest in fuel poverty why has that limit been put in place? Is it because most of the profits of electricity companies are made in the domestic and SME sectors to make up for the very low cost dump electricity provided to power station base load customers in the energy intensive industries?

The exemption limits should be further relaxed to enable the Kyoto and Royal Commission targets to be achieved. A lot of the extra money needed to stimulate renewables and CHP could be found by relaxing the exemption criteria and allowing local generators/suppliers to supply more electricity direct to local customers. Focus could then turn to bringing the Hydrogen Economy forward.

In environmental and sustainability terms the more island generation and local discrete ('private wire') networks that you have interconnected to each other the more a borough like Woking becomes sustainable in energy and if other towns and cities did the same thing there would be no need for large centralised power stations and a very high voltage national grid system because this would be replaced by a network of local embedded generation systems on local island networks interconnected to each other throughout the country. The future grid would be very much different than the one we know today operating on much lower voltage local island generation networks overlapping with other local island generation networks and so on.

Hydrogen will be the energy carrier of the future, deriving its energy from renewable fuels such as biomass, biogas, solar, wind, hydro (via electrolysers), etc. Fuel cells and the Hydrogen Economy are important, as used in conjunction with renewable fuels, is the only technology/fuel that can meet the UK's electricity, thermal and transport energy needs from renewable sources. Even if the long term environmental impact of nuclear waste is ignored, nuclear energy can only address the UK's electricity needs not the UK's thermal and transport energy needs. Only fuel cells and hydrogen can deliver all three of the UK's primary energy needs. If Government looked at this issue in an innovative way as Woking have done then it would see that the Royal Commission on Environmental Pollution CO_2 reduction targets could be met as well as setting the foundation for a sustainable energy future.

The barriers to this are not technical but regulatory and vested interest.

2.27 FURTHER INFORMATION – CASE STUDIES AND WEBSITE LINKS

Case Studies

(i) DTI/AEP/CHPA Electricity Trading in the New Market Issue No.4 - 1998 in Practice - Case Study No.1 Woking Borough Council - September 1998[1].

(ii) DETR New Practice Profile 112 - Opportunities for Electricity Sales to Tenants from Residential CHP Schemes - January 1999[2].

(iii) DTI Extended Renewable Energy Case Study 30 - Green Power: Local Sustainable Energy Systems - June 2000[3].
DTI Extended Renewable Energy Case Study 31 - Green Power: The Use of Off-Grid PV by a Local Authority for Pay and Display Machines - June 2000[3].

(iv) Energy Saving Trust Energy Services Case Study 06 – Woking Borough Council's Thameswey Joint Venture Project – April 2001[4].

(v) Energy Saving Trust Practical Help for Local Authorities – Financing Energy Efficiency: Woking Borough Council's Energy Efficiency Recycling Fund – November 2001[5].

(vi) CADDET Technical Brochure 174 – Sunny Outlook at Home for the Elderly – March 2003[6].

For further information on these case studies, please contact:-

1. ILEX, 104, Gloucester Green, Oxford, OX1 2RH
Tel. 01856 722660
Fax. 01856 722988
Email: ilex@atlas.co.uk

2. BRECSU, BRE, Garston, Watford, WD2 7JR
Tel. 01923 664258
Fax. 01923 664787
Email: brecsuenq@bre.co.uk

3. New and Renewable Energy Enquiries Bureau
ETSU, Harwell, Oxfordshire, OX11 0RA
Tel. 01235 436747
Fax. 01235 433066
Email: etsuenq@aeat.co.uk

4. Energy Saving Trust
The Energy Services Office, First Floor
The National Energy Centre, Davy Avenue
Knowlhill, Milton Keynes, MK5 8NA
Tel: 01908 558209
Fax: 01908 662296
Email: energyservices@nesltd.demon.co.uk

5. Energy Saving Trust
Dartmouth Street
London, SW1H 9BP
Tel: 0870 241 2089
Fax: 0870 130 8831
Email: info@practicalhelp.org.uk

6. CADDET Centre, Future Energy Solutions 21, 156, Harwell, Didcot, Oxfordshire
OX11 0QJ
Tel: 01235 432719
Fax: 01235 433595
Email: cadet.renew@aeat.co.uk

Website Articles and Case Studies

1www.woking.gov.uk/cgi-bin/archive.pl?item=988025744 (index to 20 case studies).
2. www.chpa.co.uk (use search engine for Woking for several internal sites).
3. www.futureenergies.com (see articles on Woking Town Centre District Energy System, Photovoltaics and Fuel Cell projects).
4. www.utcfuelcells.com/news/archive/090401.shtml (see press release on IFC's Sale of PC25™ Power Plant to Woking, England gives United Kingdom it's First Fuel Cell).
5. www.dti.gov.uk/NewReview/nr39/html/state_of_the_art_.html (UK's First Fuel Cell CHP System article).
6. www.dti.gov.uk/NewReview/nr44/html/state_of_the_art_.html (A Fuel Cells First article).
7. www.dti.gov.uk/renewable (use search engine for Woking).
8. www.energy-efficiency.gov.uk/enter.cfm (DEFRA website - use search engine for Woking).
9. www.publicservice.co.uk/pdf/pfi/spring2001 (PFI/PPP - Woking : New Ways of Cutting Costs on Power).
10. www.h2fc.com/news.html (see articles under 9/4/01).
11. www.fuelcelltoday.com (use search engine for Woking).
12. www.positivepower.co.uk/article.php?sid=28 (First Commercial Fuel Cell Installed for Woking Borough Council by International Fuel Cells article).
13. www.e4engineering.com/item.asp?id=42891&type=Reuters&ch=e4e_chem_process (Reuters article on UK: Leisure Centre gets UK's First Fuel Cell System).
14. www.guardian.co.uk/Archive/Article/0,4273,4250725,00.html (Test Bed for Fuel Cell Project article).
15. www.publicservice.co.uk/pdf/detr/summer2001/p50.pdf (Power without Pain article).
16. www.btu-heating.com (click on fuel cell).
17. www.energy-markets.com/comment/986311932.html (Woking article).
18. www.insidecom.co.uk/eibi/editorial/eibi186.html (National Energy Manager's Award article).
19. www.insidecom.co.uk/eibi/editorial/eibi504.html (Queen's Award article).
20. www.est.org.uk/pdf/es_case_study_006.pdf (Woking Borough Council's Thameswey Joint Venture Project article).
21. www.projects.bre.co.uk/CHP/ES%20Case%20Study%2006.Woking.pdf (Energy Services Case Study 06 – Woking Borough Council's Thameswey Joint Venture Project).
22. www.practicalhelp.org.uk/cgi-bin/search.cgi/SIMPL/signposting/1 (Extended Case Studies on Green Power ECS24-31).
23. www.practicalhelp.org.uk/casestudies/finance/csf .wokin.doc (Case Study 06 -Woking Borough Council's Thameswey Joint Venture Project).
24. www.practicalhelp.org.uk/casestudies/finance/csf_wokin.doc (Case Study - Financing Energy Efficiency – Woking Borough Council's Energy Efficiency Recycling Fund).
25. www.praseg.org.uk/POWERHOUSE%200ct2001.pdf (Click on Proposals for the Energy Review article on Woking).
26. www.lng-cng.com/lng/woking.htm (Woking Borough Case Study - Natural Gas Vehicles).
27. www.edie.net/news/Archive/5328.cfm (It's Real 'Rocket Science' as UK's First Fuel Cell Lands in Woking article).
28. www.doc.mmu.ac.uk/aric/eae/News/sustainability_issues.html (Local Authority Wins Queen's Award for CHP Scheme article).
29. www.bsee.co.uk/news/archivestory.php/aid/832/Html (CHP in Woking Exploits Fuel – Cell Technology article).
30. www.cia.org.uk/Speak%20Out/Better%20future/Better_future%20(more).html (Forerunners of the Hydrogen Economy article).
31. www.climnet.org/news/September2001.html (Leisure Centre gets UK's First Fuel Cell System – UK: September, 2001 article).
32. www.york.ac.uk/inst/chp/has/rudlin.pdf (Autonomous UrbanDevelopment: 3.6 Energy Services and Case Study: Thameswey Energy Services – pages 39 and 40).
33. www.idea.gov.uk/lgip/reviews/woking.pdf (Local Government Improvement Programme Visit to Woking Borough Council: Innovation and Creativity – Item 52).
34. www.et.expo.com/page.cfm/Action_Press?PressID=15/t=m (UK's Largest Domestic Solar Technology Installation Will Mean Low Cost, Green Energy for Elderly Woking Residents article).
35. www.esd.co.uk/downloads/jpk_mar02_presentation.pdf (Implementing Low Carbon Solutions: Opportunities for Business – pages 30 to 37).
36. www.parliament.the-stationery-office.co.uk/pa/cm200102/364-ii/1111309.htm (Select Committee on Trade and Industry Minutes of Evidence – Memorandum by the Combined Heat and Power Association – Item 22).
37. www.fmb.org.uk/publications/masterbuilder/march02/22.asp (Light, Heat and Energy Savings Through a Roof article).
38. www.icwgb.com/02/02412.htm (Green Energy for Pensioners article).

39. www.praseg.org.uk/PRASEG%20News%202001/PRASEG%20News%20070901.htm (PRASEG News 7 September 2001 – Item 4: Test Bed for Fuel Cell Projects article).
40. www.jxj.com/magsandj/cospp/2002_03/index.html (Click on Woking: Energy Services, DG and Fuel Cells).
41. www.newbuilder.co.uk/newbuilder/news.asp?offset=10 (Private Wire Electricity and Heating article).
42. www.constructiontimes.co.uk/default.asp?channel_id=1962&editorial_id=6371 (Energy Methods Knock-On to Housing Market article).
43. www.pv-uk.org.uk/news/BritSol-15.pdf (Elderly Residents get UK's largest PV Installation article).
44. www.forumforthefuture.org.uk/aboutus/default.asp?pageid=307 (See under Generation H Conference and click on Allan Jones).
45. www.alanpotter-publicart.com/CurrentProjects.html (Current Projects - The Fuel Cell. See also Commissions).
46. www.utc.com/press/highlights/fuel_cell_europe.htm (UTC Fuel Cells Provides a Pollution-Free Solution to Europe's Energy Problems).
47. www.inreb.org/showpage.jsp?page=m.news.jsp&id=139 (UK's First Commercial Fuel Cell System Installed in Woking).
48. www.women2020.com/report/13.pdf (Chapter 13 - Energy Sources for Urban Extensions – What's Around: Micro Energy Supply Schemes).
49. www.bvfoe.freeserve.co.uk/newssummer02.html (Newsletter Summer 2002 New Renewable Energy – Local Solar Power!!!).
50. www.sd-commission.gov.uk/pubs/lowcarbonspaces/04.htm (Low Carbon Spaces - Area Based Emission Reductions: A Scoping Study – Exemplars of Low-Carbon Initiatives: 4.2.11 Ambitious Projects - Thameswey ESCO, Woking: Low Carbon Energy Services Project).
51. www.dti.gov.uk/energy/developep/bristolseminar_report.pdf (Energy White Paper - Regional Seminar – 8th July 2002, Bristol – see under Morning Session: Woking Borough Council).
52. www.lgib.gov.uk/policy/Woking_intro.htm (World Summit on Sustainable Development – Johannesburg: Energy and Climate Change Case Studies - Woking Introduction and Graphical Case Study).
53. http://search1.dti.gov.uk/energy/developep/non_gov_org/woking_borough_council.pdf (Energy Policy - Key Issues for Consultation Response).
54. www.climateequipment.com/pages/press/sept2002/woking-pool-in.htm (Climate Absorption Chiller Teams up with UK's First Fuel Cell Project).
55. www.parliament.uk/post/pn186.pdf (Parliamentary Office of Science and Technology – October 2002: Prospects for a Hydrogen Economy [see under Current Projects]).
56. www.brookes.ac.uk/other/uk-ises/autumn2002pdf.pdf (Solar News - see under Solar Power for Leisure Centres Conference).
57. www.woking.co.uk/news/article/article_id=637.html (Blueprint Sets 2090 Date for Green Target).
58. www.bpsolar.com (use search engine for Woking).
59. www.fuelcellmarkets.com/thameswey (Thameswey).
60. www.caddet.co.uk//assets/RE174.pdf (CADDET - Sunny Outlook at Home for the Elderly).
61. www.alanpotter-publicart.com/Fuelcell.html#anchor34442082 (Woking Fuel Cell and Mural).
62. www.woking.gov.uk/html/climate/index.html (An Innovative Climate at Woking).

Note: Type 'Woking CHP' and/or 'Woking Photovoltaic' and/or 'Woking Fuel Cell' and/or Woking Climate Change Strategy in your search engine for further website articles on the Woking and Thameswey sustainable energy projects.

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Allan Jones MBE
Energy Services Manager
Woking Borough Council
16 September 2003
WOKING67

2.28 The following two case studies were obtained from the South East England Regional Assembly

Harnessing the Elements

MAY 2003 - Supporting Statement to the Proposed Alterations to Regional Planning

Guidance, South East – Energy Efficiency and Renewable Energy

2.28 Case Study One - Woking

Harnessing the Elements Supporting Statement

© Woking Borough Council

The following case study was included in this report courtesy of Allan Jones of Woking Borough Council

2.28 CASE STUDY

WOKING RENEWABLE AND SUSTAINABLE ENERGY

Woking Borough Council is recognized as the most energy efficient local authority in the UK and is the only local authority in the UK to supply customers with electricity on private wire combined heat and power (CHP) and renewable energy networks. In 1999 it set up Thameswey Limited, the UK's first Energy and Environmental Services Company, and Thameswey Energy Limited, a public/private joint venture energy services company. Over the last decade, the council has implemented a series of energy efficiency and environmental projects, including the UK's first small scale CHP/heat fired absorption chiller system, the first condensing boiler scheme for private sector housing, the first local authority private wire residential CHP schemes, the largest domestic photovoltaic/CHP installations, the first local sustainable community energy systems and the first hydrogen fuel cell CHP. Over this period, the council reduced energy consumption by over 40% and carbon dioxide emissions by over 66% (78,605 tonnes). Financial savings achieved by energy efficiency projects have amounted to almost £4.7 million over the same period.

A proposed climate change strategy for Woking sets targets for further emissions reductions over the next decade, providing the context for the council's activities over this period. The progress Woking Borough Council has made has been possible due to strong leadership and support for the initiatives by all three major political parties. It demonstrates what is possible and could be replicated in the region.

FOOTNOTES

www.egeneration.co.uk.

2.29 Case Study Two - Isle of Wight

Harnessing the Elements Supporting Statement

The Countryside Agency's Community Renewables Initiative[35] could have a catalytic effect in the region, demonstrating how projects can be brought forward which are accepted and owned by the receiving communities and which deliver a wide range of other benefits. Two local support teams for the Community Renewables Initiative have been established in the region in the Thames Valley and Surrey, Kent and Croydon. These will be assisting and training communities in devising their own schemes. In particular, such projects can demonstrate the wider benefits of renewable energy projects, including employment creation and diversification and landscape management. They also give communities a greater degree of control and ownership over schemes, a financial return and a sense of satisfaction.

This will help to change the perception of Renewables from threat to opportunity.

DEVELOPING A COMMUNITY RENEWABLE ENERGY STRATEGY FOR THE ISLE OF WIGHT

Since April 2001 the Isle of Wight Council has been developing a renewable energy Strategy for the Island, part funded by the EU Altener programme, and with technical and research support from Intermediate Technology Consultants Ltd (ITC). The development of the strategy has involved detailed consultation with the community. This included a major launch in July 2001, a presentation of the available resources and technologies at a highly participatory workshop in March 2002 and 12 community working groups through Summer 2002. Significant media coverage has helped to raise awareness and understanding amongst the island's community. The community working groups have focused upon 'flagship' renewable energy projects including community wind turbines, biomass/CHP, zero fossil energy build, biodiesel, anaerobic digestion and marine current turbines.

A cost benefit analysis has been undertaken to inform recommendations about renewable energy targets and flagship projects which will feed into the Island Renewable Energy Strategy. The recommendations made were based on the premise of community ownership and benefit deriving from any agreed renewable energy targets and technology.

FOOTNOTES

Countryside Agency (2002), 'Renewable Energy – Putting Communities In Charge' – the Community Renewables initiative.

3.0 HNRI Renewable Energy Network Consortium developed by International Agenda 21 Ltd & IMGroup

Current:

A consortium of specialist Renewable Energy companies has been formed by International Agenda 21 Ltd & the IMGroup to aid the aspirations of the HNRI programme. It is envisaged that the HNRI will be in receipt of certain profits from Wind Farms and Energy Crop plants – a revenue stream to help continue its work.

1)	**Powergen PLC**	-	Renewable Energy suppliers
2)	**Powergen Renewables**	-	Renewable Energy Developer
3)	**Bical Ltd**	-	Energy Crop Specialists
4)	**British Biogen**	-	Energy Crop Developer
5)	**PMSS Ltd**	-	Wind Farm Project Management
6)	**GE Wind Ltd**	-	Wind Farm Developer
7)	**BPSolar Ltd**	-	Solar Energy (PV & Hot Water)
8)	**PV Facades Ltd**	-	Solar Energy installers
9)	**Taylorville Holdings Ltd**	-	Gasification Plants
10)	**Okay Engineering Ltd**	-	Recycling Equipment
11)	**HLC Heneley Burrowes**	-	Recycling Developer
12)	**IMGroup** & **HSBC**	-	Project Funders & Risk Insurers
13)	**Scott Wilson**	-	Waste Gasification Project Man'
14)	**Mott Mac Donald**	-	Waste Gasification Project Man'
15)	**EcoSecurities**	-	Carbon Management (CO2)
16)	**The Carbon Trust**	-	SEEDA – Gary Foster
17)	**Sovereign Ltd-Soil Bind**	-	Sustainable Construction material
18)	**Energy for Sustainable Development Ltd**	-	Sustainable Energy Consultants
19)	**Centre for Sustainable Energy Ltd**	-	Sustainability Advisors
20)	**CSMA Consultants Ltd.**	-	Sustainable Energy Consultants
21)	**Roger Tyme & Partners**	-	Planners & Development Economists
22)	**Jestico + Whiles**	-	Sustainable Architecture & Design
23)	**Dulas Ltd.**	-	Renewable Energy Identification
24)	**Hampshire Waste Services**	-	Project Integra – existing EFW
25)	**Waste to energy Ltd**	-	Gasification equipment supplier
26)	**Tarmac Recycling Ltd**	-	Construction waste recycling
27)	**Vital Energie Ltd**	-	District Heating
28)	**Atkins Power**	-	Power Engineers
29)	**TVEnergy Ltd**	-	Biomass Suppliers

3.1 Major Development Areas (MDAs)

The Structure Plan designates four major Development Areas (MDAs): West of Waterlooville; South-East of Eastleigh; Basingstoke; Andover. Each MDA will comprise a mix of uses including housing, employment, shopping leisure and social facilities so as to create a new community. Policies MDA1 - MDA5

Extensions to three of these MDAs and an MDA at Winchester City (north) from part of the reserve provision for housing.

Housing – Structure Plan

The Structure Plan's provision for new housing comprises a `baseline provision' and a `reserve provision'. The latter will only be released for development if required by Regional Planning Guidance and monitoring of housing supply. The figures for each local planning authority area are:

Local planning authority	Baseline Housing 1996-2011	Reserve Provision 2001-2011
Basingstoke & Deane	12,060 including 4000 at the Basingstoke MDA	500 plus 1,500 at the Basingstoke MDA
East Hampshire	5,500	1,500
Eastleigh	6,295 including 3000 at the South East of Eastleigh MDA	1,500 plus 1,000 at the South East of Eastleigh MDA
Fareham	4,740	1,500
Gosport	2,980	-
Hart	4,750	1,500
Havant	2,990	500
New Forest	5,480	500
Portsmouth	9,000	-
Rushmoor	2,980	-
Southampton	7,330	-
Test Valley North	6,160 including 3000 at the Andover MDA	-
Test Valley South	2,730	1,000
Winchester	7,295 including 2000 at the West of Waterlooville MDA	1,000 at the West of Waterlooville MDA. 2,000 at the Winchester City North MDA
Baseline Total	80,290	14,000

The Structure Plan requires a range of housing densities, types and sizes to meet different needs including those of the elderly, disabled or people who cannot afford market housing. Policies H1 - H12

HNRI

Renewable Energy should be considered as a priority in each of the MDA's listed in the Housing Structur Plan on the following page.

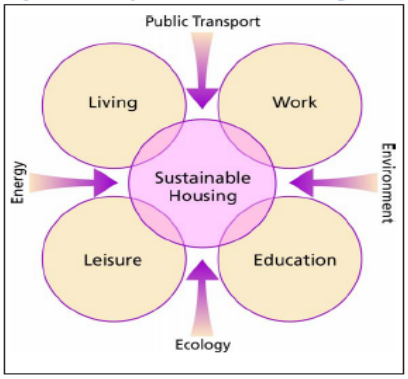
Biomass such as Coppices Willow is grown around the Waterlooville MDA and can be utiized in an Energy Plant.

Biomass
Energy Crops
District Heating
Resource Centre
Wind Turbines
Solar PV & Hot Water
Sustainable Construction SoilBind for Roads & paths.

Hampshire Natural Resources Initiative

Waterlooville MDA

FIGURE 2.1
Key Relationships in Sustainable Housing

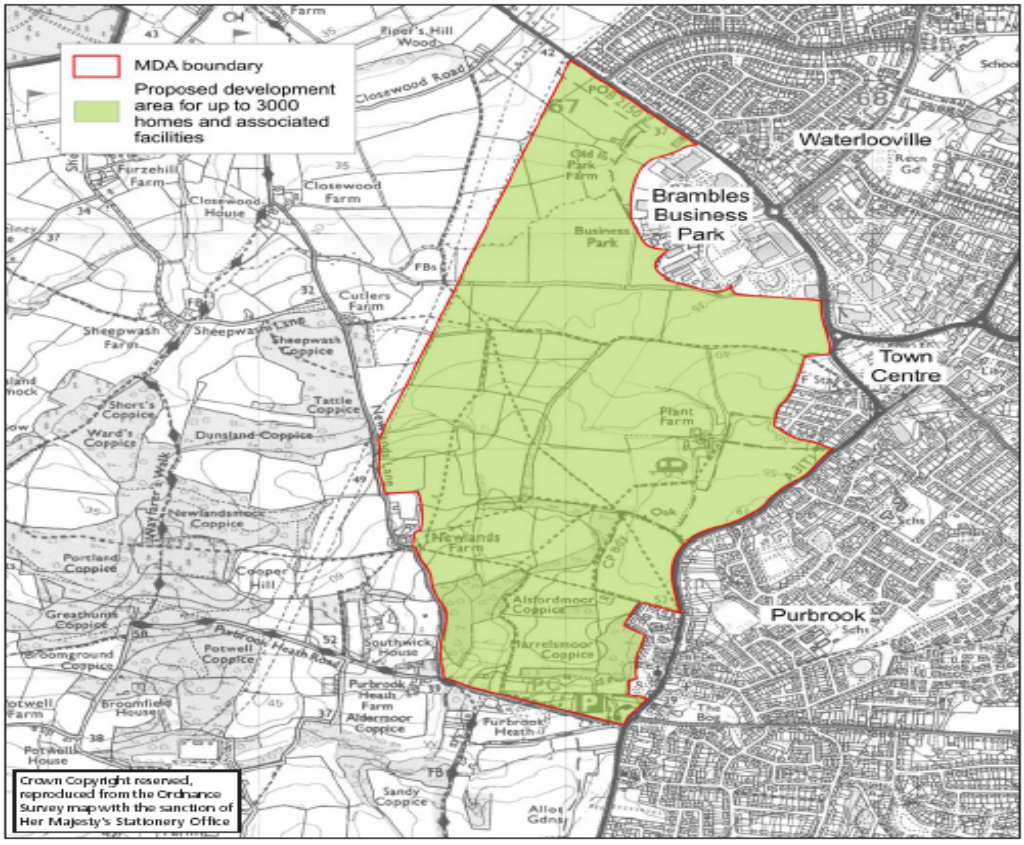


Possibility of Solar Energy Demonstration, Biomass Plant 5MW, Resource Centre & Wind Turbines

1.5 Site Description

Figure 1.2 shows the Major Development Area, as identified in the current version of the Local Plans, in relation to its immediate surroundings. The built-up area of Waterlooville wraps around the eastern half of the site and the surrounding suburbs extend to the north, south and east of the town. Brambles Business Park lies to the west of the town centre and north east of the site. To the south-east of the site is the settlement of Purbrook and Denmead is located to the north separated from Waterlooville by open countryside.

FIGURE 1.2 Site Location Plan



ATKINS *West of Waterlooville Major Development Area : Masterplan Framework Options*

In General all the additional costs associated with the Havant Borough Council Ecohomes development in New Lane resulted in an extra 10% on the New Build cost.

If HCC, Winchester and the HNRI were to recommend to developers for the MDA's all the inclusions made in this report then costs would be reduced by utilisation of Construction waste recycling and reuse, the use of SoilBind products significantly reducing build costs of roads and paved areas.

All additional finance required for Renewable Energy technology incorporation can be provided by the IMGroup.

Renewable Energy

Biomass – Wind – Solar

IMGROUP & INTERNATIONAL AGENDA 21 LTD

Hampshire Natural Resources Initiative

IMGroup – MDA Centre Solar PV Proposals

Possible inclusion into HCC Natural Light programme

An opportunity for a Sustainable Energy Community – Renewable Energy Wind Turbines, Solar PV & Energy Crops

:t as a focal point for the new
vide a limited range of shops and
nience store and community
sidents of the MDA.

Illustration of a Local Centre Gateway: Based on the Option 2 layout

ATKINS *West of Waterlooville Major Development Area : Masterplan Framework Options*

IMGroup have held a series of three advisory meetings with Winchester City Council, Havant BC & the Grainger Trust Landowners.

3.3 Case study Four – Havant Borough Council – Ecohomes.

Your energy,

The beautiful timber clad homes in New Lane and Flexford Gardens are Havant's first Eco-homes, an initiative led by the borough council and built in partnership with the Parchment Housing Group to demonstrate how properties may be designed and built to conserve precious resources: truly sustainable housing.

Paul comments, "We want this project to show the way forward, not to be a one-off, money-no-object showcase. It will demonstrate how new homes can be developed according
to principles of sustainability, encourage this practice in future housing developments, and raise awareness of what can be achieved through a more thoughtful approach to how we
construct and occupy our buildings.

”The homes, which have now been allocated to residents of the borough, will have exceptionally low running costs, made achievable by the following ‘green’ features:

• Timber-framed construction with exceptional levels of recycled cellulose insulation

• High-specification, timber windows, using ‘low E’ glass with argon (gas) filled glazing units

• Facilities to encourage recycling including rainwater collection

• Spray taps and showers to reduce water consumption

• Sun spaces to capture heat and redistribute it throughout homes

• Use of the sun for hot water heating and generating electricity from light

• Built in flexibility to help meet changing needs of occupants Monitoring will be carried out on the homes over a two year period to measure energy consumption, reductions in emissions, and establish potential savings.

There are two different types of solar panels used on the new homes at New Lane and they both work all year round. Solar Hot Water panels use the sun’s warmth to pre-heat the domestic hot water supply, typically meeting a family’s hot water requirements during the summer months and substantially reducing the need for the boiler to fire during the colder months.

Solar PV (photovoltaic) panels convert light into electricity. The generated power can be used directly in the home and even exported to the National Grid – making the home a small power station! For those residents who wish to go the extra mile there are currently government grants to encourage householders to fit both types of solar panel and help reduce the burning of fossil fuels.

To make it even easier for residents interested specifically in installing solar hot water panels the Borough Council in partnership with neighbouring councils and an organization called SolEEAC, the Solent Energy Efficiency Advice Centre, can provide access to affordable, quality controlled systems – call them on 0800 512 012.

Havant's first Eco-homes

We all need energy to run our homes, schools and the many other facilities we visit each day, but how many of you have thought about investing in energy conservation measures or using alternative forms of energy that don't pollute our environment, and could save you money?

The Council, and inparticular our Home Energy Conservation Officer, Paul Hemming, has been working hard on many different conservation projects for the benefit of borough residents and to help Havant meet the government's 2010 target of improving domestic energy efficiency by 30%. This work has involved attracting major investments from external organisations, publicizing grants available to all and being involved in Havant's first Eco-Homes project.
There are many different types of energy conservation schemes available, from assistance with loft insulation to installation of solar panels, all of which can attract money from outside the borough council, which in turn benefits you the resident. During the last two years Paul, working with partner organisations, has successfully secured over £1m, which has helped to provide heating and insulation to 1388 homes in the borough through the government's Warm Front programme, and subsidized loft and cavity wall insulation from a Scottish Power scheme. It has also provided funds towards the photovoltaic panels on the New Lane Eco-homes, which generate free electricity from light; and a schools education package.

Substantial subsidies and grants are still available to all owner-occupied and privately rented homes, *regardless of income*, for loft and cavity wall insulation, tank and pipe lagging and low energy light bulbs. For some people on low incomes help is available towards a heating package such as the installation of gas central heating. Taking advantage of these subsidies will not only save you money… it will help the environment by reducing pollution. For example, investing £320 now to improve the insulation of your home could, over the next 10 years, save you £2,000 and reduce your contribution to climate change by 14 tonnes of CO_2 (carbon dioxide). Simple actions such as improving insulation and heating systems resulted last year in borough residents cutting annual emissions of CO_2 by 11,000 tonnes and householder savings of £1.5 million per year in fuel costs. These schemes and projects also support two of the council's key aims as recently published in the council's community strategy, namely Enhancing our Environment and Enabling Better Housing, reinforcing the council's commitment to creating a better future for Havant.

There are many different ways you can become more energy efficient; we have to change our way of thinking about the harmful effects everyday living can have on our surroundings. Are you doing your bit? If you would like to find out more about energy conservation and the grants available or want more information on schemes and projects then please **contact the Solent Energy Efficiency Advice Centre on 0800 512 012.**

your future

3.4 Case study Five – IMGroup Construction Recycling

IMGroup & International Agenda 21 Ltd offer a one stop approach to project development , technology options & finance.

Member Companies:

Scott Wilson
Mott MacDonald
Okay Engineering Ltd
Whitbybird Engineers
Tarmac Group
Bath Demolition
Denholm Hall Capital Markets
Atkins Power

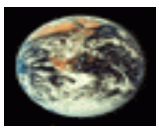
Bath Demolition - Static & Mobile Concrete Hardcore Crushing equipment providers help to reuse & recycle valuable concrete resources back into the Construction market.

Tarmac group - Provision of quality recycled aggregates to improve environmental performance in Sustainable Construction. Application of Quality Management Systems ensures high quality recycled products.

Scott Wilson - Project Management, Resource Management, Design & Build Roads, Highways, Transport planning, Environmental Planning & Master Planning.

Mott MacDonald - Civil Engineering, Project Management, Waste Collection, treatment and transfer.

Denholm Hall Capital Markets - Project Finance.

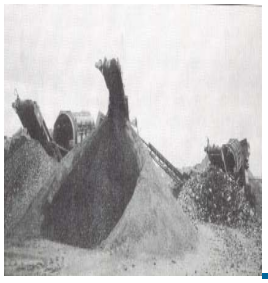


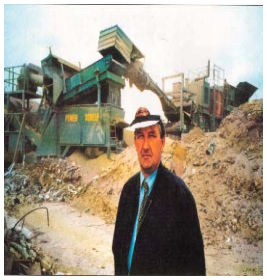
Construction Waste
Concrete Crushing & Recycling Aggregate

Design, Build, Own & Funding Solutions

INTERNATIONAL MERCANTILE Group

In association with– JEMU
Joint Environmental Marketing Unit UK





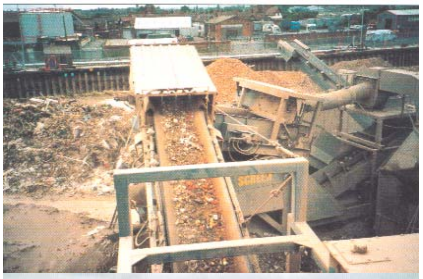
Construction Industry & Municipal Solid Waste Solutions & Funding

Inside Contents

Concrete Crushing & Aggregate Recycling

International Agenda 21 Ltd

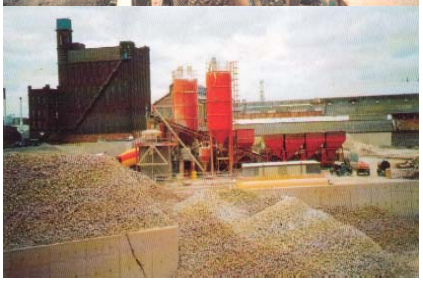
In conjunction with Sovereign, SoilBind & member companies of the IMGroup we are able to provide Construction Waste Recycling Technology and funding packages for clients on an International Basis.



International Agenda 21 Ltd

Specialise in Sustainable Development solutions to many waste types in our society:

Construction
Municipal Solid Waste-MSW
Commercial packaging
Industrial
Sewage Treatment



Construction waste concrete can be turned into a reusable resource either as an aggregate filler or when applied with SoilBind can replace normal methods of road construction at a fraction of the cost.

SoilBind can significantly increase revenues streams from construction waste reuse.

Environmental Savings
Increased Revenues
Reduction in Transportation costs
Utilising Local Soil types

3.5 Case study Six – Construction – SoilBinb – Aggrepave

International Polymer Soil Stabilising Consortium

SOILBIND

AGGREPAVE

TYPES OF APPLICATIONS FOR SURFACE APPLIED POLYMER STABILISING

TYPE 1

Aggrepave Polymer surface soaked 40mm depth 6mm to dust aggregate layer
Polymer surface sealed sub-base

80mm minimum Polymer stabilised sub-soil or sound existing concrete base

TYPE 2

Aggrepave Polymer surface soaked 80mm depth 6mm to dust aggregate layer

Polymer surface sealed sub-base

Compacted suitable sub-soil

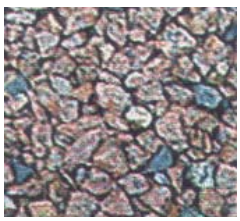
TYPE 3

Aggrepave Polymer surface soaked 40 mm depth 6mm to dust aggregate layer
Polymer surface sealed Driveway/ pathway

Existing sound Asphalt Driveway/Pathway

SoilBind






AGGREPAVE

New 2002SS Water Based, Brick/Concrete Paver Sealer

Easy to Apply: With a watering can…you can do it.

Advantages of Sealing paved areas:
It reduces water penetration through the joints which ultimately results in loose blocks and base failure. 2002SS significantly increase the life of paving blocks and also reduces the possibility of staining, UV damage and the growth of grass and weeds in the paving joints.

2002SS IS A WATER BASED, ENVIRONMENTALLY FRIENDLY, NON-TOXIC, NON-HAZARDOUS CO-POLYMER THAT PROVIDES A LONG LASTING SEAL TO A WIDE VARIETY OF CONSTRUCTION MATERIALS. (ISO9002 Approved)
2002SS DRIES TO A CLEAR FINISH AND DOES NOT CHANGE THE COLOUR OF THE PAVERS.

APPLICATION:
Ensure that the area is clean and dry prior to application. Remove grass and weeds.
Do not apply if rain is imminent
Do not apply if frost is imminent
Mix 1ltr of 2002SS concentrate with 9 ltrs of cold water
Apply this with a watering can, fitted with a coarse rose head, over 10 sq mtrs of the paving area.
If the surface dries within 3 minutes spray again.
Wash hands and all equipment with water.
Follow the safety instructions for eye contact and other emergencies

Contact: SoilBind Ltd

Tel: 0044 (0) 20 8866 0713
Fax: 0044 (0) 20 8429 0959
E-mail:

3.6 Case Study Seven - Construction Savings Using SoilBind

SoilBind Ltd.

Typical Cost & Aggregate Savings using Soilbind Products

APPLICATION	*2001M50/LBS/LDC POLYMER* SOIL STABILISING	*EVERBOND* STRUCTURAL COATING
Roads Medium Duty	**40/60%**	
Lighter Duty	**50/75%**	
Driveways	**50/75%**	
Footpaths	**50/75%**	
Paved areas (medium)	**40/60%**	
(light)	**50/70%**	
Draining Ditches	**30/60%**	
Surface water/Sewage tanks	**40/50%**	
Lagoons/Settling ponds	**40/50%**	**50/80%**
Landfill Containment	**40/50%**	**50/80%**
Foundations (lightweight)	**40/60%**	
Piling	**40/50%**	
Dams and Dykes	**30/60%**	**40/80%**
Slope Stabilising	**40/60%**	**40/80%**
Utility Trenchfill	**30/60%**	
Railway Track embankments	**30/60%**	
Coastal Erosion	**30/70%**	**40/75%**
Natural landscape features	**30/50%**	**40/60%**
External sports facilities (tracks, tennis courts etc)	**40/70%**	**40/75%(linemarking)**

OUTPUT:(8 hour day with dry weather)
Using basic construction equipment to produce a 150mm/250mm layer depth the output would be approx. 2000 sq mtrs per day.

Using a Bomag recycling machine the output would be approx. 8000 sq mtrs per day.

NOTE:
The above savings are indicative only and will depend on existing soil conditions and the mix and density required to achieve the engineering specification.
Laboratory soil tests and analysis, supervision, training, monitoring and quality assurance validation are not included.

SoilBind - Hiking trails, pathways, and jogging tracks

Natural soil colour and texture retained

From the Rocky Mountains - to the Appalachian Way - to New York Central Park

Liquid Dust Control (LDC) **Surface spray application**

A liquid polymer based concentrate that is mixed with water and sprayed onto scarified surface of sub-soils (and 50mm deep) which is then compacted to create a durable, dust free, water resistant surface that retains the soils natural colour.
Can also be used as an effective waterproofing membrane for drainage ditches, ponds, water retention reservoirs etc.
LDC is non-toxic, environmentally friendly and is unaffected by sub-zero through to tropical temperatures.
Can be applied with all standard spraying equipment, wheel based/back packs and/or even watering cans.
Ensure that the surface is compacted and graded for water drainage before treating with **LDC**, prior to compaction.
Recommended mixture is a minimum of 1.5 ltr **LDC** concentrate mixed with 10 ltrs water per 10 sq mtrs of area to be treated.
Apply evenly over the entire area, if it dries within 3 minutes spray again one hour later.

M50 Soil Stabiliser for non-cohesive soils

A liquid co-polymer based concentrate that is mixed with water prior to being sprayed, and mixed in, to a specified depth of graded sub-soil which is then compacted. The compacted layer can be used immediately but the surface is sprayed again after compaction to protect the layer during the 5 day curing process when maximum strength is achieved.
This produces a hard, dust free, water-resistant layer for pathways, jogging tracks, parking areas etc.
Stone chippings can be added to the surface prior to final rolling and sealing to provide a consistent stone surface with wear and grip properties. (Stone chippings, circa 5-8 mm, should be pre-coated with **M50** solution and be wet when applied.)
M50 is non-toxic, environmentally friendly and can also withstand extreme weather conditions.
M50 can be applied with all standard spraying equipment but filters must be removed from any pumps to prevent blockages.
Mixture rates will vary subject to the layer depth and the engineering requirement, but for a layer depth of 150mm with well graded soil, the average dosage rate, with surface seal will be 0.45 ltrs of **M50** concentrate plus 2 ltrs water per sq mtr. Below base spraying is recommended where high water tables are present, increasing the dosage rate to 0.6 ltrs per sq. mtr.

Typical Pathway problem:
Pathway is below road level and has root invasion from overhanging trees. Water erosion due to incorrect grading and lack of drainage.

SOLUTION:
Stabilise layer: Form a simple half-pipe drainage channel: Seal surface and drainage channel with M50

SoilBind

- Comparison Of Road Construction Costs (UK - USD)

SoilBind products provide environmentally friendly, cost effective,

water based solutions for the control of dust and surface erosion problems

SPECIFICATION	**AXLE LOAD 18,000 KIP**		**TRAFFIC LOADING - MEDIUM**			
	TOTAL TRUCK LOAD - 20 TONS		**DESIGN PERIOD - 20 YEARS**			
ASPHALT		**CONCRETE**		**SOILBIND**		
	Depth mm		Depth mm		Depth mm	
HR Asphalt	45	Concrete	150	HR Asphalt Wear Course	50	
Dense bitumen base	150	Sand	25	Top Sealing Coat		
Subbase CBR	200	Subbase CBR	200	SoilBind Base	250	
Base Compaction		Base Compaction		Base Sealing coat		
Calculations						
Base Compaction Cost	3.63	Base Compaction Cost	3.63	Base Compaction Cost	3.63	
Cost per SQM	3.63	Cost per SQM	3.63	Cost per SQM	3.63	
Subbase CBR US $/m³ =	38.42	Subbase CBR US $/m³ =	38.42	Base Sealing Coat /L	10.45	
Cost per SQM	7.68	Cost per SQM	7.68	Cost per SQM	1.49	
Compact subbase	1.81	Compact subbase	1.81			
Cost per SQM	9.49	Cost per SQM	9.49	Soilbind Base Cost	10.45	
				Materials - 2001M50 - 2L/m³	5.23	
Dense bit base US $/m³ =	116.00	Sand US $/m³ =	30.45	#Processing/Labour	0.36	
Cost per SQM	17.40	Cost per SQM	0.76	Cost per SQM	5.59	
		Compact sand	1.81			
HR Asphalt Cost US $/m³=	130.50	Cost per SQM	2.57	Top Sealing Coat /L	10.45	
Cost per SQM	5.87			Cost per SQM	1.49	
		Concrete CostUS$ /m³=	112.37			
		Cost per SQM	16.86	HR Asphalt Cost US $/m³	130.50	
				Cost per SQM	6.53	
Total per SQM	**36.40**	**Total per SQM**	**32.55**	**Total per SQM**	**18.73**	

No allowance has been made for reinforcement mesh or any construction joints. This would cost in the region of 20-25% of the concrete rate per SQM.

#Assumes Bomag 121 Recycling Machine or equivalent

Up to 250mm depth- single pass@ US $0.36 per SQM

SoilBind

SPECIFICATION	AXLE LOAD 9,000 KIP TOTAL TRUCK LOAD - 10 TONS	TRAFFIC LOADING - MEDIUM DESIGN PERIOD - 20 YEARS	
ASPHALT	**CONCRETE**	**SOILBIND**	
	Depth mm	Depth mm	Depth mm
HR Asphalt	45	Concrete	150	HR Asphalt Wear Course	50
Dense bitumen base	150	Sand	25	Top Sealing Coat	
Subbase CBR	150	Subbase CBR	150	SoilBind Base	200
Base Compaction		Base Compaction		Base Sealing coat	
Calculations					
Base Compaction Cost	3.63	Base Compaction Cost	3.63	Base Compaction Cost	3.63
Cost per SQM	3.63	Cost per SQM	3.63	Cost per SQM	3.63
Subbase CBR US$/m³ =	38.42	Subbase CBR US$/m³ =	38.42	Base Sealing Coat /L	10.45
Cost per SQM	5.76	Cost per SQM	5.76	Cost per SQM	1.49
Compact subbase	1.81	Compact subbase	1.81		
Cost per SQM	7.57	Cost per SQM	5.23	Soilbind Base Cost	10.45
				Materials - 2001M50- 2L/m³	4.18
Dense bit base US$/m³ =	116.00	Sand US$/m³ =	30.45	#Processing/Labour	0.36
Cost per SQM	17.40	Cost per SQM	0.76	Cost per SQM	4.54
		Compact sand	1.81		
HR Asphalt Cost US$/m³=	130.50	Cost per SQM	2.57	Top Sealing Coat /L	10/45
Cost per SQM	5.87			Cost per SQM	1.49
		Concrete Cost US$/m³=	112.37		
		Cost per SQM	16.86	HR Asphalt Cost US$/m³	130.50
				Cost per SQM	6.53
Total per SQM	**34.48**	**Total per SQM**	**28.29**	**Total per SQM**	**17.68**

No allowance has been made for reinforcement mesh or any construction joints. This would cost in the region of 20-25% of the concrete rate per SQM.

#Assumes Bomag 121 Recycling Machine or equivalent

Up to 250mm depth- single pass@ US $0.36 per SQM

ANTICIPATED "CBR" INCREASES WITH APPLICATION OF SOILBIND STABILIZERS

(all products distributed by Soilbind Limited are Environmentally Friendly and ISO9002 approved)

ASSHTO GROUP	DESCRIPTION OF SOILS (*) See Note below	Expected CBR increase Using LBS	LBS	2001M50	Expected CBR Increase with 2001M50	LDC for dust control
A-1-A	Well graded gravel and gravely sand mixture, little or no fines	0	*		0	
A-1-2	Well graded gravel's and gravel sand Mixtures. (see note below)	2X	*	Must add fines	3X	
A-1-2	Poorly graded gravel and gravel sand Mixtures. (see note below)	2X	*	Must add Fines	3X	
A-1-B	Silty gravel, gravel sand silt mixtures (see note below)	2X	*		3X	
A-1-B	Clay gravel, gravel clay, sand mixtures	2X	*		4X	
A-1-B	Well graded sand and gravel sands (see note below)	2X	*		4X	
A-2-4 0R 5	Silty sands, sand silt mixtures	3X	*		4X	
A-2-6 OR 7	Clayey sands, sand clay mixtures	4X	*		4X	
A-4	Inorganic silts, very fine sands, rock Flour, Silty or clayey fine sands, organic silts and organic Silty clays of low plasticity	4X			4X	
A-6	Inorganic, low to medium plasticity, Gravel, sandy ,Silty or lean clays	5X	*		4X	
A-5	Inorganic silts, minacious or Diatomaceous fine sands or silts	5X	*		4X	
AR-7 OR 6	Inorganic clays of medium to high plasticity fat clays	6X			5X	
AR-5 OR 5	Inorganic clays of medium to high plasticity	6X			5X	
A-8	Peat, muck and other highly organic soils. (dust control only)	N/A	N/A		2	

Note (*)	Soils not meeting the above criteria must be mixed with clay or lime to change the AASHTO rating to conform to bring the clay/lime content to 25% to 45%
Soilbind products comparison with other stabilisers	
LDC	Used for fugitive dust and erosion control. In heavier multiple applications will stabilise road surfaces. Will require fine grading approximately once a year with new application.
LBS	Is about 4 times less expensive than cement, or lime, and does not have any storage problems. Permanently stabilises most soils and is compatible with all surfacing materials
2001M50	Specifically formulated for stabilising fine sand and Silty soils. The polymers form a good bond to fugitive dust, sand and silt particles providing a medium grade surface. In many cases the cost is considerably lower than importing clay or lime base soils.
Lime/ Recycled Concrete	Is generally as costly and hard to handle as cement but when used with LBS will significantly increase the CBR values over the clay mixtures
Portland Cement	Cement has a major cost factor that many projects cannot afford. It has storage problems and can break down under certain moisture conditions if it is not protected by asphalt or concrete
Asphalt Emulsions	Environmentally unfriendly and does not significantly raise CBR values. It is a cheap use of waste product produced in the processing of oil. It has been banned in several countries.
2001M50 for dust control	Can also be used as a dust control agent with a dilution rate of 25 to 35 to 1 depending on the pore space of the material

La Selva del Camp – Cataluny, Spain – January 2004

1 - Existing road softens and erodes when wet and is prone to potholing resulting in dangerous driving conditions. The road required constant maintenance.

2 - Existing surface is ripped to the required depth with care being taken not to dig too deep as this could result in an uneven layer strength after stabilising.

3 - Offset Disc Harrow used to break down the soil to produce a well grade mix.

4 - 4000 litre constant pressure bowser dispersing water/polymer solution. Speed of vehicle regulated to disperse mixture evenly across the width of the road. It is important to calculate the area that each bowser load will treat as this will enable the mixing process to be implemented immediately. It also ensures that the surface will not dry out too fast between the mixing and compaction phases.

5 - Offset Disc Harrow or alternatively Power Harrow, should be used immediately to mix the polymer/water thoroughly into the treated soil.

6 - Photograph of the road grader, which is used prior to and during the compaction process to create the correct road profile. This is vital to prevent rainwater from constantly lying on the finished road surface as this is the main contributor to the formation of potholes.

7 - Vibro Compaction single drum smooth roller with rubber tractor tyres which has to be driven backwards to remove tyre indentations on the finished road surface. Smooth Vibro roller is preferred.

8 - Ready for surface sealing. Compression test indicated stabilised layer would support 100 tonne load immediately.

9 - Surface sealed with a single pass of the bowser. It is important that vehicles do not drive on the surface during the sealing process. The surface is rolled again, with NO vibration, when the surface is sufficiently dry that it does not stick to the roller drum

International Polymer Soil Stabilising Consortium

SOILBIND

New 2002SS Water Based, Brick/Concrete Paver Sealer

Easy to Apply: With a watering can…you can

AGGREPAVE SOLUTION

IMPORT - or where suitable

Evenly graded 6mm to dust granular stone mix with max 10% dust.

GRIND & GRADE -

Using crusher grinder attached to 260-280 HP tractor with PTO and creep box, 2.8m wide x up to 200mm deep in one operation @ 1 metre/minute to 6mm to dust (90% aggregate – 10% fines – maximum) with cover down and adjustable linkage grading executed in the same operation, maximum depth for AGGREPAVE surface soak solution should be 100mm.

SURFACE SPRAY -

Bowser with 3m drop arm/winged spray bar drawn by tractor (which must have creep box).

ROLL -

8 to 10L concentrate 2001M50 + 12L water ± or use LDC to retain natural stone colour. (Water content adjusted according to moisture content on stone/soil/dust mix.) Where material imported, prior to laying spray base as tack coat to assist retaining surface spray solution.

SURFACE SEAL -

Roll surface or for small areas use "Whacker plate"

TYPICAL OUTPUT -

Apply at above dosage 12 – 24 hours after rolling (drying rate subject to weather)

EXAMPLE -

0.5KM x 3m wide area / 8hr day or 1500 sq m/8 hr day with 2 persons.

TYPICAL DEPTH -

Example of Stone Dust Mix of Screenings passing the Sieve Size below:

90 to 100%	30 to 56%	30 to 43%	10 to 20%	3 to 7%	2 to 3%
8mm	#4 (6mm)	#16	#10	#100	#200

COVERAGE - (per 20L of solution)

25mm on existing concrete surface as repaved surface path, (not to be used on soil sub-base).
50mm on well compacted sub-base light use
80mm on well compacted surface medium use – small cars – driveways
100mm on well compacted surface – cars, light trucks 4x4's
40sq m @ 25mm, 20 sq m @ 50mm, 12.5 sq m @ 80mm, 10 sq m @ 100mm DO NOT EXCEED 100mm THICKNESS
Apply approx. 60% of solution as first spray coat with 40% for second coat.

HOW IT WORKS -

By surface soaking (no mixing in) with the quantity dosage rate as indicated above typically about 40% passes through the stone/dust mixed surface. With a well compacted base will only marginally permeate the surface of the soil, but with concrete it will seal the surface completely.
The polymer coats and binds the aggregate and dust particles to create an open voided slab which allows water to permeate through. Subject to how effectively the polymer has sealed the compacted surface (soil or concrete) will either permeate through or run off, thus retaining the integrity of the base, reducing pot hole formation, and subject to grading also puddles forming on the surface. Drainage for water from the sealed surface below the aggregate should be provided.

AGGREGATE/FINES -

Where existing on site soil and stone mix is suitable for crushing a proportion of the fines/dust would be clay, the clay content should not exceed 5% with the other 5% maximum non clay. A 10%. fines total maximum should not be exceeded. The aggregate: dust mix ration should be 9:1

FINISH -

Where the natural colour is to be retained use LDC as 2001M50 will darken the stone surface. Initial curing is dependent on temperature and wind, typically 5-7 days during which time only light usage should be allowed (no high heeled shoes but spread load). Use walking boards if in doubt. Full cure and maximum strength achieved at 14-28 days. The stability of and durability of any paved surface will be dependent on the supporting sub-base and it is important to ensure that this is will compacted, evenly – and no soft spots remain unattended prior to utilising the AGGREPAVE solution. The AGGREPAGE stone solution must be "contained at the edges prior to compaction.

3.7 Examples of Solar Energy in Havant & Potential for Waterlooville.

Hampshire Natural Resources Initiative

Example of Havant Borough Council
Environmentally Friendly & Affordable Homes

Paul Hemming of Havant Borough Council together with the Parchment Housing Group, Hermitage Housing Association & the main building contractor Speltham are currently completing seven Houses, two Bungalows & two Flats which are both Environmentally Friendly & Economically Affordable.

Each home has Solar PV & Solar Hot Water systems for electricity & Hot water

The Building company Speltham Ltd were appointed the main contractor for the Environmentally Friendly & Affordable Homes. In this exciting development in New Lane in Havant.

Thirty Six Solar
PV Panels on each roof.
&
One Solar Evacuated Tube
Hot Water System
For each home.

Buildings are mainly South facing in order to utilise Solar Gain to it's fullest. Under-floor Heating & Water Capture.
Solar gain in area is
2.8 KWh per sq metre per day

The above examples of Affordable Homes with Sustainable Development criteria at their heart could set a precedence for the Waterlooville MDA and the other 80,000 new build homes to be built in Hampshire over the next decade.

Examples of Solar Photo-voltaic Panels and roofing tiles from BPSolar.

Retrofit to existing Council Housing stock and new buildings installations in each of the MDA's in Hampshire could be possible.

Grants sourced by IMGroup and Financial packages available to HCC and all other Councils in Hampshire from IMGroup.

4 Possible HNRI - Projects

4.1 Project One – Energy Crops Miscanthus Grass & Coppiced Willow Biomass Wood Energy plants

Miscanthus Grass

International Agenda 21 Ltd has been in close negotiation with Hampshire Arable Systems (HAS) – Crop Advisors to Farmers in Hampshire. A series of three meetings have taken place with HAS and two meetings and presentations with Farmers in the North of the County who have shown an interest in growing Energy Crops – Miscanthus.

A total of twenty Farmers have expressed a keen interest, so far in establishing the Miscanthus Grass crop on their farmland and one Farmers has submitted to DEFRA for the Energy Crop Establishment Grant.

DEFRA Establishment Grants – International Agenda 21 Ltd & Bio-Renewables Ltd are able to offer the Farmers aid in obtaining the Energy Crops Establishment Grants available for Miscanthus & Coppiced Willow.

Leasing Arrangement offered by Bio-Renewables Ltd to Farmers

As a further aid to successfully stabling Energy crops in Hampshire and in particular Miscanthus the following leasing arrangement has been enabled by Dr Mike Bullard of Bio-Renewables Ltd.

MISCANTHUS SUPPLY AND PLANTING BY BIO-RENEWABLES LTD
PAYMENT OPTIONS FOR HAMPSHIRE - CONFIDENTIAL

	DOWNPAYMENT	POST-PLANTING PAYMENT	INSTALMENT YEAR 2	INSTALMENT YEAR 3	INSTALMENT YEAR 4	INSTALMENT YEAR 5	TOTAL	
	immediate	05/02/2004	05/02/2005	05/02/2006	05/02/2007	05/02/2008		
IMMEDIATE PAYMENT OPTION	500	1300					**1800**	plus VAT
LEASING ARRANGEMENT	500	420	238	257	277	299	**1991**	plus VAT*

*years 2- 3 costs inflated by 8% compound

PLANTING COSTS INCLUDE
delivery of rhizomes and planting machinery
supply of rhizomes
advice on agronomy
advice on grant application
one trained planting operative
provision of contract materials handler plus operator

Costs relate to area actually planted. Up to 10% of land may be left open ground and still eligible for £920/ha planting grant

FARMER COSTS
provision of tractor driver
provision of one additional planting operative
provision of materials handler and driver
second tractor
sprays
cultivations
post planting rolling

Additional Feed-stocks to Biomass Plant & Increased Financial Revenues

MSW

↓

Integrated Waste Management Plant Resource Centre

↓

Biomass Plant : Gasification – 5MW

Waterlooville MDA & Rushmoor

↑

Waste Wood

Additional

↓ ↑

Energy

+

Waste Oils

Finance

↓ ↑

Hospital Waste

↓ ↑

Addition of some Plastics

↑

Tyres

↑

Energy Crops from local Coppices

International Agenda 21 Ltd and the IMGroup are currently involved with financial negotiations with the Gasification Company Waste-to-Energy Ltd to enable the company to expand further into the Renewable Energy markets place.

Below is the current situation with the company Waste-to-Energy Ltd.

Commercial in Confidence

Potential for Investment in UK Renewable Energy Business

The subject – Waste-to-Energy Ltd Company has been established for over 10 years and is involved in the development and manufacture of waste to energy units which convert waste and renewable sources into usable thermal and electrical energy without emitting any harmful gases or by products. Operation has been proved commercially with plc water and manufacturing companies. Confirmation the process operates within all legislative limits has also been proven in trials in plants operated by Anglia Water plc, and British Leather as authenticated by Scientifics Ltd an independent internationally accredited company.

The company holds significant intellectual property surrounding the design of the equipment and has supplied units to customers that have been successfully operated to safely dispose products as diverse as biomass, sewage waste, leather dyed waste, poultry waste including discarded carcasses, tyres, wood, lignite, packaging waste and many more categories.

NOFF04 Contracts

NOFFO4 contracts may be available for use by Hampshire County Council – sourced by International Agenda 21 Ltd & IMGroup.

The market in which the Company operates is developing very rapidly with active enquires or letters of intent of value between £26m and £50m depending on options chosen. It is well placed to take advantage of contracts that the Government has placed to generate electricity from biomass, for example :

The company has the rights to exploit a specific NOFFO4 contract (non-fossil fuel obligation) offered by the Government that guarantees payment of electricity at £104.70 per MWhr until 2013, more than three times the current price paid for electricity. This project can be implemented immediately because the site has the benefit of planning permission to generate and export electrical power, and the necessary connections are available to connect to the national grid. The company also has options on at least two similar NOFFO contracts producing electricity from biomass.

Risk has been managed by securing the supply of feedstock by contract, securing the income from sales by contract and using technology successfully trailed in Newcastle University, and proven by use on more difficult materials as previously explained. The electricity sales contract has guaranteed prices to 2013 at a significantly higher level than the normal market price for electricity or that are currently paid to recyclable projects. Specifically, £104.70 per MWhr is guaranteed to be paid rather than the £25 per MWhr generally available at current rates. The project is very profitable with payback well within the scope of the contract, showing a minimum rate of return of 18% on capital employed.

ATKINS Power Energy solutions are possible managers and long term operators of the project. Other members of the management team include those with financial and general management experience at plc director level and those with project management experience of the design procurement and construction of 10 petrochemical / oil platforms of value between £70m and £950m.

£2.5m is needed to commence the first phase of this project, of which £1.8m is for the purchase of capital equipment, £0.2m is for project management and £0.5m is for general overhead and contingency. Funding for the balance of 6 1MWe gasifiers that can be provided under the contract will be raised from bank finance following proven operation of the initial unit.

The Order Book

Completion of the first phase of the NOFFO4 project will have the added benefit of securing many sales from a high percentage of enquiries in the pending order book, because purchasers have said they will have the confidence to commit when they see a 1MWe plant in operation.

These sales will yield a profit of 70% on cost.

Enquiries are being stimulated by the growing profitability of this sector being driven by the ever more stringent legislation continuously improving vital economic factors, including:

- New EC legislation to tightening up on landfill disposal regulations and markedly increasing the cost of disposal.
- UK Government incentives to convert waste to energy and the commitment that 10% of UK power must come from renewable sources by 2010 (Kyoto)
- Commercial and legislative pressure to dispose of waste as close as possible to the source of its generation.

High Gate Fee materials

Completion of the first phase of the first phase of the NOFFO4 project will also enable testing to be undertaken to prove that at a commercial scale gasifier units can safely treat hazardous materials including Medical and Clinical Waste (not sharps that can be handled separately). Proof that the units can handle waste of this type at commercial scale will open sales and BOO contacts in this very profitable sector where it is expected profitability yielding rates of return on capital employed of 18% will be the norm.

Applicability of the Gasification Process

The gasification process is ideally suited to the generation of power from waste at it's source in the industrialised world and, because of the inherent simplicity of the process, worldwide in 'underdeveloped' regions including Africa, SE Asia, the Americas etc. Advantage can be taken of the tolerance of the gasification process in the safe treatment of diverse forms of waste to install modularised Gasifier units in remote regions using local sources of waste, thereby making electrical power available to remote regions (often comprising 80% of the land by area) where the expense of diesel fuel for electricity production is prohibitively expensive.

The Gasification process is also ideally suited for the treatment of hazardous materials on a worldwide basis. Taking medical and clinical waste as just one example, it is entirely conceivable that each hospital and supermarket would have a gasification unit providing clean gas for use in the boiler or refrigeration systems, as appropriate.

The Company's expertise is in the design, manufacture and operation of gasifier units that are proven, scaleable and environmentally benign. The company seeks £2.5million to implement the first phase of the NOFFO3 contract, secured against the project income that yields an18% rate of return.

The Company has a business plan for those developers & investors who register a serious interest.

For more information please contact Paul Cope on 07767 775759, and/or
Richard Wright on 07768 007427

4.2 Project Two – Biomass – Wood Energy Plant example for Hampshire

Hampshire – Possible Wood Options

Hampshire County Council had expressed an interest to include wood feedstock for Energy plants in the County and as a result the following is an indication of wood tonnages, costs, revenues and payback for an Biomass Energy Plant sized at 11MW.

Negotiations have taken place with Alan Corson – the marketing Officer for England from the UK Forest Enterprise organisation regarding taking wood as a feedstock from the New Forest area. Owing to the early stage of the HNRI's Renewable Energy programme the wood in the New Forest area is being supplied to other outlets and not for an Biomass Energy Plant.

Below serves once more as an example of the possibilities using wood as a feedstock.

Option 1 **Maximum Production of Electricit**

INPUT

10,000tpa solid wood, 50% dry, is equivalent to 6,500 tpa of wood at 85% dry
30,000tpa wood shavings, 66.7% dry is equivalent to 24,510 tpa of wood at 85% dry
All wood used to produce gas from gasifier / turbine combination.
Each tonne of 15% dry wood produces 1.25MW.
(6500 + 24510) x 1.25 = 38,762.5 MWhrs per annum

OUTPUT : Electricity sales

PLANT REQUIRED

Chipper, splitter, Dryer, Briquetter / ET2 compactor
Gasifier x 5 (at 7446 hours working pa consuming 31,010tpa of wood)
Bio-fuel producing 38,762.5 / 7446 = 5.21MW from the bio-fuel gas
Drying energy uses waste heat and waste oil
One 11MW CCGT, with waste oil burning and the majority of the bio-fuel gas going to the waste heat boiler. (see Notes 2 and 3)

Capex

Chipper - drier system	£1,000,000
Gasifier x 5	£3,800,000
Oil storage and supply system	£500,000
1 x 11MW CCGT (Rolls Royce turbine)	£4,400,000
Civils and buildings, controls, main electrical works	**£1,500,000**
Subtotal	**£11,200,000**
Project management, and engineering at 15%	£1,680,000
TOTAL Project Cost	£12,880,000

Income from bio-fuel and natural gas (Note 2) is 8.38MW x £60 x 7446 availability = £3,744,000 ie £3.7m income pa Income from waste oil being burned in the waste heat recovery boiler would provide at an additional £1.2m.

Opex includes maintenance of the turbine – generator set and an allowance of £22.1 per hour for the turbine natural gas at £165k pa. Opex is £1.25million plus licence fee to cover ongoing supervision of maintenance and operation of £250,000 pa.

Payback: Income £3.7m + £1.2 - Opex £1.25m + £0.25 = income £3.4 million Capex is £12.9m

PAYBACK 3.8 YEARS

Note 1

Alternatively; burn the majority of bio-fuel gas in the waste heat recovery boiler, one 5MW CCGT, operating at 43%, with waste heat boiler producing 11MW required at £4.4 million.

The majority of bio-fuel gas could be burned directly in the (ceramic reactor) inside the Waste Heat Boiler. This is advantageous in that it should not require natural gas 'assistance'. All the gas being burnt in the turbines will have to be enriched. So given only the bio-fuel gas being burnt in the turbine will be enriched to produce 5MW, the amount of bio-fuel consumed would be 1.83MW (being 5 x 5.5/15). The balance of 3.38MW of bio-fuel gas (5.21 – 1.83) would be burnt in the waste heat boiler making 8.38 MW being produced in total.

Note 2.
Natural make-up gas at 0.7pence per kWhr; ie £7 per MW – there are 5-1.83 = 3.17MW per hour costing £22.1 per hour, (but for 11 MW power production)

Note 3

The CCGT can easily produce 11MW by burning an additional 2.62MW (11 - 8.38) of waste oil in the waste heat recovery boiler in the ceramic reactor. The oil would be provided at either no cost, or a positive gate fee contribution, and provide additional income of 2.62 x £60 x 7446 = £1,170,511 increasing income to :
£3.7m + £0.96m - £1.25m + £0.25m = £3.11m, shortening payback to 3.1 years.

Option 2 Maximum Profitability with electricity production

INPUT

10,000tpa solid wood, 50% dry, is equivalent to 6,500 tpa of wood at 85% dry. All used to produce charcoal at 20% and hydrocarbon gases 80% by weight, of 6500 tpa.
30,000tpa wood shavings, 66.7% dry is equivalent to 24,510 tpa of wood at 85% dry
24,510 tpa dry shavings; 13,564tpa used to produce wood logs an 10,946tpa in the gasifiers being (7446 + 3500) and the gas from the gasifier and turbine combination used to make electricity.
Each tonne of 15% dry wood produces 1.25MW
(6500 x 0.8 + 7446 + 3500) x 1.25 = 16,146 x 1.25 = 20,82.5 MWhrs per annum

OUTPUT : Electricity sales, charcoal, dry wood logs (suitable for power stations)

PLANT REQUIRED

Chipper, splitter, Dryer, Briquetter / ET2 compactor
Charcoal maker x 5 (at 6500 tpa / 24 x 365 x 0.85 hrs pa = 0.87 tphr wood with each batch taking 5 hours)
Log makers, x 2 (producing 13,564tpa wood logs)
Gasifier x 2 [Notes; At 7446 hours working. The gasifiers actually consume collectively 10,946tpa from a wood shavings tonnage perspective, with the 'top-up being provided by 5,200 tpa gas from charcoal makers.
Energy for drying is provided by waste oil, (with the option of using bio-fuel gas.)
One 11MW CCGT with waste oil being burned in the waste heat boiler, at £4.4m (see Notes 2 and 3)

Capex

Chipper - drier system	£1,000,000
Charcoal makers and air cleaning	£1,000,000
Log makers x 2 and air cleaning	£1,800,000
Gasifier x 2	£1,600,000
Oil storage and supply system	£500,000
1 x 11MW CCGT	£4,400,000

Civils, building, controls, electrical and grid connections	**£1,800,000**
Subtotal	**£12,100,000**

Project management, and engineering at 15%	£1,815,000
TOTAL Project Cost	£13,915,000

Income from bio-fuel and natural gas (Note 2 and 3) is 5MW x £60 x 24 x 365 x 0.85 availability = £2,233,800 ie £2.2m income pa
Income from waste oil being burned in the waste heat recovery boiler would provide at an additional 6MW x £60 x 365 x 0.85 = £2,680,560m, ie 2.7m. Charcoal income is 20% of 6,500 x £150 = £195,000. Log maker income is 13,564 x £90 = £1.22m.

Opex would include maintenance of the turbine – generator set and an allowance of £22.1 per hour for the turbine natural gas at £165k pa) and charcoal and log maker. Opex is £2.00million plus licence fee to cover ongoing supervision of maintenance and operation of £250,000.

Payback: Income £2.2m + £2.7 + £0.2 + £1.22m = £6.32m
Opex £2.0m + £0.25 licence = £2.25 million
Capex is £13.9m

PAYBACK 3.4 YEARS

NOTES;

Note 1

Alternatively; burn the bio-fuel gas in the 5MW turbine of a 5MW CCGT burning excess bio-fuel gas and waste oil in the waste heat recovery boiler and the dryer. One 5MW CCGT operating at 43% efficiency required at £4.4 million

The total bio-fuel gas needed by the 5MW turbine is 1.8MW (being 5 x 5.5 / 15). This is provided by the gasifiers.) The balance of the 5.0 MW produced by the two gasifiers being used by either the dryers or the waste heat recovery boilers. The waste oil is also used in the dryers and waste heat recovery boilers as required. This is advantageous in firing in both the waste heat recovery boiler and dryer will not require natural gas 'assistance'.

Note 2.

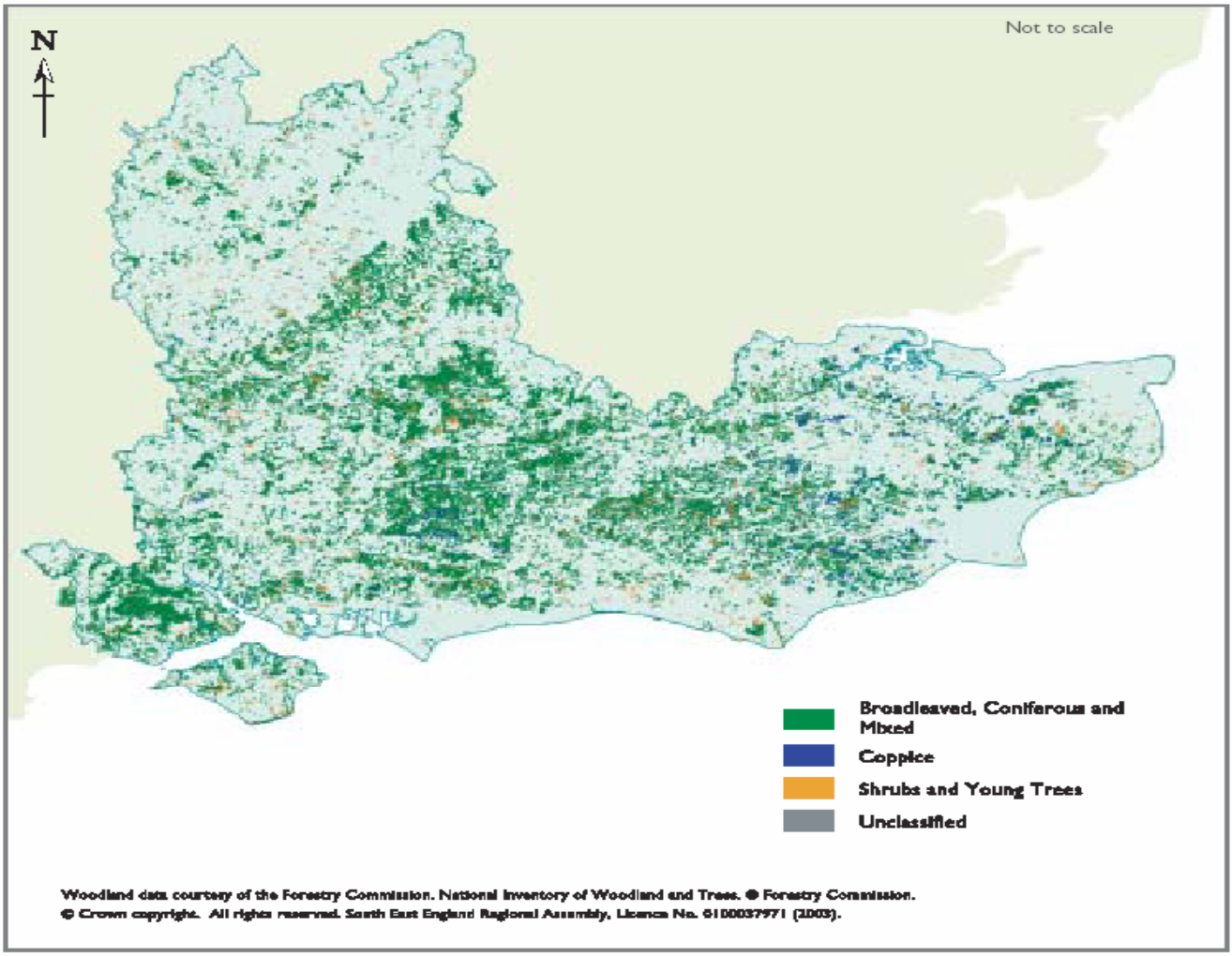
Natural make-up gas is required in the 5MW turbine at 0.7pence per kWhr; ie £7 per MW – there are 5-1.83 = 3.17MW per hour costing £22.1 per hour, (but for 11 MW power production)

Note 3

The CCGT can easily produce 11MW by burning an additional 6MW (11 - 5) of waste oil / boi-fuel gas in the waste heat recovery boiler using the ceramic reactor. There would be no gate fee for the oil, indeed the saving in land fill / treatment charges may result in there being additional income from a gate fee. Additional electricity income arises of 6.0MW x £60 x 24 x 365 x 0.85 = £2,680,560 increasing income to £2.2m + £2.7m + £0.2 + £1.22 minus opex at £2.25m = £4.07m, shortening payback to 3.4 years.

Map 3.2

Existing Woodland and Tree Cover



Woodland data courtesy of the Forestry Commission. National Inventory of Woodland and Trees. © Forestry Commission.
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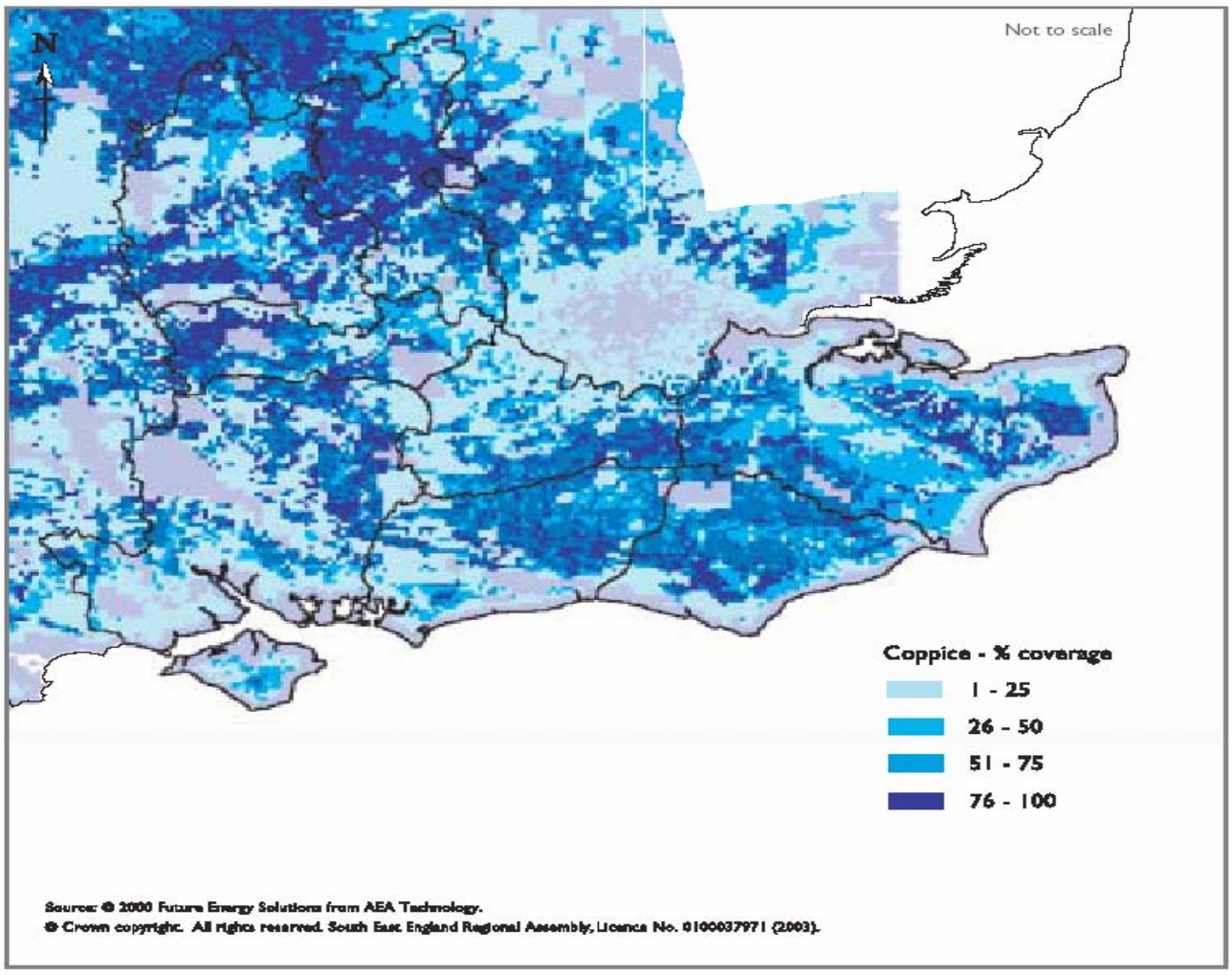
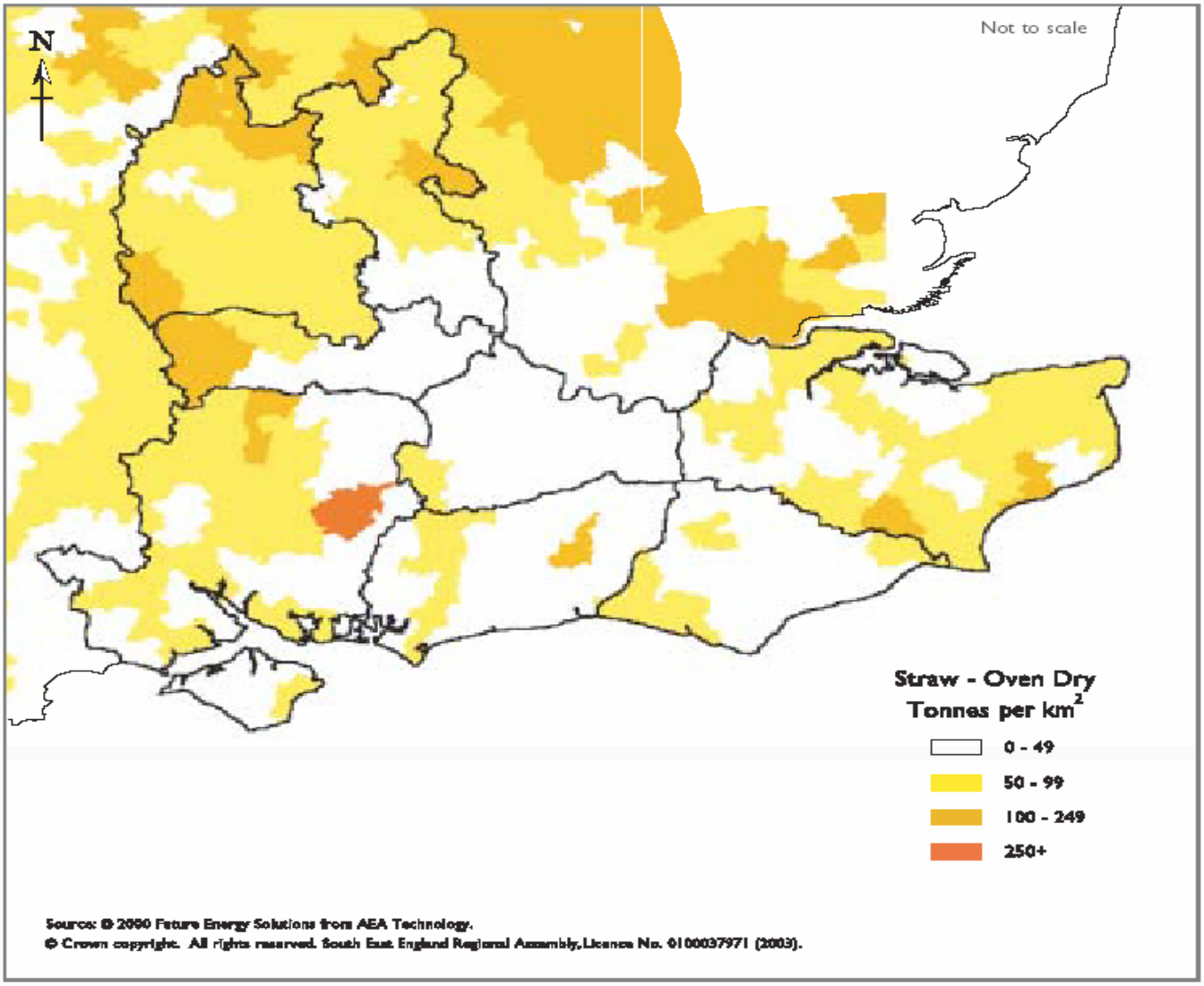
Map 3.3

Technical Potential for New Short Rotation Coppice



Map 3.4

Existing Straw Production



4.3 CASE STUDY SIX - EYE – Biomass Wood Energy Plant Example

EYE ENERGY LIMTED

To serve once more as an aid to HCC & the HNRI the following wood biomass business proposal from Waste-to-Energy Ltd is included in the report as a guide to expected costs, revenues, risks and payback periods from a Biomass Energy Plant.

Example

Waste-to-Energy Ltd
(Gasification Energy plant)

Business Plan for the exploitation
of
Eye Energy Limited

Waste to Energy Limited

December 2003.

Business Plan for the Exploitation of Eye Energy and Reconstruction of Waste to Energy

Contents

Executive Summary

The principals Paul Cope and Richard Wright have combined experience of managing substantial businesses and construction projects. The principals have arranged for Atkins Power to have a supervisory managing role in the business in the construction and operational phases.

The principals wish to enter the sustainable energy and waste to energy sector through investment into a power production business called Eye Energy Ltd. Investment is into a ring-fenced Newco that has income guaranteed by Government contract paying favourable rates for sustainable power produced at the rate of £105 per MWhr index linked to 2013. The business shows a strong return on capital employed.

The business has an additional income stream from sales commission arising from closing sales on the existing order book (£25m+) developed by Waste to Energy Ltd the equipment provider and holder of IPR. Equity can also be held in Waste to Energy Ltd by the shareholders of Eye Energy Ltd.

Commercial risk is managed by the application of best business practises by a highly qualified management team. Income is guaranteed by Government contact and the supply of wood guaranteed by contract. Technology risk is managed by utilising a technology already proven on many more difficult materials as witnessed and tested by independent accredited laboratories.

Future sales opportunities are ensured by the adoption of this sustainable power technology by a British County Council who are creating a 6000 home new-town that meets sustainable energy, recycling and minimum waste targets required by the Government and EU. This town will form a template that will be replicated throughout the County and possibly the UK.

The principals require £2.5 million to achieve the first phase of the £9.8million power generation project. These first phase funds will be used to establish in operation the optimum parameters for the power generation before the balance of 3 units are built. Following operation success of phase 1 the balance of funds required to build out the remaining power generation units should be available from bank sources.

Options exist for investment of into Waste to Energy Ltd where shareholding can be substantially increased by investment of cash in the range £0.5 million to £1 million. The principals recommend investment decisions are made on the basis of the Eye Energy power contract in the first instance because risk is minimised and income guaranteed by Government contract.

1. Summary

This paper sets out the proposal to exploit a biomass energy generation contract until 2013 and reconstruct a major UK supplier of gasifier technology that is capable of making a major contribution to energy generation from the safe disposal of waste.

Project highlights:

Eye Energy Project

- Guaranteed Selling and material purchase costs
- Annual energy sales of £5.5m
- Capital Requirement of £9.8m in two phases £2.5m and £7.9m
- Project IRR 28% on discount rate of 7.5%

Waste to Energy

- Projected 3 year equipment sales of £27.5m where orders are closed following demonstration of the technology at full scale by Eye Energy Ltd. Multiple sales to County Councils probable following the
- Commission to Eye Energy of 5% on sales inclusion by the principals of this technology in a prestigious sustainable energy project.

2. Background – The Company

Waste to Energy (W2E) has been a significant player in the emerging market for sustainable energy, converting waste to energy and alternative methods of dealing with waste in all its forms over the last 10 years. Under the direction of its Managing Director and owner Mike Ling, the Company focused on the gasification process as the method for treating some specialist and difficult waste streams. In developing solutions for the treatment of leather dye waste for British Leather and dried sewage waste for Anglian Water the company has developed considerable know how and intellectual property protected patents on the process.

As the business developed additional finance and expertise was required. Summit Asset Management injected additional capital in 1998 in return for 25% of the share capital. This management team was successful in developing the orders referred to above, but was not able to convert the notified interest into sales due to the immature nature of the market at that time and the absence of a full sized plant.

The business (W2E) has a number of very significant enquiries and has an innovative reputation in the market but has been hampered by a lack of working capital. A Canadian company has expressed an interest in acquiring a stake and investing. In the event their offer has changed and will require Waste to Energy being wound up and the IP being incorporated in a newly floated company in Canada.

An alternative form of funding is sought that will restructure the business, retain the IP and provide a company in the UK that will enable the business to contribute significantly to the UK's drive to meet its Kyoto obligations.

Having looked at the prospects for the business it is believed that the opportunities for future sales have been underestimated and can be accelerated by a successful demonstration unit. In particular Waste to Energy has negotiated rights to export power to the Grid under a Noffo4 contract until 2013 by converting biomass to energy.

3. Background – the Need for this technology

The United Kingdom in common with most of the Western Europe and North America has obligations under the Kyoto agreement to reduce the emission of greenhouse gases and produce 10% of their power consumption from sustainable energy sources.

In addition the United Kingdom is running short of land fill sites. The materials being placed in those landfill sites are becoming increasingly closely controlled by ever stringent legislation as the environmental implications of the cocktail of materials being landfilled are becoming more appreciated. The UK land fill tax is set to increase in the next years as the full cost of disposal is appreciated and the adage of the "polluter pays" takes effect.

Technology to dispose of waste and achieve sustainable power has not been commercially competitive in the United Kingdom due to the widespread simple and cheap option of burying the problem, and to the lack of interest and commercial incentive in disposing of material in an environmentally safe manner.

As environmental awareness is increasing, the obligations from Kyoto become clearer and the key dates nearer the economic realities are becoming part of the way of doing business, so the commercial opportunities for safe disposal methods and production of sustainable energy emerge. The Government have acknowledged the requirement for technologies to be proven and have through the NOFFO scheme underwritten the price of electricity to a minimum of £105 per MWhr, fully five times the commercial rate. This technology, already proven at one third scale is in prime position to exploit the commercial opportunities that will explode in the next five years by being the technology of choice for the production of sustainable energy and the safe disposal of organic material.

4. Background – the Process

This technology is Down Draft Gasification and is capable of meeting the environmental challenge because of it's ability to be appropriately scaled, and its proven profile for low emissions that meets all standards and can dispose of a variety of wastes. In summary, the plants :

a. can be sized so as to meet the profile of the waste,
b. are unlikely to be subject to planning objections raised by other disposal processes and
c. given output is fuel gas rather than hot combustion products do not have a chimney and have no visible "exhaust – waste plume".

The unique and critical aspect of gasification is that the level of air entering the chamber is strictly controlled and the solids give off their gases without combustion. The gases are then passed through a patented vortex core at a temperature of 1,200°C and extended throat at temperatures between 400ºC and 1000ºC where they are cleaned of any tars and oils. The tight control on air supply (oxygen) prevents the formation of dioxins and ozone depleting gases making gasification the ideal environmental solution.

The produced clean gas has a calorific value of about 5,000 kilojoules per cubic metre and can be passed into a combined heat and power unit for the production of electricity and hot water.

The process efficiency is in excess of 90% and even though the temperatures at the core of the reactor vessel are 1200°C the outer surface of the gasifier remains cool, <80°C.

5. Background - The Energy Market and Eye Energy

April 2002 saw the launch of two environmental markets in the UK. On 2 April, the voluntary UK Emissions Trading Scheme became operational which promised to provide much needed experience in trading greenhouse gas emissions in advance of international trading in 2008 under the Kyoto Protocol.

UK power companies faced a more immediate challenge having to meet the mandatory Renewable Obligation which required them to present a number of Renewable Obligation Certificates (ROCs) to the regulator, at the end of the financial year. This states the percentage of their output supplied in that year from renewable sources.

Renewable obligations were aimed at bringing green energy online quicker than would otherwise happen by incentivising renewable generation. Regulators are looking to tradable 'green certificates' as a measure of compliance with these obligations. Renewable power generators earn these certificates – ROCs in the UK – in line with the amount of power that they produce.

The Renewable Obligation for 2003 is 4.3% and rises to 4.9% of total energy by 2005, thereafter increasing annually to 10.4% in 2010, and set to remain in place until 2027.

Aside from the ROC system, the Government has encouraged the development of technologies to produce sustainable power by issue of the NOFFO4 contracts (non-fossil fuel obligation) that guarantees payment of electricity at £104.70 per MWhr index linked until 2013, more than five times the current price paid for electricity. The Eye Energy project exploits the benefit of a NOFFO4 contract by profitably proving the full scaled gasification plant in operation. It is planned that a separate business (Eye Energy) will be formed to exploit the contract and started immediately, Planning permission to generate and export electrical power has already been obtained and the necessary connections to the national grid are also available.

The supply of feedstock has been secured by contract, and the technology successfully trialled in Newcastle University, and proven by use on more difficult materials as previously explained.

6. Competitive Products

In the UK, a number of Companies are involved in the early stages of developing gasification processes. Notable gasification processes include:

a. Compact Power: an operational Advanced Thermal Process (ATP) in Bristol treating 8,000 tonnes per annum of difficult waste from the Municipal Waste Stream. The plant went on-line in February 2001. The design was based on a full scale Pyrolysis plant that operated at Severn Trent's Finham facility between 1994 and 1997.

b. IET Energy: are building a Entech Gasification plant (US designed) in cooperation with Viridor Waste Management in Weston-Super-Mare, Somerset.

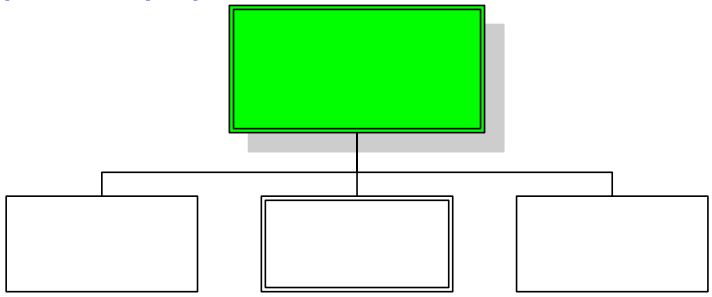
c. Waste Gas Technology: Developing gasification system with waste to energy and bioenergy applications - Fair Oak,.

Proposed Structure of the New Company

It is proposed that Eye Energy Ltd be formed to generate electricity under the Noffo4 contract referred to above and enable trials to be completed for hazardous waste processing. This will in turn generate further sales in the Hazardous Waste sector. Eye Energy Ltd, will receive 5% royalty from Waste to Energy gasifier sales.

The injection of £2.5 million of equity funds will provide sufficient funding for phase 1 of the Eye Energy Project and attract 25% of the available share holding.

The proposed company structure is shown below:



HCC & HNRI might consider being shareholder via funding arranged by IMGroup to ensure long-term revenue streams from a similar project.

7. The Strategic Importance of the Eye Project to the future of Waste to Energy Ltd.

The Eye Energy Project is not only a profitable and sustainable project in its own right, but also provides a lifeline and showcase for the technology designed and manufactured by Waste to Energy Ltd. It is therefore vital to building a lasting position in the sustainable energy business for the Waste to Energy business.

The Eye project will be an excellent reference site for Waste to Energy technology as well as proving a test base to trial alternative materials. This will assist the develop the technology to treat more difficult fuel sources such that it can benefit from the higher gate fees and ROC fuel prices paid for the disposal of such materials.

8. Adding Additional Value

In addition to the W2E prospects outlined in the attachments we have worked towards a commitment from Hampshire County council to have gasifiers from W2E incorporated in their prestigious and showcase self sufficient housing estates under the Agenda 21 initiative.

9. Manufacturing of Units

Waste to Energy Ltd (W2E) has in the past utilised the services of a local manufacturer which the principals believe has not helped to lower manufacturing costs. As a consequence W2E has found it difficult to make money on the orders that it has been able to attract. The principals will ensure that manufacturing for the Eye Energy units will be shared with other reputable suppliers capable of meeting standards and through the process of competition lower the cost base as estimated by W2E.

Eye En

33%

33

10. Management Team support

The Management team of Eye Energy comprise Paul Cope, Richard Wright and Atkins Power, assisted by the W2E technical team of Mike Ling, the founder and designer of systems and assisted by Dr Malik from Newcastle University. Dr Malik has considerable knowledge and experience of the capability of gasifiers and electrical generation. Summit Asset management will provide commercial and financial advice where appropriate..

Eye Energy will be constructed so as to benefit from professional engineering input assisted by W.S.Atkins who will act in a project management and technical advising role during project implementation and throughout the operational phase. It is proposed that Paul Cope will be the Managing Director and handle commercial aspects for Eye Energy and W2E Ltd Richard Wright will be the Technical Director coordinating optimisation of the process and trials and demonstrations to prospective purchasers.

11. Business Plan Assumptions

Eye Energy

a. Phase 1 of the project involves a single gasifier with two supporting gas engines capable of producing 1.6MW to the grid.

b. Phase 2 costs include in built contingencies to cover the addition of infra structure costs that in the event may be unnecessary.

c. Contingencies have been included for labour and management.

d. All engines will be supplied from the recognised leader in the field and come with a guarantee of performance from the manufacturer and full maintenance contract. The model contains maintenance allowances in each phase of the project.

e. Labour costs include allowance for 5 shift systems with sufficient labour.

12. Financial Summaries

a. Eye Energy Capital Summary
b. Single Eye Energy Unit – Phase 1 - Profitability and Cash Flow
c. Next 3 Eye Energy Units – Phase 2 - Profitability and Cash Flow
d. Total Eye Energy Project - Profitability and Cash Flow
e. Eye Energy - First 12 months of trading
f. Waste to Energy Machinery Sales Prospects 2004 – 2006
g. Eye Energy plus W2E commission 2004 -2006 - Profitability and Cash Flow

13. Background Information

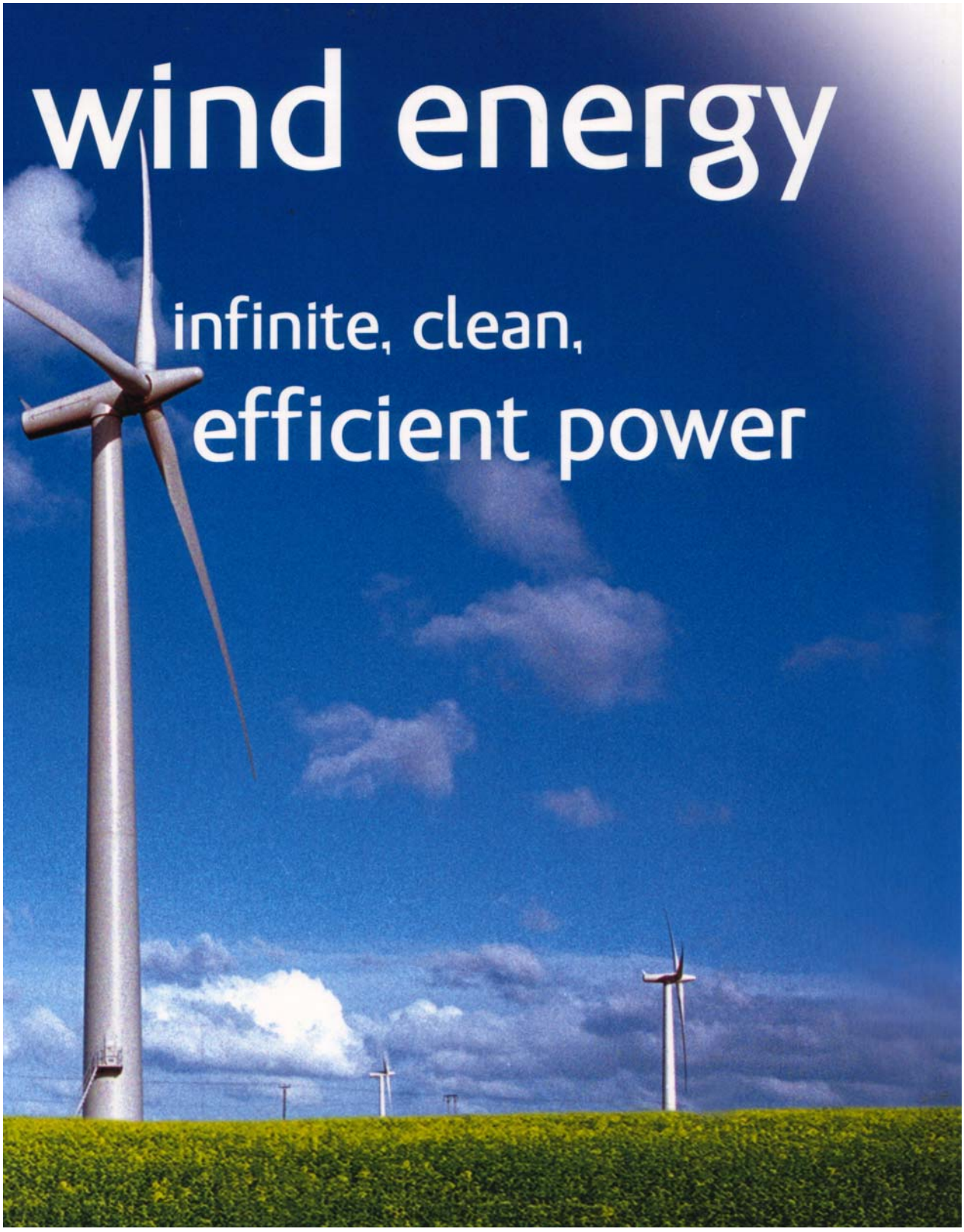
a. Waste to Energy Business Plan as submitted
b. Letter from International Agenda 21 Ltd

Eye Energy Capital Summary

Major items only

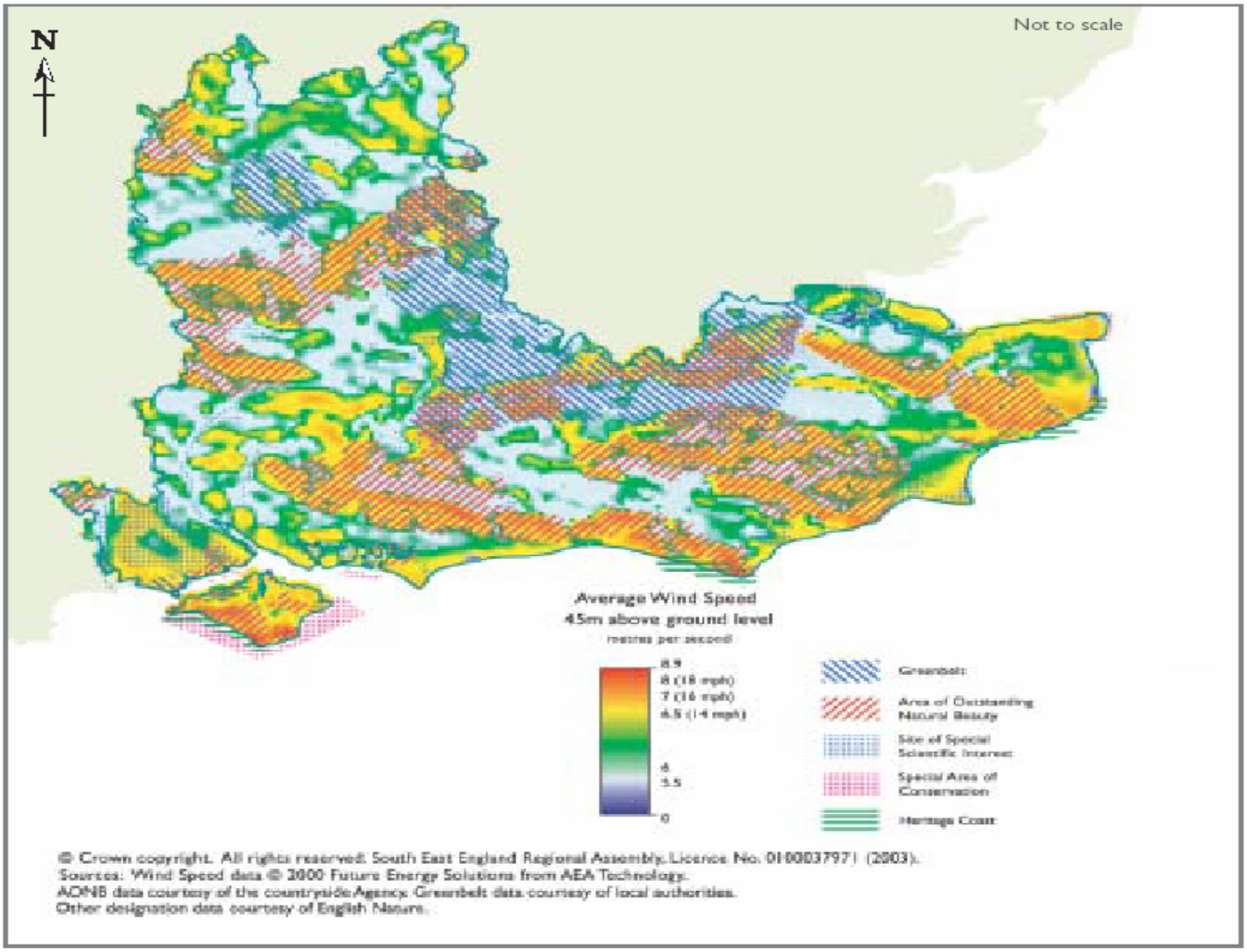
Phase 1				
Description	Quantity	Supplier	Unit Cost	Total Cost
1.6MW Gasifier	1	Waste to Energy	£400k	£400k
Gas Eng Generator	2	2 x 800KW Jenbacher	£400k	£800k
Contingency			£185k	£185k
		Total		£2,078k
Phase 2				
Description	Quantity	Supplier	Unit Cost	
1.6MW Gasifier	3 (4 in total)	Waste to Energy	£400k	£1,200k
Gas Engine Generator	6 (8 in total)	Jenbacher	£300k	£1,800k
Control room	1		£350k	£350k
Contract fee			£840k	£840k
Civil works			£425k	£425k
Connection costs			£500k	£500k
Project Management			£400k	£400k
Export heating			£300k	£300k
Contingency			£700k	£700k
		Total		**£7,878k**

4.4 WIND ENERGY



4.5 Average Wind Speed Plus Key Environmental Designations Map

Map 3.1
Average Wind Speed Plus Key Environmental Designations



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Sources: Wind Speed data © 2000 Future Energy Solutions from AEA Technology.
AONB data courtesy of the countryside Agency. Greenbelt data courtesy of local authorities.
Other designation data courtesy of English Nature.

4.6 PUBLIC ATTITUDES TO WIND FARMS

social research

Research Findings
No.12/2003

Energy Policy Unit

General Research

Public Attitudes to Windfarms

MORI Scotland

In February 2003, MORI Scotland was commissioned by the Scottish Executive to conduct survey research among people living close to Scotland's operational windfarms. A total of 1,810 adults aged 18+ were interviewed by telephone between 27 February and the 18 March 2003. All respondents lived within a 20 km zone of the 10 operational windfarms that have 9 or more turbines. The survey obtained results that are representative of people living within three zones (up to 5 km of a windfarm, 5 km to 10 km and 10 to 20 km), and are representative of people living within 20 km of each of the ten windfarms.

Main findings

- People living within 20 km of a windfarm like the areas they live in, mentioning the peacefulness (28%), scenery (26%), rural isolation (23%) and friendly people (20%) as particular strengths. When asked to say what the shortcomings are, most commonly mentioned are a lack of amenities (20%), poor public transport (18%), and lack of jobs (8%).

- Unless prompted to do so, people who live within 20 km of windfarms rarely mention the local windfarm, if asked to describe the positive or negative aspects of living where they do. Five respondents in the survey spontaneously mentioned their local windfarm as a negative aspect of the area, and two mentioned it as a positive aspect.

- Three times the number of residents say that their local windfarm has had a broadly positive impact on the area (20%) as say that it has had a negative impact (7%). Most people feel that it has had neither a positive nor a negative impact.

- People who lived in their homes before the windfarm was developed say that, in advance of the windfarm development, they thought that problems might be caused by its impact on the landscape (27%), traffic during construction (19%) and noise during construction (15%). By comparison, since the windfarm development, only 12% say the landscape has been spoiled, 6% say that during construction there were problems with additional traffic, and 4% say there was noise or disturbance from construction traffic.

- There is substantial support for the idea of enlarging existing windfarm sites among those who live close to them, particularly if the increase in the number of turbines involves the addition of no more than 50% of the existing number. A majority (54%) would support an expansion of their local windfarm by half the number of turbines again, while one in ten is opposed (9%). Support drops somewhat if the proposal is to double the number of turbines. In this case, four in ten would be in favour (42%) and one in five (21%) would be opposed.

Visibility of windfarms

Just one in eight people who live within 20 km of a windfarm can see the turbines from their homes (12%), and one in five say that they never see the turbines (20%). For those who live closer to the windfarm site, the turbines are more visible. For example six in ten (63%) of those who live within 5 km of their local windfarm site can see the turbines from their homes.

Of those who do see the turbines, few say they can see them all the time (12%), although this is more common for those that live within 5 km of the sites, of whom 58% say they can see the turbines all the time.

Many of those living within 20 km say that they see the turbines when travelling on local (45%) or major (48%) roads.

Attitudes towards the area

Most people who live within 20 km of a windfarm rate their area as either 'very good' (50%) or 'fairly good' (42%). They like the peacefulness (28%), scenery (26%) and rural isolation (23%). The drawbacks mentioned by respondents are the lack of amenities (20%) and poor public transport (18%). Only seven respondents spontaneously mentioned their local windfarm as either a negative or positive aspect of the area.

Overall impact of windfarms

People are three times as likely to say that they feel that their local windfarm has had a generally positive impact on the area (20%) as they are to say it has had a negative impact (7%). Many hold mixed views (51%), or express no opinion at all (22%). People living within 5 km of the local windfarm hold the most positive views, with 45% saying that they think the overall impact has been positive, and 6% saying they think it has been negative. Those living between 5 and 10 km of the windfarm share a similar opinion, with 43% saying the windfarm has had a positive impact and 6% saying it has been negative.

Anticipated, and actual, impact of windfarms

Respondents were asked to think back to their views prior to the construction of the windfarm, and to say whether they had anticipated certain specific problems as a result of the proposed windfarm. Three quarters of people living within 20 km of a windfarm say that they were resident when the windfarm was developed. Of these people, around half (54%) say that they did not anticipate problems with any of the issues. On the other hand, 27% thought the landscape might be spoiled, 18% thought there might be extra traffic during construction, and 15% thought that construction might cause noise or disturbance. One in eight (12%) thought there might be damage to plant or animal life or that there might be noise from the turbines.

Asked to comment on the extent to which each of these issues had actually been a problem, eight in ten say that none has (82%), while one in eight (12%) says that the landscape has been spoiled, 6% say that there was extra traffic during construction, and 4% say that construction caused noise or disturbance. Those living within 5 km of a windfarm are no more likely to say that these issues have been problems.

Information provision

People within 20 km of the proposed windfarm recall getting information about the proposal from local newspapers (40%), but many do not remember getting any information at all (37%). People living closest to the windfarm, within 5 km, are just as likely to say they got information from the local newspaper, but are more likely than others to say they got information from the local authority planning office (13%), a public meeting (12%) or by word of mouth (11%).

Suggestions for methods of communication and consultation for any future windfarm proposals include the use of local newspapers (43%), household delivery of leaflets (33%) and public meetings (29%).

4.7 CASE STUDY SEVEN - *Spurnes*-Orkneys

Executive Summary

Opportunity & Process

Hampshire Wind Energy Ltd ("HWEL") - a special purpose vehicle could be established by Hampshire County Council, Hampshire Natural Resources Initiative (HNRI), International Mercantile Group (IMG),Your Energy Ltd ("YEL") and Project Management Support Services Limited ("PMSS") to hold the assets of turbine wind farm projects in Hampshire and to raise funding for each Wind Farm development proposal.

The Major Development Area (MDA) sites should include Wind Turbines as part of the demonstration of Renewable Energy in future Hampshire developments, which must be successfully developed with completed planning consent and grid connection agreements in place. Tenders for the Turbine Purchase Agreement, Civils / Balance of Plant and Power Purchase Agreement will also be required and are under negotiation with Powergen PLC.

Planning consent will be sort for wind turbines, initially in the Waterlooville MDA Area and the Rushmoor MOD land development, there may be a current capacity constraint under the grid connection offer, the current optimised scheme design is therefore two to three turbines in the Waterlooville MDA. It is anticipated that future grid reinforcement works may enable the current capacity constraint to be lifted and hence the future value of a fourth wind turbine consented site should be considered in any offers made along with unrestricted output from the first three turbines.

The smallest wind turbines in serial production you can order right now are 750-800kW capacity. One of these would produce enough electricity to power 500 homes. To power 2000 homes, you would either need 4 of these, or have 2-3 turbines rated at 1.5MW.

Wind Speeds in the Waterlooville area are approximately 4 to 5 m-s. For the larger 1MW Wind Turbines the ideal wind speed is between 7 to 15 m per sec.

Project Overview

Wind data must be gathered for the projects and will need to be independently analysed resulting in a predicted long-term average wind speed for the project in "x" m/s at 60m (hub height).

To serve as an example a 10m/s wind speed indicated in a YEL & PMSS Scottish Wind Farm development project in *Spurnes*-Orkneys an annual output of 31GWh p.a. is expected under the existing grid constraint of 7.5MW. (Note: 3 x 2.75MW machines restrained to 7.5MW). When the fourth turbine is enabled, it is anticipated that the total site will be 11MW (4 x 2.75) unrestrained which would yield a gross annual production of approximately 45GWh p.a. The wind speed for any Wind Turbine development in Hampshire will be significantly below that of the Spurnes Wind Farm development.

1.1 Key financial indicators (Estimated)for the Spurnes project – to serve as an example of revenues.

Note: All numbers are £000 unless otherwise stated and a discount rate of 8% has been applied to an all equity model.

Operational years	5 yrs	10 yrs	15 yrs	20 yrs	25 yrs
Project NPV (real)	(745)	1,816	3,903	5,481	6,473
Project IRR (real)	3.6%	14.3%	17.5%	18.5%	18.9%
Cumulative nominal cash flow	1,286	7,673	16,501	27,405	38,603

	Years
Simple payback	4
NPV breakeven	7

Programme Spurnes Overview

	Development	Construction
Estimated Completion Date	Dec 03	Sep 04

Contact Details

All enquiries & formal offers (refer to instructions in section 2.4) should be sent to:

Alan Chivers
PMSS Limited
43 Rownhams Lane
North Baddesley
Southampton
SO52 9 HR

T: 02380 741211
F: 02380 741211
E: alan@pmss.co.uk

HCC & HNRI Opportunity & Process

Market Background

In April 2002 the UK Government introduced legislation, which enforces the Renewables Obligation on all licensed electricity suppliers. The Renewables Obligation requires electricity suppliers such as Powergen PLC to progressively increase the proportion of their electricity sourced from renewable resources toward 10% in 2010. Although no targets are set down beyond this date, the Renewables Obligation extends to 2027 and current aspirations are for a target of 20% by 2020. The Office for Gas & Electricity Markets ('OFGEM') will penalise suppliers that fail to meet their annual targets at a rate of 3p/kWh (index linked at rpi) that is not supplied by green energy. Significantly these penalties are not held by Government but returned to the electricity supply companies in accordance with their relative performance against the obligation. In essence a supply business falling below the average performance of the industry will be forced to compensate its competitors who have performed above average every year between now and 2027.

Acquisition of HWEL and / or its associated Project Assets

Hampshire Wind Energy Ltd ("HWEL") could be a special purpose vehicle which is to be established by Your Energy Ltd ("YEL") and Project Management Support Services Limited ("PMSS") to hold the assets of a four turbine wind farm project at Waterlooville & Rushmoor MOD development.

The sponsors / shareholder companies will have to successfully develop the sites and receive planning consent in 2004 and a grid connection offer between April - June 2004. The sponsors / shareholder companies will pursue all other key project documents and obtain offers for the Power Purchase Agreement ("PPA") from Powergen PLC, Turbine Purchase Agreement (including wind-farm electrical infrastructure) ("TPA"), Consultancy Agreements and the Civils Contract. These offers along with the wind data collected demonstrate the value that has could be created.

The future value of three or four consented wind turbine sites should be considered in any offers made along with unrestricted output from the first two wind turbines.

Offers may be made as cash payments (immediate or deferred), earnouts / royalties, retained equity or a combination thereof.

It should be noted that the IMGroup sponsors / shareholders have a preference for cash payments and offers will be considered in light of this preference.

4.8 Hampshire Wind Turbines - Project Overview

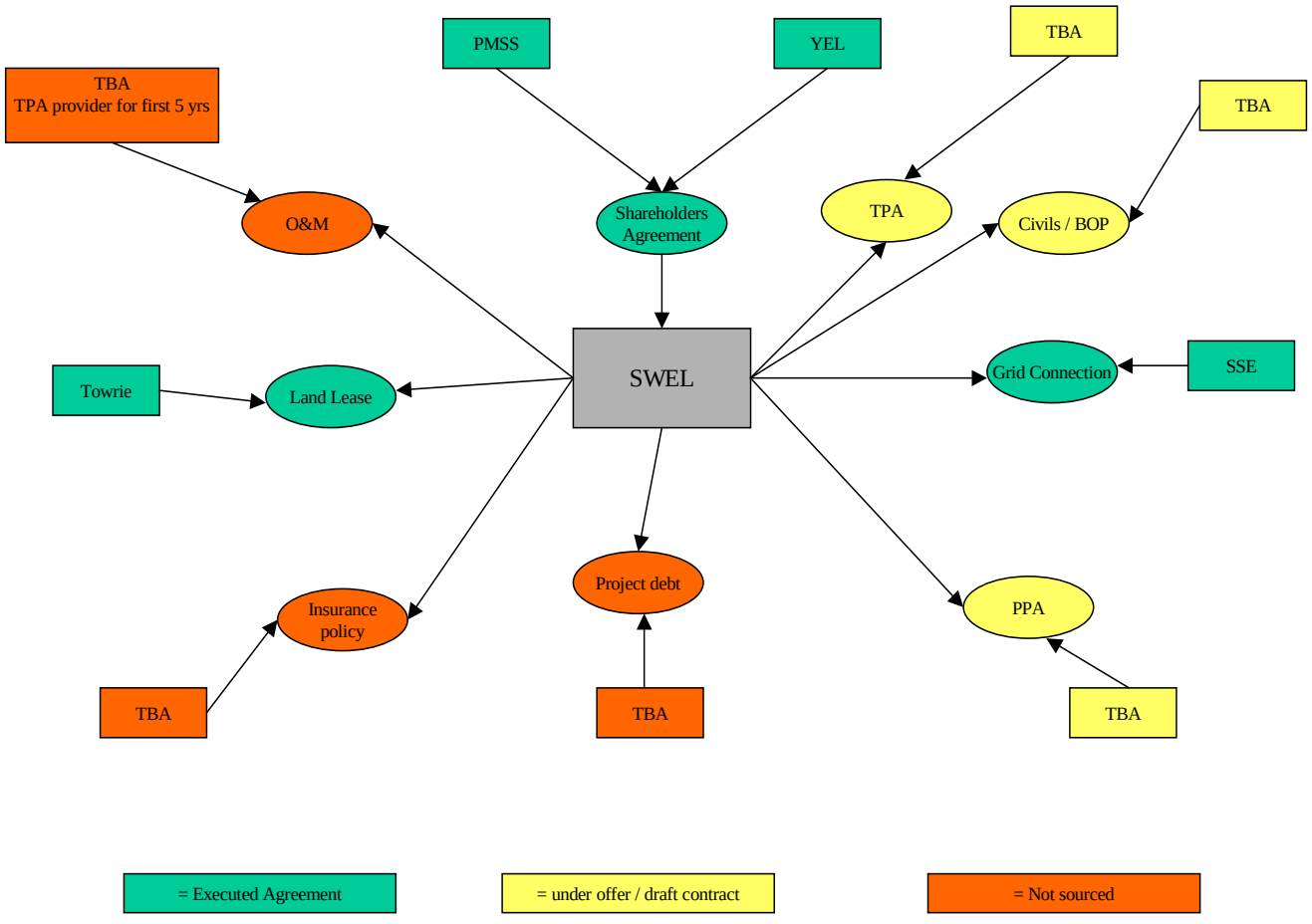
Project details

The project could be located on the Farmland adjoining the Waterlooville MDA & Rushmoor MOD development sites.
The Waterlooville site lies within an area controlled by Winchester City Council and also on the boundary of Havant Borough Council, which is the planning authority that has awarded consent for the MDA project.

Although the planning consent has been awarded in respect of Housing, no application has yet been submitted for between two & four wind turbine locations.

HWEL – Waterlooville & Rushmoor Proposed structure could follow that indicated below:

Diagrammatic overview of the current the Scottish - Spurnes-Orkneys Project Structure



Development Team

The Wind projects in Hampshire could be developed by the HNRI Consortium - HWEL, HNRI, IMGroup, Your Energy Ltd and Project Management Support Services Limited.

HWEL to be formed if agreed to by Hampshire County Council & HNRI.

HNRI formed in September 2001 – Hampshire Natural Resources Initiative – Trust – non-profit making.

Your Energy was formed in 2001 by a team of power industry professionals that between them have developed and constructed six wind farms across the UK. The multi-discipline team is actively developing an extensive wind energy portfolio across the UK.

PMSS - Project Management Support Services was established in 1996, and is an independent consultancy providing services in project and construction management, feasibility and due diligence, design and health & safety for onshore and offshore wind farm developers & contractors in the UK and overseas. They have been involved in the successful delivery of over twenty wind farms, and are currently providing managerial support to 2 offshore and 3 onshore wind farm construction projects.

IMGroup – Consortium formed from June 2001of over twenty six Environmental Companies and Environmental Project Funders to offer assistance to HCC & HNRI.

Hampshire Project plan

The critical success factors for compliance with the programme are:

1. Planning application made as early as possible and IMGroup - Financial Close two months after planning agreed or earlier allowing advance order placement of the WTG foundation embedments required on site one month after financial agreements from IMGroup for WTG Foundation construction. WTG suppliers confirm that short delivery timescales on embedments possible.

2. Planning Condition requires that construction of roads, hardstandings and WTG foundation bases to be performed outside of any Bird Breeding Season. Refer to Section 8 of this IM titled “Planning Conditions” for further information.

3. Turbine manufacturer has confirmed no major technical concerns with the construction of the project.

4. Arrangements for transportation and offloading of WTG components should be made with HCC and Winchester City Council – in the case of the Waterlooville MDA.

Timely completion of the SSE grid connection works (contract delivery 12 to 16 months from start date).

Risk Analysis and Management

Project Risk Insurance will be put in place by IMGroup to minimise any risk to HCC & HNRI

As the project must gain planning consent, once obtained the vast majority of development risk will have been removed from the project. The major risks from this point forward are:

1. Delay in completion of the construction programme – the construction programme may be impacted on by the poor weather conditions and any bird breeding season (April – August) during which no ground works can take place.

2. Operating costs greater than budgeted – a long term O&M position has not been negotiated though 5 year fully inclusive warranty and O&M terms have been included in the bids from the turbine suppliers. There are active local O&M Contractors operating in Hampshire, who have expressed a long term interest in the O&M of the project – initial contact has been made.

3. Project revenues overestimated – anemometry data and correlation is strong indicating good assurance over long term production. However, beyond the12 year term of the indicative PPA offer the project would be exposed to regulatory risk and a change in revenues enacted by the Government.

A full risk analysis table is included in Schedule 2

Contractual Arrangements

A table summarising the contractual position of the project is attached as Schedule 1. The below commentary identifies the salient points.

Review of critical path contracts / agreements

The critical path for delivery of an operating project is currently determined by the Grid Connection offer.

The construction programme will also be impacted by the planning condition that no groundworks can take place during April to August to allow for the bird breeding season. It is therefore imperative to mobilise the ground works early at the start of a year or after August 2004.

Review of other key contracts / agreements

The land must be secured if from a private owner and secured under a land option and lease for 25 Years with an option to extend for a further 25 years.

Tenders will be required and received for the following key project contracts and are under detailed review / negotiation:

- PPA
- TPA (Including Electrical infrastructure)
- Civils
- Consultancy

The remaining key project contracts / agreements which need to be negotiated are:

- IMGroup - financing agreements
- IMGroup - insurance
- O&M (beyond 5 yr warranty period offered by turbine suppliers)

Technical Review

Technical overview

The Project will have a maximum export capacity for example Spurnes Project - 7.5MW at 33kV as per the Grid Connection Offer. Planning Permission must be gained for two or four turbines - positions with an envelope dimension of 60m hub height and 80m turbine rotor diameter. The turbines may have internal or external transformers, if external allowance is made for GRP housing. During tendering it was found that the most economically advantageous project was using 3 off turbines of 2.75MW capacity.

It is possible to limit the output of the wind farm to comply with the grid export capacity of 7.5MW by active power management of the turbines. If it was required that the turbines are returned to their full rating on a seasonal basis or at some time when the grid conditions improve, this can be done very easily. The turbines short listed are equipped to comply with the National Grid Code.

The turbines will be connected via HV electrical cables in series, with the most northerly turbine being connected to the SSE compact GRP substation located close to the existing 33kV overhead line crossing the site. The SSE substation will contain the utility 33kV metering circuit breaker and associated equipment (including the meters). On other Hampshire based wind energy projects, the meters will be enclosed in the switchgear control room with access gained by the SSE meter operators. Arrangements can be made with SSE for witnessing meter readings.

Either included within the SSE substation, or directly adjacent to it, or within the closest wind turbine will be housed the wind farm “load make fault break” isolation and earth switch in a suitable housing. Further details of the wind farm electrical system specification can be found in the Turbine Purchase Agreement Specification.

The wind turbines will be erected onto site specific designed foundations of the mass reinforced concrete concept. The ground conditions at the site are ideal with rockhead located close to the surface allowing an economic design. All rock/stone excavated during the turbine bases construction will be used in the hardstanding and track construction for the project. Additional stone required will be either trench excavated alongside the track.

All civil and structural engineering design has been performed by local Civils and Structural Engineer, who have performed similar roles on at least 3 similar wind energy projects in the UK over the last 5 years.

The specification for the wind farm electrical system will be designed by Electrical Engineers who have extensive experience in wind farm electrical design.

Key components

Wind Turbine Generators supply contract includes for the design and installation of the wind farm electrical system as well as the specification, design, manufacture, supply, delivery, installation, supervision, completion, commissioning, testing and making good of Wind Turbines and Ancillary Equipment. The contract allows for 5 year Warranty and Operation and Maintenance.

Plant operating parameters

The WTG Contractor will Operate and Maintain the WTG’s and Wind Farm HV Electrical System for a period of 5 years from Taking Over.

Comparable projects

There are many similar projects in the UK, two of which are situated at Burgar Hill on the Mainland, namely Sigurd (N60 1.3MW Nordex Turbine) and Thorfinn (NEGMicon 1 x NM72 1.5MW and 1 x NM92 2.75MW) and the third situated on the island of Stronsay called Rothiesholm Wind Farm (3 x GE900s 900kW). PMSS were the Project Managers and Planning Supervisors for Sigurd and Rothiesholm construction and therefore have unparalleled experience managing remote island wind farm projects. YEL staff were the development managers on Sigurd & Rothiesholm and are well versed in the specific issues applying to these projects.

Anemometry

A 40manemometry mast will need to be erected in Spring 2004 on the location of Turbine 1. Measurements of wind speed will be taken at 40m, 30m and 10m and wind direction at 38.5m and 18.5m. At the request of any aviation bodies a high intensity aviation light will be installed, below the sensors, at the top of the mast. This is powered via a solar panel and Marlec wind generator.

An independent wind resource and energy yield assessment has been commissioned by HCC Environment Strategy Team pr whereby the data will correlated with long term records from the nearest Met Office. The report has still to be commleted.

The assessment will predict the long - term annual mean wind speed at 40m as"x" m/s. At the consented hub height of 60m the long - term annual mean wind speed should also be predicted to be "x"m/s.

Annual energy yield predictions should be produced for a range of wind turbines, including a tabulation of assumptions and losses. They should be based upon all four consented bases being utilised by the development, with no constraint on grid connection. For the purposes of this Information Memorandum this figure has been adjusted in the attached financial model to reflect the use of three of the consented positions and with a grid constraint capacity of 7.5MW.

Planning and Environmental Considerations

Planning Conditions

To enable HCC & HNRI to determine timescales, the Spurness Wind Energy Project gained consent on 15th January 2003 by Orkney Islands Council.

The decision was subject to the satisfaction of 27 planning conditions. Some of these require satisfaction prior to construction commencing on site, others relate to the construction process and long term site operation and decommissioning.

Unlike other wind farms constructed in the Orkneys, the developer has not been asked to produce a financial bond to the council to cover decommissioning of the scheme in the event that it was no longer operational.

A full planning consent and conditions should be made available, however we draw attention to the following terms and conditions:

Condition 1: The consent granted is for a period of 25 years from the decision notice.

Condition 2: An archaeological watching brief is required during construction.

Condition 3: All households within 10km to the north east of the development must be contacted within 12 months of the last turbine becoming operational to determine if there has been a deterioration in television signal. (Historically on other projects, this has been ameliorated by digital reception at the affected households).

Condition 4: Each of the wind turbine nacelles and the monitoring mast shall be fitted with a 360 degree medium intensity fixed red light to become operational immediately upon erection of each structure.

Conditions 5: Prior to the commencement of the development a full and detailed methodology for a noise monitoring scheme (in accordance with the DTI Noise Working Group) shall be submitted to and agreed with the planning authority.

The conditions also ask that the DTI NWG minimum threshold is adhered to (i.e. 35dB(A)LA90, 10min at wind speeds not exceeding 10m/s at the nearest noise sensitive property).

All noise modelling will be been undertaken to ensure that the conditions can be complied to at this derelict building. A background noise study post-consent should be produced which could indicate the existing background noise levels (day/night) to be 43.5-44dB(A) at 10m/s for both dwellings, in the case of the Scottish project.

This is a relatively high background noise environment and a wind turbine with a source sound power level of 104dB(A) will comply with the requirements of the Havant local authority and Winchester City Council. The final turbine choice will be verified against this background noise study.

Condition 6: Construction of the development hereby approved shall take place outside the period from April to August due to any bird breeding activity. This condition may be required by English Natural Heritage. It may be the case that agreement with English Natural Heritage that this condition be relaxed to apply only to the construction of foundations and access tracks, and that if a bird monitoring programme is adopted during construction which indicates that the birds are not being disturbed then foundation and access track work may continue.

Condition 7: That the permanent meteorological mast is fixed lattice to minimise the risk of bird casualties.

Health & Safety Considerations

Applicable Legislation

Legislation applicable to this project with regard to Health & Safety is founded upon the Health and Safety at Work Act: 1974 and managed:-

(a) During design and construction under The Construction (Design and Management) Regulations: 1994 and Approved Code of Practice 1st February 2002.
(b) During operation and maintenance under The Management of Health & Safety at Work Act: 1999.

Status of compliance under The Construction (Design and Management) Regulations and Approved Code of Practice

Application, Interpretation & Notification.

(a) It has been established that CDM applies to this project because it is located in Great Britain, involves construction work, is "notifiable" to the HSE and will employ more than 5 people during construction.
(b) The enforcing authority for this project will be the HSE.
(c) The project is "notifiable" to the HSE because construction work will last longer than 30 working days. The notification document for F10 must be submitted to the HSE at this point.

Clients Duties.

(a) The Client for this project is currently identified as Hampshire Wind Energy Limited (HWEL). This organisation is head of the procurement chain, has arranged for design work to be carried out and is planned to engage Contractors.
(b) HWEL have judged as competent & appointed PMSS Limited as Planning Supervisors for the project. A copy of the terms of engagement is available for review.
(c) Competent and appointed Designers can be selected from the HNRI Consortium group for the civil engineering aspect of the project. A copy of the terms of engagement is available for review. Preliminary design risk assessments will have to be carried out and included within the civil engineering enquiry documents.
(d) A Principal Contractor has not been appointed at this stage. Tenders will have to be sought for civil engineering works and it is anticipated that the successful civil engineering Contractor will execute the duties of Principal Contractor.
(e) The Client is currently in full compliance with the Regulations.

Planning Supervisors Duties

(a) The Client will receive a preliminary advice on the competence and resources of the tendering contractors and suppliers. Formal analytical and documented appraisals will be carried out as part of the tender process.
(b) The Planning Supervisor must be satisfied that Designers are addressing the identification and control of risks in a satisfactory manner.
(c) A Pre-Tender Health & Safety Plan should be prepared for the project and should be sent out to all tendering Contractors for consideration in respect of allocating adequate competence and resources within their tender for various aspects of the project.
(d) Co-operation between designers has been ensured to date by full and open communications of the HNRI consortium.
(e) The project has not yet been notified to the HSE (See note c under "Application" above).
(f) Documentation must be collected for review and incorporation in to the Health & Safety File.
(g) The Planning Supervisor is currently in full compliance with the Regulations.

Designers Duties.

(a) Preliminary design risk assessments should be carried out and included within the civil engineering enquiry documents.
(b) Full and open lines of communication must be effected with the Client and Planning Supervisor.
(c) Electrical Engineers should be in full compliance with the Regulations.

Project: Spurness
Analysis: Inputs & Assumptions

I. Project Timetable

Financial Closure (NTP)	01-Dec-03
Construction period (months)	10
Construction period (days)	302.166667
Commercial operation	01-Oct-04
First year end	2003
First operating year end	2004
Days operating in first year	91
Months operating in first year	3
Project length post construction (years)	25
PPA start date	01-Oct-04
PPA end date	28-Sep-16
PPA end year	2016
PPA end year months	9

II. Plant Characteristics & Operating Parameters

Electrical:	
No. turbines	3
Turbine capacity (Mwe)	2.75
Initial gross capacity (MWe)	8.25
Auxilliary consumption (Mwe)	0.00
Initial net capacity (Mwe)	8.25
Forced outages	0.0%
Planned outages	0.0%
Availability (Hrs)	8,760
Load / Capacity	42%
Initial gross generation (MWhe)	30,137
Initial auxiliary consumption (MWhe)	-
Initial net generation (MWhe)	30,137
Embedded / Contract supply (MWhe)	30,137
Scheme embedded supply (MWhe)	30,137
Import supply (Mwhe)	0
Export (MWhe)	-

III. Operating Costs

Variable:		£000 p.a.
Operation and maintenance staff	35	35
Land	2%	30
Total	35	65
Fixed:		
Management / Admin		0
Rates	21	21
Insurance	21	21
Grid maintenance		0
Other	30	30
Reactive power	3	3
		0
		0
		0
		0
Total	75	
		75

IV. Debt Terms

		Loan 1
Moratorium (post takeover)	Mths	0
First payment (post takeover)	Mths	6
Installments per annum		2
Term (post moratorium)	Yrs	10
Commitment fee - up front		1.4%
Commitment fee - unitilised portion		0
Administration fee		0
Varibale / fixed rate		Fixed
Interest rate (LIBOR)		3.5%
Spread over base rate		1.4%
Total interest rate		4.9%
Interest tax		0.0%
Total interest rate (including tax)		4.9%
Debt		75%
Equity		25%

V. Depreciation

Accounting	4.00%
Tax (Reducing balance)	25%
First year allowance	0%

VI. Working capital

Operating:	
Accounts receivable (days)	30
Accounts payable (days)	60
Interest on cash balances	3%
Interest on overdraft	8%

IX. project Returns

		5yr	10yr	15yr	20yr	25yr
Total Project Equity- real						
IRR		-2.0%	13.2%	17.0%	18.4%	18.9%
NPV	10%	(1,646)	799	2,464	3,691	4,451
NPV (8%)		(1,435)	1,390	3,508	5,212	6,370

X. Sensitivity analysis drivers

Capex change	100%
Output	100%
O&M change	100%

Risk	**Status**	***Mitigation of risk***	**Principal bearer of risk**	***Financial impact***	**Likelihood (H, M, L)**	**Impact (H, M, L)**
DEVELOPMENT						
1. Planning consent / connections not obtained	Consented	N/a	N/a	N / a	N/a	N/a
2. Environmental objections and non consent	Consented	N/a	N/a	N/a	N/a	N/a
3. Land option / lease not obtained	Option signed. Lease to be executed	N/a	N/a	N/a	N/a	N/a
PLANNING						
1. Objection by statutory consultees	Consented	N/a	N/a	N/a	N/a	N/a
2. Highways	Consented	N/a	N/a	N/a	N/a	N/a
3. Grid connections	Consented	N/a	N/a	N/a	N/a	N/a
ENVIRONMENTAL						
1. Noise	Full noise modelling has been performed	Noise modelling indicates that there is no issue complying with the DTI NWG minimum threshold at the nearest property and there is a significant margin. Turbine supplier will warrant noise levels	Turbine provider Equity		L	H
2. EMI	Studies completed	The site layout design has considered the location of all radio links.	Equity		L	L

Risk	Status	*Mitigation of risk*	Principal bearer of risk	*Financial impact*	Likelihood (H, M, L)	Impact (H, M, L)
3. Birds	Environmental Impact Assessment completed. The planning condition imposed – refer to section 8 of IM.	Restricting groundworks operations during the bird breeding season (see section 8 of the IM)	Equity	If civils delayed into the bird breeding period could impact on turbine erection. Possible delay to project completion.	L	M
COMPLETION						
Intermittent Shortfall in capacity	Most economic position is 3 * 2.75MW. As such capacity will initially be restricted to 7.5MW by the grid connection	No downside is envisaged as individual turbines are limited and fourth turbine site remains available.	N/a	N/a	L	M
Shortfall in production	Independent anemometry report presented indicating site specific output for turbines	Strong correlation / accuracy of wind data. Warranted performance of turbines	Turbine manufacture for warranty period.	Significant margin in returns due to high and consistent wind regime	L	M
Cost overruns	Contracts being negotiated, TPA fixed price contract, grid connect fixed price contract, civils re-measurable upon final design.	Fixed price contracts being secured with variations at owners request only	TPA = Contractor Grid Connect = SS&E Civils = Equity	Main impact would be on civils, but contingencies included	L	L

Risk	***Status***	***Mitigation of risk***	**Principal bearer of risk**	***Financial impact***	**Likelihood (H, M, L)**	**Impact (H, M, L)**
Delays in completion	Not commenced.	Targeting financial closure early December so as to mobilise and complete ground works prior to bird breeding season (April) Grid connection – discussions ongoing in respect of improving connection date. Weather delays on turbine erection – work performed in summer months. Managers previously experienced in turbine assembly in these islands.	Contractor to LD levels	Extended construction finance charges	L	M
Availability of land, building materials, energy and raw materials	Availability of stone for construction has been considered in detail. Negotiations are underway with a quarry owner adjacent to the site. All materials will be required to be imported to the island with the possible exception of stone.	Until such negotiations have been concluded, an allowance for importing stone to the island has been allowed within the civil engineering costings. Allowance has been made within the contract for importing materials.	Equity / Contractor	On conclusion of negotiations with the local quarry owner, a saving of approximately £40,000.00 can be expected from the civil engineering package. Risk is all positive i.e. only savings can be made.	L.	L

Risk	Status	*Mitigation of risk*	Principal bearer of risk	*Financial impact*	Likelihood (H, M, L)	Impact (H, M, L)
WIND RESOURCE						
1. Lack of wind	On site measurements > 18 months and independent anemometry report presented indicating site specific output for turbines	Strong correlation / accuracy of wind data. Warranted performance of turbines	Equity	Significant margin in returns due to high and consistent wind regime	L	M
TRANSPORTATION						
1. Inability to deliver key resources	Transportation is a contractor risk. Discussions ongoing with Orkney Harbour Authority	Contractors must provide suitable transportation and arrangements. SWEL to assist in the discussions with OHA. Turbine contractors have confirmed no major reservations. If additional mooring bollards cannot be agreed with OHA alternative is additional vessel costs.	Contractor	May require some additional mooring bollards	M	L
PRODUCTION AND OPERATIONAL						
1. Failure to achieve output at planned levels	Independent anemometry report presented indicating site specific output for turbines. Five year O&M contract with turbine supplier.	Strong correlation / accuracy of wind data. Warranted performance of turbines. O&M Contract for 5 years. Resources located for O&M thereafter.	Turbine manufacture for warranty period, Equity thereafter.	Negligible in first 5 years (warranted production).	L	M
2. Operating costs greater than budgeted	O&M to be taken out under an extended 5 year warranty.	Secured for 5 years.	Turbine manufacture for warranty period. Equity thereafter.	Considered low	L	L

Risk	Status	*Mitigation of risk*	Principal bearer of risk	*Financial impact*	Likelihood (H, M, L)	Impact (H, M, L)
OWNERSHIP AND MANAGEMENT CONTROL						
1. Lack of control		Development process controlled by an exclusive development agreement 100% of project assets or SWEL equity offered for sale ensuring no minority interests			L	L
SALES & REVENUE						
1. Project revenues forced down by market forces	Long term PPA being negotiated	Regulator risk for ROCs and LECs being underwritten by a major utility offtaker	Offtaker		L	H
2. Receivables not collected	Long term PPA being negotiated	Credit worthy offtaker being secured. ROCs not issued if payments in arrears			L	M
RELATIVE PROJECT COMPETITIVENESS						
1. In a non-tariff / competitive market the project would be uncompetitive ?	On shore wind is one of the most competitive new build technologies in the UK	Regulatory risk underwritten in PPA	Offtaker and equity		L	M

Risk	**Status**	***Mitigation of risk***	**Principal bearer of risk**	***Financial impact***	**Likelihood (H, M, L)**	**Impact (H, M, L)**
CONTRACTUAL AND LEGAL						
1. Contracts that are uncommercial or 'brittle' are likely to break over time	Contracts being negotiated.	Contracts drafted by Bond Pearce	Equity		L	M
2. Contracts are not reflective of each other i.e. back to back position	Contracts being negotiated.	Contracts drafted by Bond Pearce and 'consistency' sign off being considered	Equity		L	M
POLITICAL AND REGULATORY REGIME						
Major realignment of exchange rates	Turbine contracts being negotiated	Pricing fixed at execution of the contract and short lead time to delivery and final payment. Exchange rates forward contracts can be arranged if required.	Equity		L	M
Change in taxation			Equity		M	M
Requirement for governmental concessions, licences or permits					L	M
Political interference					L	L

Risk	Status	*Mitigation of risk*	Principal bearer of risk	*Financial impact*	Likelihood (H, M, L)	Impact (H, M, L)
Introduction of more stringent environmental protection legislation during the life of the project					M	M
Deregulation or the lifting of supporting government policies	On shore wind is one of the most competitive new build technologies in the UK	Regulatory risk underwritten in PPA	Offtaker and equity		L	M
FINANCIAL MARKETS AND MACRO ECONOMICS						
1. Adverse fluctuations in exchange rates	Turbine contracts being negotiated	Pricing fixed at execution of the contract and short lead time to delivery and final payment. Exchange rates forward contracts can be arranged if required.	Equity		L	M
2. Increase in interest rates		Short lead time to construction period and ability to fix interest rates.	Equity		L	M
3. Inflation		Revenues are largely index linked			L	L

4.9 Solar PV Inclusions in MDA's & Housing Stock - Proposal to HNRI & HCC

Potential for PV Roofs on New Build Housing & Existing Housing Stock

Dwellings in Hampshire County

Present numbers up to end of 2003 = 708,039 Houses
New Houses to be Built in 2004 = 6,812 Houses

Should HCC wish to hit the Governments Renewable Energy Targets at no cost to HCC they could consider that inclusion of PV as a Planning requirement for future Housing and Commercial Developments.

With regard to Existing Housing, HCC could encourage existing house owners to install PV Roof's and take up on the Government's 50% grant. HCC could lead by example by installing PV on House's in their ownership and assist Housing Associations to follow a similar strategy to prevent future Fuel Poverty.

Typical New House

In the South of England an installation of 3.5kWp of PV on the Roof of a New House, approximately half the Roof area, will provide a balance between the Energy Generated of the PV and the average Energy Consumption of a house.
PV Power Rating / House = 3.5kWp
Energy Generated / House = 2,975kWh / year
CO2 savings = 2.08 Tonnes / year
Cost Installed = £14,000
Government Grant = 50%
Cost addition to House = £7,000
Average Price of New House = £250,000
Additional Increase in Initial House Price for including PV = 3%
PV Life = Life of House

House Life Cycle Figures. (Based on 60 years)

Energy Generated / House = 178,500kWh
CO2 savings / House = 125 Tonnes (More than the Weight of the House)
Electricity value at today's price of 7p / kWh = £12,495
Payback on Price paid = 33 years
Renewable Energy Obligation at today's price of 3p / kWh = £5,355
Payback with Energy + REO = 23 years
However Electricity is expected to rise steeply in price in the future.
If we apply a 5% above inflation average increase the payback's reduce to :-
Payback without REO = 20 years and provides 40 years Free electricity.
Payback with REO = 15 years and provides 45 years Free electricity

Waterlooville MDA

2,000 to 3,000 New Build Homes
If say that the PV House Roof be included on 2,000 houses on the Waterlooville MDA development would result in the following:-
Total PV Power Rating = 7,000kWp
Electricity Generation = 5,950,000kWh / year
CO2 savings = 4,165 Tonnes / year
Initial House Price Penalty = +3%

Waterlooville MDA – BPSolar PV & Hot Water systems could be made possible

The local centre is intended to act as a focal point for the new community. It is expected to provide a limited range of shops and services, including a small convenience store and community facilities, to serve the needs of residents of the MDA.

Illustration of a Local Centre Gateway: Based on the Option 2 layout

ATKINS *West of Waterlooville Major Development Area : Masterplan Framework Options*

Rushmoor MOD

6,000 to 9,000 New Build Homes
If the PV House Roof be included on 6,000 houses on the Rushmoor MOD development would result in the following:-

Total PV Power Rating = 21,000kWp
Electricity Generation = 17,850,000kWh / year
CO2 savings = 12,495 Tonnes / year
Initial House Price Penalty = +3%

The development on MOD land at Rushmoor MDA – BPSolar PV & Hot Water systems could be made possible with IMGroup funding.