UNECE International Forum on people-first PPPs for the Sustainable Development Goals
9 - 11 May 2017
Hong Kong

Waste to Energy

Richard Ornitz

INFRALINX CAPITAL, LLC

WASTE-TO-ENERGY

"Nearly every problem has been solved by someone, somewhere. The challenge of the 21st century is to find out what works and scale it up." – Bill Clinton

New York, Boston, Frankfurt, London, Zurich, Warsaw

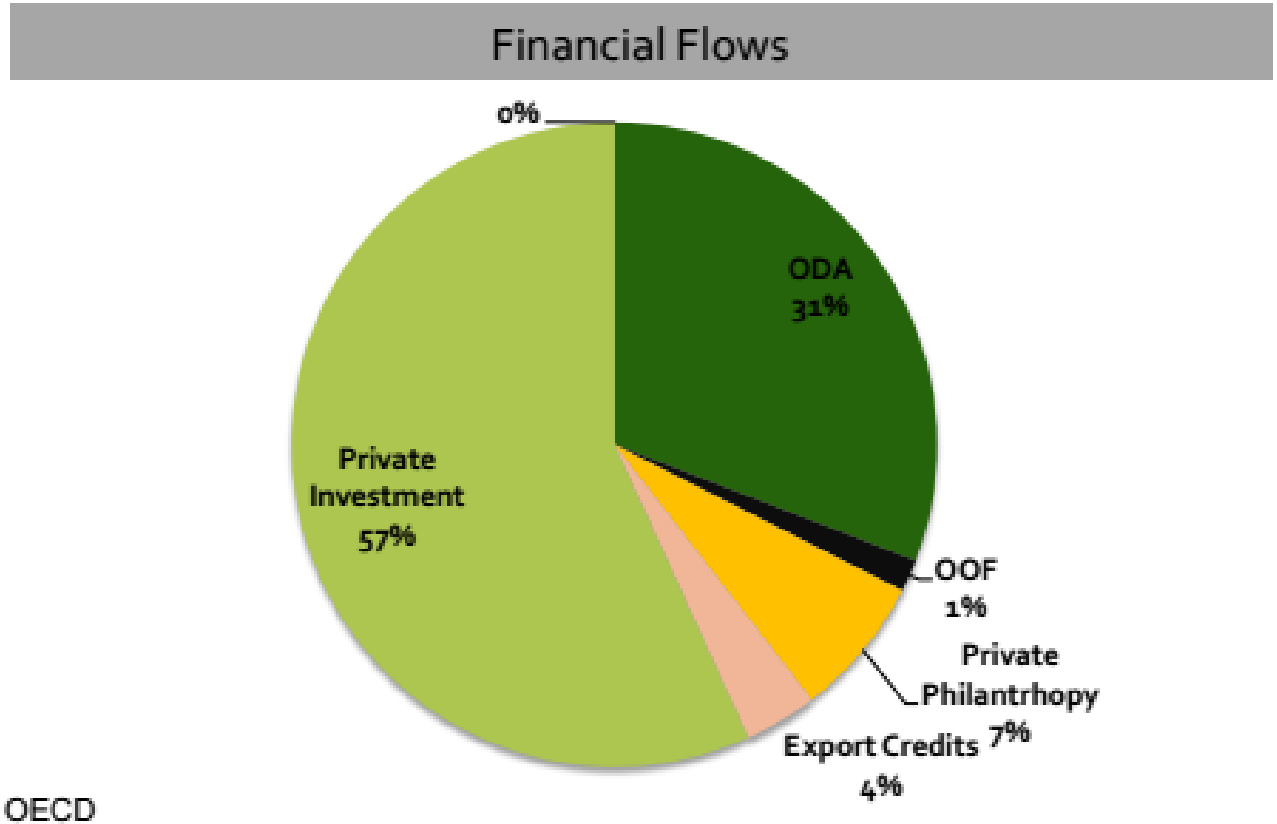
Credit: Steven Feather, Flickr

Answers to Core Questions

- How to solve the garbage problem in refugee camps
- How to solve the danger of waste management
- How to build small WTE units to provide energy to rural areas (nightlights, etc.)
- Combine for profit small WTE projects with impact investment in rural areas in emerging markets – leveraged social capital

Capital Flows to Developing World

Private Investment from Developed to Developing countries now exceeds all other capital flows combined.



Source: OECD

What is for profit investing

- For profit investing is providing a service or product that can be sold to a market for a return on investment

  IE a reasonable profit margin after all costs of development, financing, construction and operation

ROI varies by risk and volume

What is Impact Investing

Impact Investing is the provision of **capital** to enterprises with the **intention** of making both a **financial return** & generating a strong **beneficial impact** on the planet and society.

Impact Investments should **maximize "Total Tangible & Intangible Returns"** (TTIR) to their investors.

Come to the next session at 1700 hrs !!!

TOTAL IMPACT CAPITAL

GIIN
GLOBAL IMPACT INVESTING NETWORK

ACHIEVING THE SUSTAINABLE DEVELOPMENT GOALS: **THE ROLE OF IMPACT INVESTING**

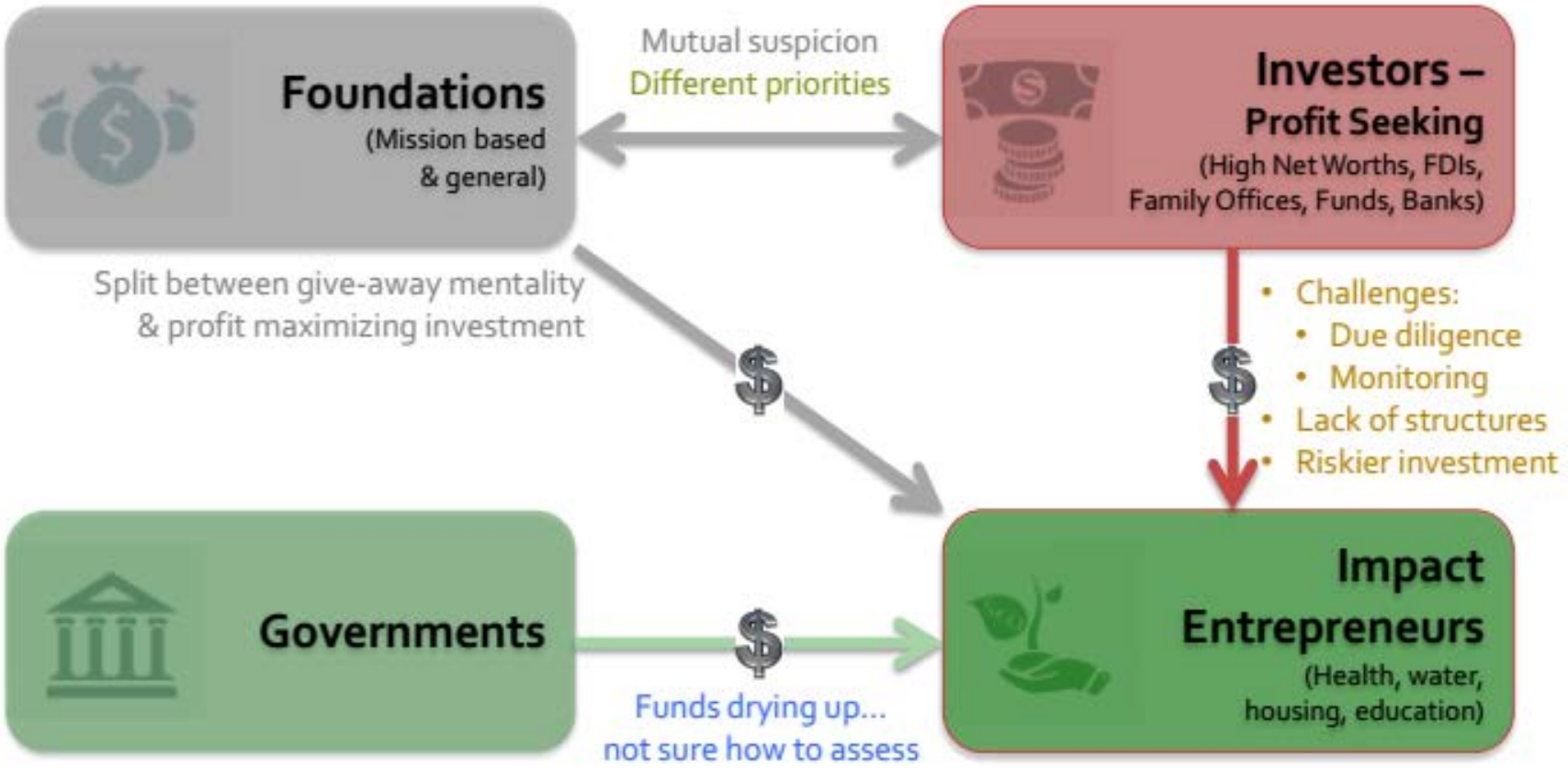
UN Sustainable Development Goal 9

Sonen evaluates the extent to which its investment strategies align with the United Nations' Sustainable Development Goals. Among the 17 goals, SDG 9 calls for investing in resilient infrastructure, promoting inclusive and sustainable industrialization and fostering innovation[7].

Underlying targets for each goal identify specific ways in which the Goals' success will be measured and evaluated. Sonen tests its infrastructure investments' alignment with these targets to assess our own contribution to reaching SDG 9. Targets include:

- Develop quality reliable, sustainable and resilient infrastructure with a focus on affordable and equitable access for all,
- Upgrade infrastructure and industry to greater sustainability, increased resource-use efficiency and use of environmentally sound technologies,
- Facilitate sustainable and resilient infrastructure development in developing countries, and
- Increase access to information and communications technology.

Current Impact Funding Landscape



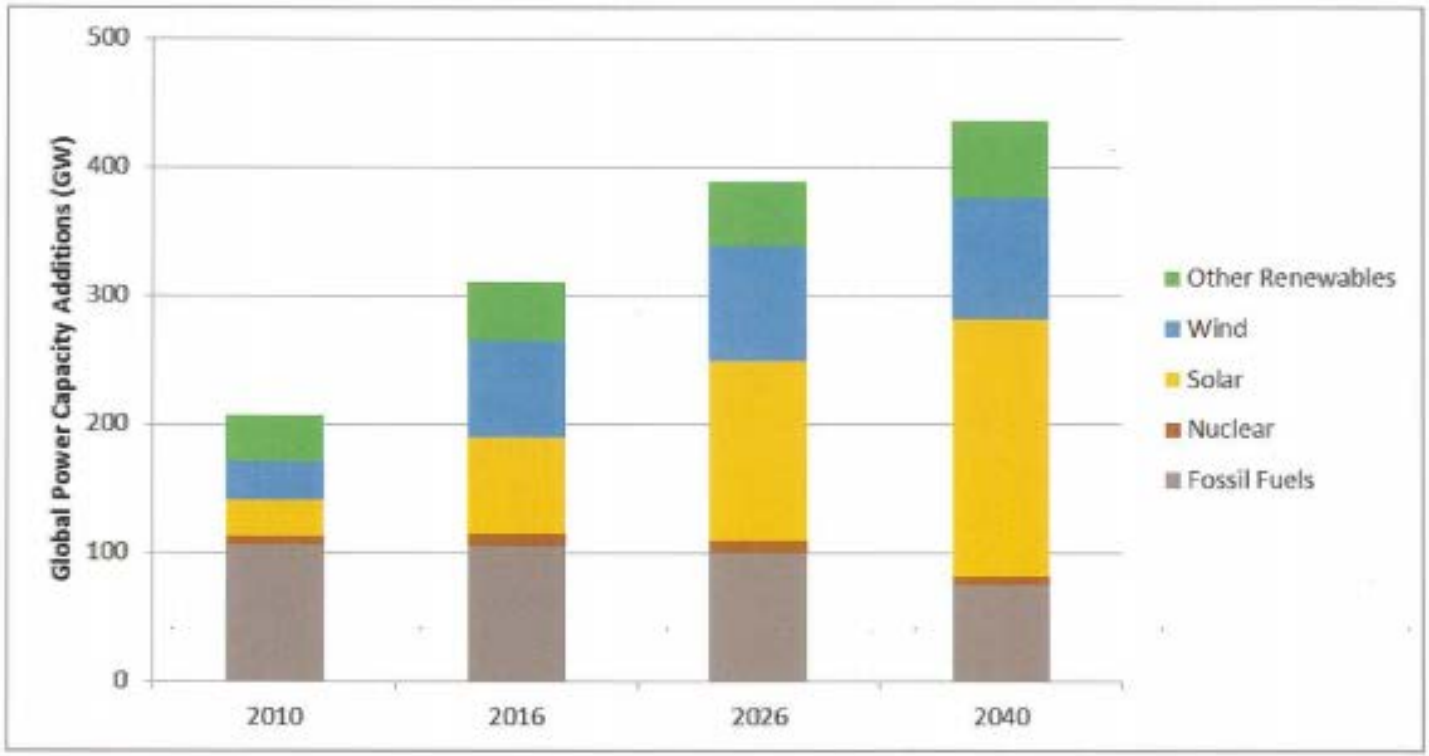
Activities in silo… inefficient use of capital and resources

Development Finance Institutions

- Historically Development institutions focused on below issues:
  - Investment in an undercapitalized region, increasing exposure in frontier and low income markets
  - Undercapitalized sectors that traditional investors perceive as not being profitable, or focusing on the missing middle.

TOP 5 DFIs by Capitalization	Total Capital	New Commitments	Inception Year
International Finance Corporation	77	18	1956
OPIC	8.52	3.9	1971
FMO(Netherlands Development Finance Company)	7	1.72	1970
DEG(German Investment Corp)	5.4	1.64	1962
Commonwealth Development Corporation(UK)	2.54	0.5	1948

… Are Driving A Shift Toward A Cleaner Economy

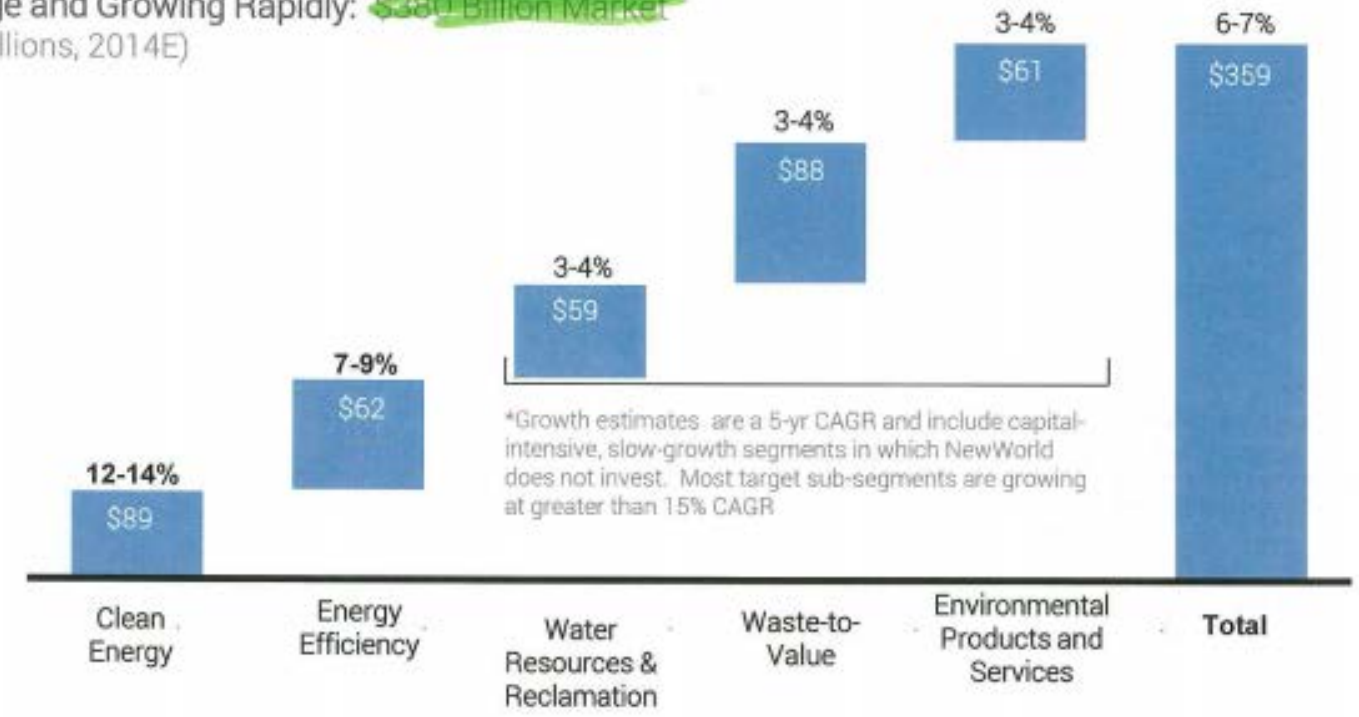


Source: Based on data from Bloomberg New Energy Finance

Clean Energy Is ~~No Longer A Niche Market~~

U.S. Environmental Markets are Large, Growing, Innovative...

Large and Growing Rapidly: $380 Billion Market
($ Billions, 2014E)

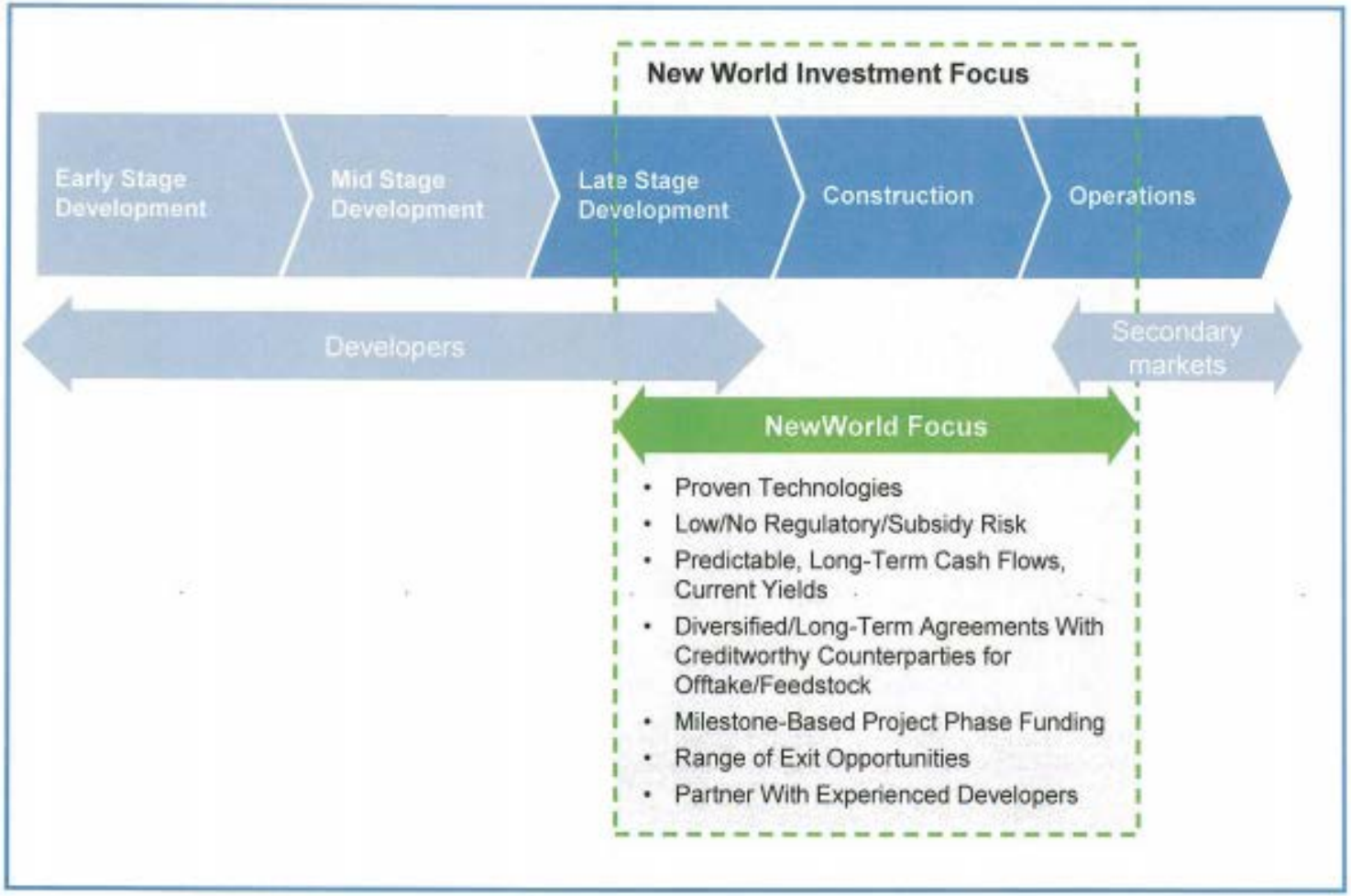


*Growth estimates are a 5-yr CAGR and include capital-intensive, slow-growth segments in which NewWorld does not invest. Most target sub-segments are growing at greater than 15% CAGR

Source: Morgan Stanley, BCC Research, SBI, JP Morgan, EIA, IEA, EPA, Lux Research, EBI, Global Water Market Intelligence, NewWorld estimates.

Innovative: Driven by technology and business system innovation, increasingly favorable regulation, benefits of young markets ("market recency"), the "virtuous quadrant" of high returns and high collateral benefits, and past levels of VC investment

Infrastructure Investing: Target Focus



Infrastructure Investing: Explicit Risk Mitigation

Avoid and minimize risk with each project....

Risk	Mitigant
Technology	Proven technology track record, avoid First-of-a-Kind facilities
Regulatory/subsidy	Evaluate case-by-case; do not rely on anticipated regulatory policy; use subsidies as an enhancement, not a foundation
Project-phase (development or construction)	Rely on project milestones involving permitting, leasing, or other approvals and agreements to help inform and evaluate risk; tie release of funding to milestone achievement
Operational	Operating agreements, O&M contracts with experienced providers
Feedstock	Diversified or long-term agreements with rated/creditworthy counterparties
Offtake	Long-term agreements with rated/creditworthy counterparties, with merchant exposure for upside
Exit	Structure and aggregate a portfolio of projects; optimize and demonstrate performance; leverage projects to improve economic return

....while mitigating risk through a portfolio-wide approach

- A strategic blend of risk/return project profiles
- Diversifying holdings across technology, project stage, credit, regulatory regime (various U.S. states and Canada), and investment horizon


theguardian

Solid Waste Management in developing countries is general characterized by

- Highly inefficient waste collection practices
- Limited resources
- Variable and inadequate level of service
- Lack of environmental control systems
- Lack of appropriate legislation
- Limited know-how
- Indiscriminate dumping, littering and scavenging
- Poor environmental and waste awareness among general public

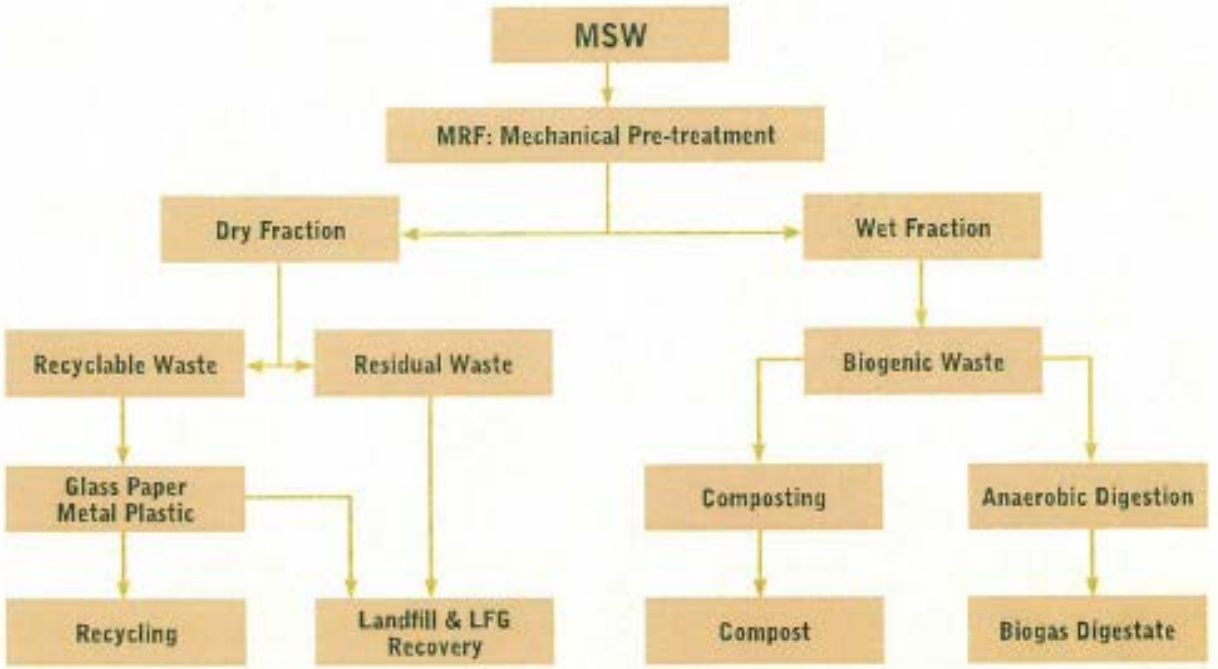


Figure 1: A typical dry-wet waste diversion model
MRF = Material Recovery Facility; LFG = Land Fill Gas

[*] Trois C. & Jagath R. (2011), Sustained Carbon Emissions Reductions through Zero Waste Strategies for South African Municipalities. Waste Management, INTECH Publications. ISBN 978-953-307-179-4.

Sustainable Waste Management Worldwide

- Europe is most advanced continent
  - Driver is legislation that discourage disposal to landfills
  - Leading examples: Sweden, Switzerland, Austria and German
  - In UK landfill tax
  - Exception Bulgaria, Romania, Latvia and Lithuania

- USA is market driven
  - Does not ban landfill
  - Dislikes taxes
  - Underground burial is norm
  - Limiting factor is space
  - 2010: already had 250 million tons of solid waste (MSW) of which 12% to waste conversation facilities

Figure 3: Status of WtE plants in Europe

Canada is similar to the USA. So far, it has built EfW plants in Vancouver, Ontario (2), Alberta (2) and Quebec only.

On the other hand Japan, Korea, Singapore and other densely populated Asian countries are very advanced when it comes to waste treatment. In Singapore, for example, 60% of solid waste is recycled, 37% is incinerated and only 3% goes to landfill.

Today's modern waste incineration plants do not have to be placed in remote areas anymore thanks to complete enclosure and stack gas treatment. A good example is Paris where the new Issoame WtE plant is located in the city where the waste is produced (3.5 million tonnes a year) and the energy can be used. Two-thirds of the plant is below ground. Copenhagen has gone a similar way: a new plant is under construction only 4km from the city centre, to deal with 400,000 tonnes of waste from the city per year, generating 2 MWh of district heat and 0.7 MWh of electricity from each tonne of waste. An architectural competition resulted in a winning project for an above-ground plant. The building is 500m long and 100m high. Instead of a mountain of waste, there will be a "white mountain of snow" – an integrated ski slope using artificial snow with a 500m downhill track and a ski-lift (Figure 4).

Figure 4: Incineration plant in Copenhagen with integrated ski-slope

DRIVERS FOR OPTIMISED WASTE MANAGEMENT IN LOW AND MEDIUM-INCOME COUNTRIES

Herman Huisman, Ministry of the Environment, The Netherlands

The amount of municipal solid waste (MSW), one of the most important by-products of an urban lifestyle, is growing even faster than the rate of urbanisation. Ten years ago, 2.9 billion urban residents generated about 0.64 kg of MSW per person per day (0.68 billion tonnes per year). A recent World Bank report (2012)[1] estimates that these amounts have increased to about 3 billion residents generating 1.2 kg per person per day (1.3 billion tonnes per year).

Waste production is a question of income and life-style. High-income countries produce the most waste per capita, while low-income countries produce the least. The highest production is found in Organisation for Economic Cooperation and Development (OECD) countries, with an average of 2.2 kg/capita/day.

Solid waste is usually the one service that falls completely within the local government's purview. A city that cannot effectively manage its waste is rarely able to manage more complex services such as health, education or transportation. Poorly managed waste has an enormous impact on health, the local and global environment, and the economy. Improperly managed waste usually results in downstream costs higher than what it would have cost to manage the waste properly in the first place.

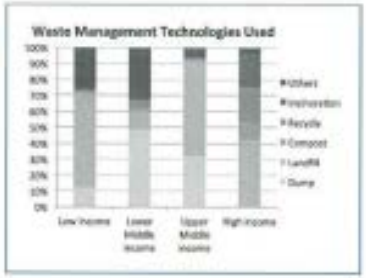


Figure 5: Waste management technologies related to income

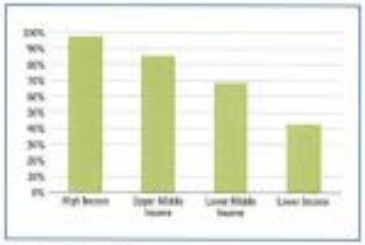


Figure 6: Waste collection rates by income

Waste treatment

Worldwide, landfilling is the most widespread technology (about 340 million tonnes per year), followed by recycling (130 million tonnes per year), WtE (120 million tonnes per year), dumping (70 million tonnes per year) and composting/digestion (50 million tonnes per year). Dumping has been reduced but the health impacts of landfilling remain very high, as do GHG emissions. Open dumping is responsible for 18% of global methane emission. The type and variety of waste management methods used are also dependent on income: the higher the average income, the more advanced are the technologies applied (Figure 5).

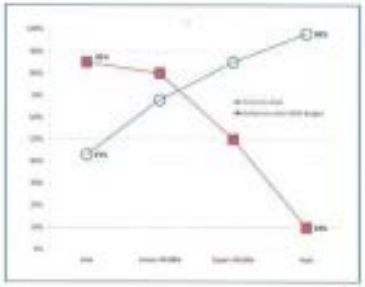


Figure 7: Collective rate as function of relative collection cost

[1] World Bank (2012), What a Waste: A Global Review of Solid Waste Management, March 2012, No.15

Technology Options for Incineration

- Combustion
  - Grate furnaces
  - Fluidized bed
  - Rotary Kiln
- Gasification
  - Shaft furnaces
  - Fluidized beds
- Pyrolysis
  - Products are
    - Steam
    - Heat
    - Power
    - CHIP

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TOTAL IMPACT CAPITAL

Key Factors on Intergrated Waste Management

- Worldwide waste increases every year
  - 2012 – 1.3 billion tons/year
  - 2025 – 2.2 billion tons/year
  - Or 1.2 to 1.42 kg more per person per day projected in 15 years
- Waste generation and disposal is directly related to income as is rate of recycling
- Sustainable management of solid waste stream is imperative to minimize environmental and public health risks.

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Results of poor waste management

- Parasites, tetanus, malaria, hookworm, cholera and diarrhea
- Flash floods, water pollution
- Littered landscapes
- Issues of safety and availability
- Greater emissions/methane

World Bank Recommends Five Basic Steps for WTE

- Strategic planning
- Better institutional arrangements
- More efficient operations
- More effective formal management
- Environmentally safe disposal

- Start small
- Keep it simple
- Be cautious "wonder" solutions

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TOTAL IMPACT CAPITAL

Role of Development Banks

- Development Banks are the perfect source for capital for wte projects with significant local development impact
  - EBRD – for Central and Eastern Europe
  - EIB- for Europe
  - IFC- leading world bank finance arm
  - OPIC –principal USA development bank
  - IBD - for Latin America
  - African DB – for Africa
  - ADB – for Asia
- Provide:
  - Capital – debt and equity
  - Risk Insurance
  - Political over

CASE STUDY 1:
AUSTRALIA

Indicative Proposal for Financial Advisory and Arranging Services to

Prof. Dr. Gerhard Janssen
CEO, Martin Biopower Pty Ltd.

May 2015

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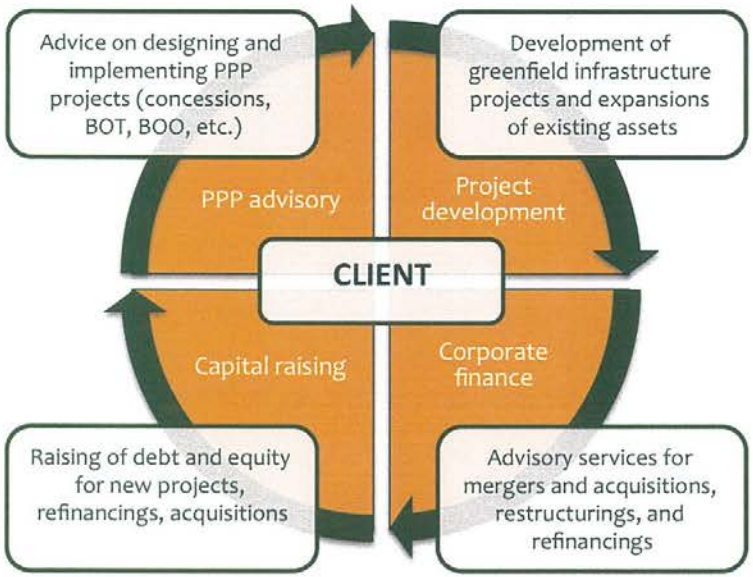
4 Our Roles and Range of services

- ILX provides infrastructure solutions for its clients.



Key roles of ILX :

- for **Developers**, ILX acts as an integrated service provider in the early stages of deals, willing to share development cost risk;
- for **Equity Investors**, ILX provides an opportunity to partner for transaction sourcing and seed financing capacity;
- for **Lenders**, ILX provides an access to ready-to-finance projects and full-scale due diligence services; and
- for the **Public Sector**, ILX supports ready-to-go deals, fulfilling the public need for stimulus, budget balancing and jobs..

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We cover the whole Infrastructure Value Chain ...

Tasks

1
- Identify **needs** and establish priorities for projects
- Identify **suitability** of the project for PPP structure
- Create **preliminary financials and budget**
- Define **expropriation process** and **permits**

2
- Establish **regulatory framework** to ensure a **robust PPP process**

3
- Set up of **project plan** and desired outcomes
- **Refine business case** and evaluate PPP viability
- **Feasibility** studies
- **RFQ** support
- **Teaming Agreement**
- **Equity** contribution
- **Merchant Bank** as capital investor

4
- Identify **potential bidders**
- Documents **tender process**
- Design **evaluation criteria** and prepare RFP document
- Project **Risk Assessment**

6
- **Asset Management** during design & construction phase

7
- **Asset Management** during operations phase or handover

5
- Financial **structuring**
- Financial **modeling**
- **Financing Agreements**
- Project **returns** for **capital and debt**
- **Due diligence**
- **Financial Close**

Fees

Retainer fees	Equity Fees Success Fees (at award)	Investment capital Equity / Financing Fees	Equity / AM Fees Carried interest	Equity / AM Fees Carried interest

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7 Our Understanding of the Project

Underlying assumptions

- **Martin Biopower Pty Ltd.** („Sponsor") with the help of its parent, Martin GmbH, intends to develop, build, finance and operate two WtE plants north of Perth, WA and another mixed WtE plant at a different location within Western Australia;
- All such activities occur under a framework arrangement with the WA Government, the EPA, the **City of Perth** as well as selected other communities;
- The Sponsor intends to provide its own financial solution for the proper implementation of these **WtE plants**, commencing with the XXX Plant („Project").

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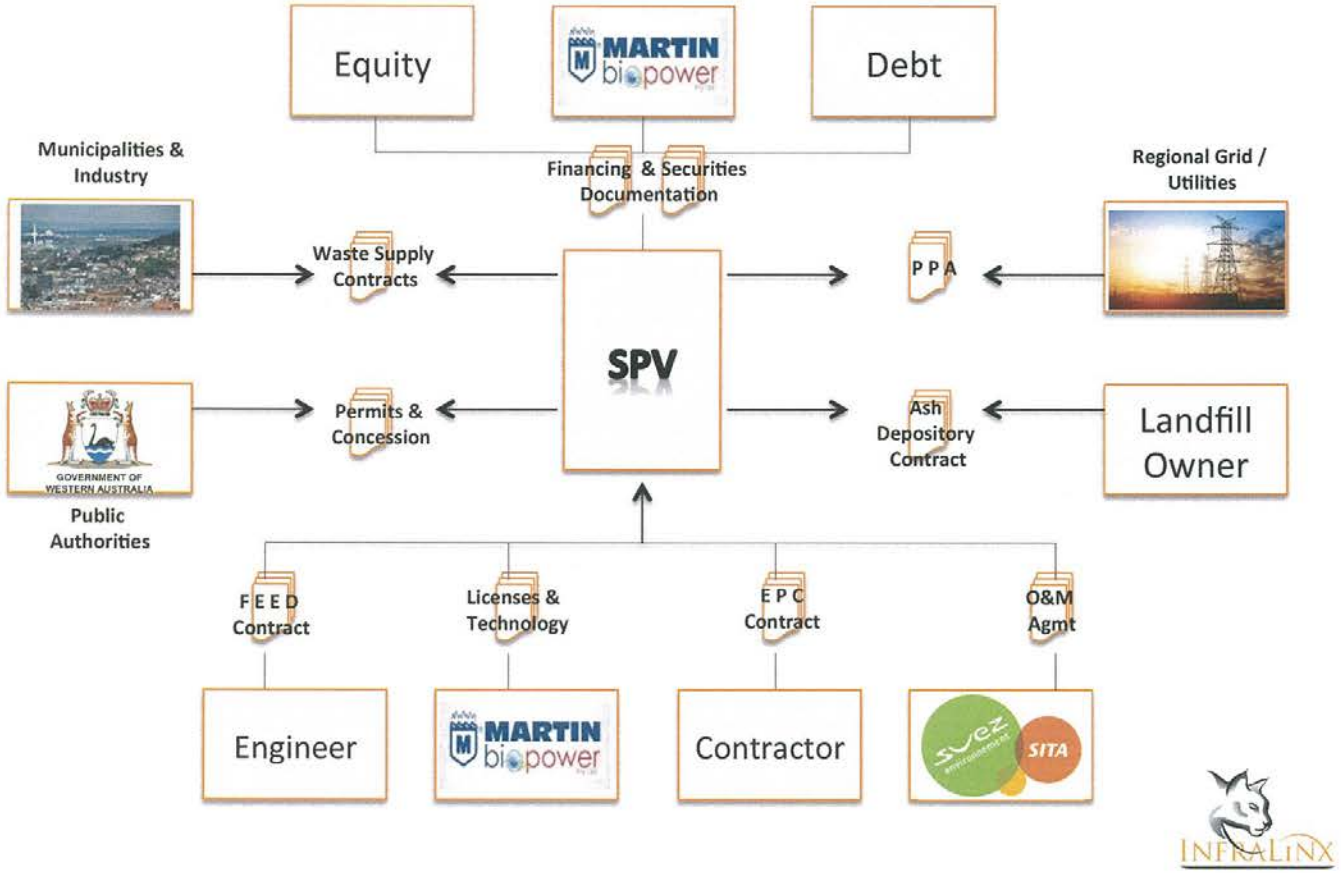
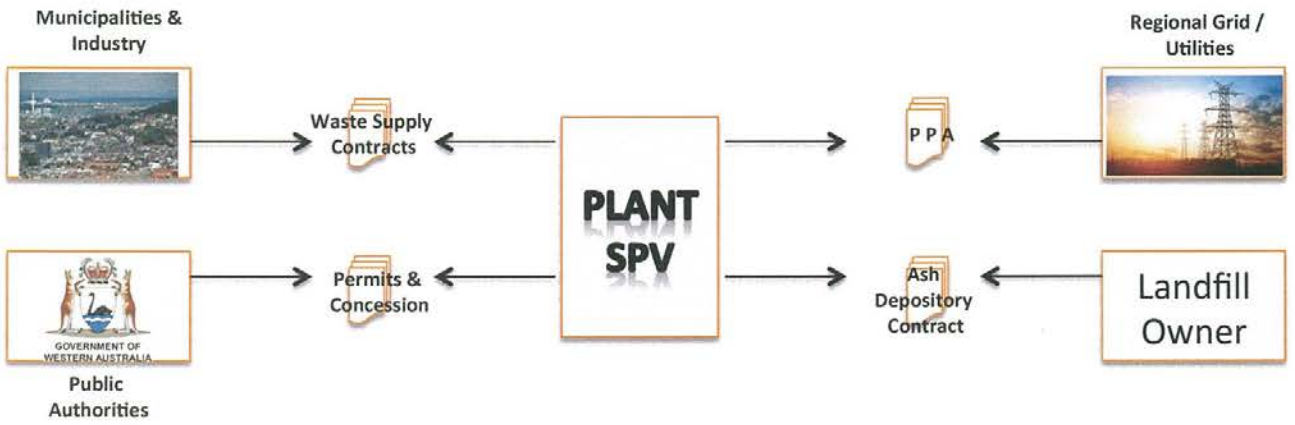
8 WtE – Contractual Framework (generic)



9 Risk Mitigation Analysis – core contracts



The core contracts will be based on a long-term concession-like arrangement between the Client and a responsible Public Authority or Authorities. In addition, all public permits must be in place or destined to become effective upon Financial Closing.

The waste supply contracts need to correlate with the terms and conditions of the concession and permits. Likewise, the power purchase agreement with the electricity offtaker (or, if aplicable, the steam purchase agreement with district heating), needs to correlate in terms and remuneration with the concession and the waste supply agreement. Ash depository needs to be solid and unchallenged.

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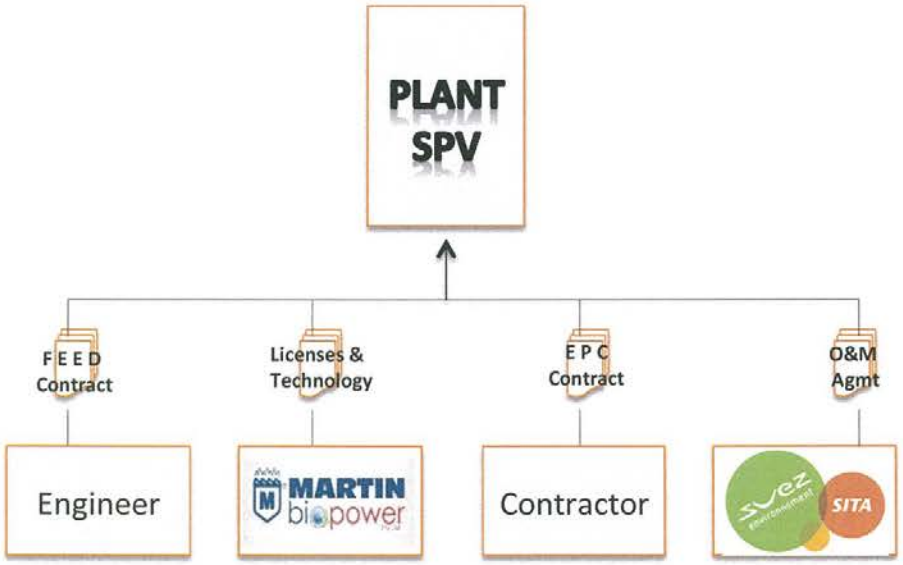
10 Risk Mitigation Analysis - construction and operations



Plant SPV needs to have clear transfer of licenses and technology from Sponsor / Parent against mixture of fees and shares in SPV. Rights and obligations against SPV to be pari passu with others.

ILX will assist Plant SPV

- FEED and EPC contracts to be synchronized to achieve on time and within budget the delivery of plant in a fit-for-purpose state.
- O&M agreement is the most crucial element as it will secure revenue stream and availability of plant throughout life of project.

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11 Capital Budgeting and Arranging of Funds

Arranging of debt includes the approach of

- Commercial lenders in Australia, South East Asia and Europe;
- International Financial Institutions such as IFC, ADB and EIB;
- infrastructure debt funds; and
- major industry suppliers.

Arranging of equity includes the approach of

- Australian super-annuation funds;
- suitabe private equity funds in South East Asia and Europe
- international insurance companies and pensions funds;
- major industry suppliers;
- other suitable co-investors as cleared by the Client.

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13 Proposed ILX Deliverables for the Project

We anticipate a 15-18 months period for WtE projects to reach financial closing ...

... which we organize into 7 major steps, each to be detailed by Client's demand.

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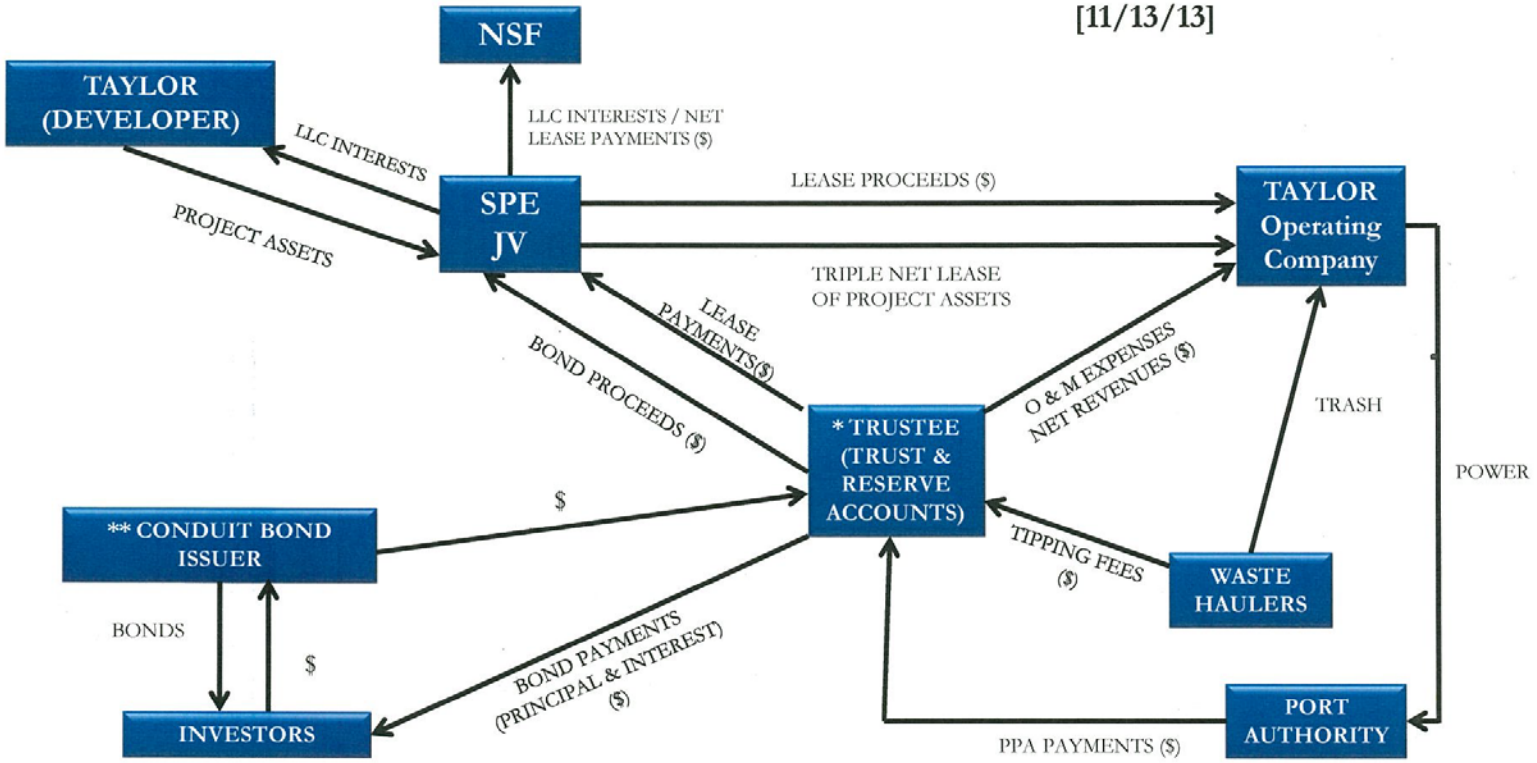
CASE STUDY 2:

TAYLOR/MONTGOMERY WASTE TO ENERGY [11/13/13]



Project Revenue Waterfall (from Trust):

1st -- O&M expenses
2nd -- Bond payments (P&I)
3rd -- Bond Reserves
4th -- Rent / O&M reserves
5th -- Net revenue to SPE

* Trustee holds bond & bond reserve accounts

** Bond proceeds transferred to Trust project account and paid to SPE per Trust Indenture

THE TAYLOR BIOMASS GASIFICATION PROCESS
WHAT IS IT, HOW DOES IT WORK, WHAT ARE ITS ADVANTAGES?

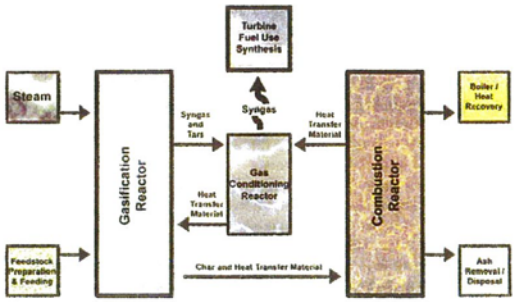
WHAT IS IT?

- An environmentally clean method to separate biomass and recyclables fraction from wastes such as; Construction and Demolition (C&D), Municipal Solid Waste (MSW), Commercial waste (CW) residuals and efficiently produce renewable, sustainable electricity (biopower)
- An indirectly heated biomass gasification process
  - No air or oxygen in the gasification reactor – removes almost all toxic residue
  - Uses compact circulating fluidized bed reactors (similar to entrained reactors)
- Includes in-situ (within the main process) residual tar conversion into additional useful syngas
  - Simplified and more effective gas cleanup
  - Improved heat recovery
  - Organics reduced in waste water (and waste water recycled for process use)
  - High Energy syngas composition eliminating the need for further modification processing
- Provides high hydrogen concentrations without additional downstream processes
  - Potential for hydrogen recovery in the future
  - Gas suitable for synthesis applications (production of transportation jet fuels or chemicals)

HOW DOES IT WORK?

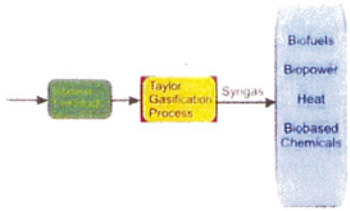
- In the process, a circulating, catalytically active, heat carrying material (sand) is used to rapidly heat the incoming biomass, convert it to syngas, and convey unconverted biomass (char) from the gasification reactor into an associated combustor.
- In the gasification reactor, biomass from the sorting and separating system is surrounded by the sand and steam. No air or oxygen is added so there are no combustion reactions taking place, providing minimal environmental impact. The biomass is rapidly converted into medium calorific value synthesis gas at a temperature of approximately 1500F.
- Unconverted biomass (char), and the cooled sand, pass through the gasification reactor and then are separated from the synthesis gas.
- The synthesis gas continues on to the gas conditioning reactor while the sand is conveyed into the associated combustion reactor.
- In the gas conditioning reactor, steam in the product gas reacts with condensable materials in the gas (tars) to produce carbon monoxide, hydrogen, and low molecular weight hydrocarbons such as methane and benzene, all used for power generation or the production of chemical products. In addition, some carbon monoxide is converted into hydrogen by reaction with steam.
- In the combustion reactor, air is introduced which consumes the char and, in the process, reheats the sand to approximately 1800F. In the combustion reactor all remaining carbon is consumed, resulting in a carbon-free ash (about 10% of biomass processed in gasifier).
- The reheated sand is separated from the flue gas (exhaust) and returned to the gasifier.
- Ash is removed from the exhaust, resulting in a high temperature (1800F) clean flue gas stream, available for heat recovery.
- The process operates at essentially atmospheric pressure, simplifying the feeding and handling of the incoming biomass.

SIMPLIFIED PROCESS DIAGRAM



WHAT ARE THE ADVANTAGES OF THIS SYSTEM?

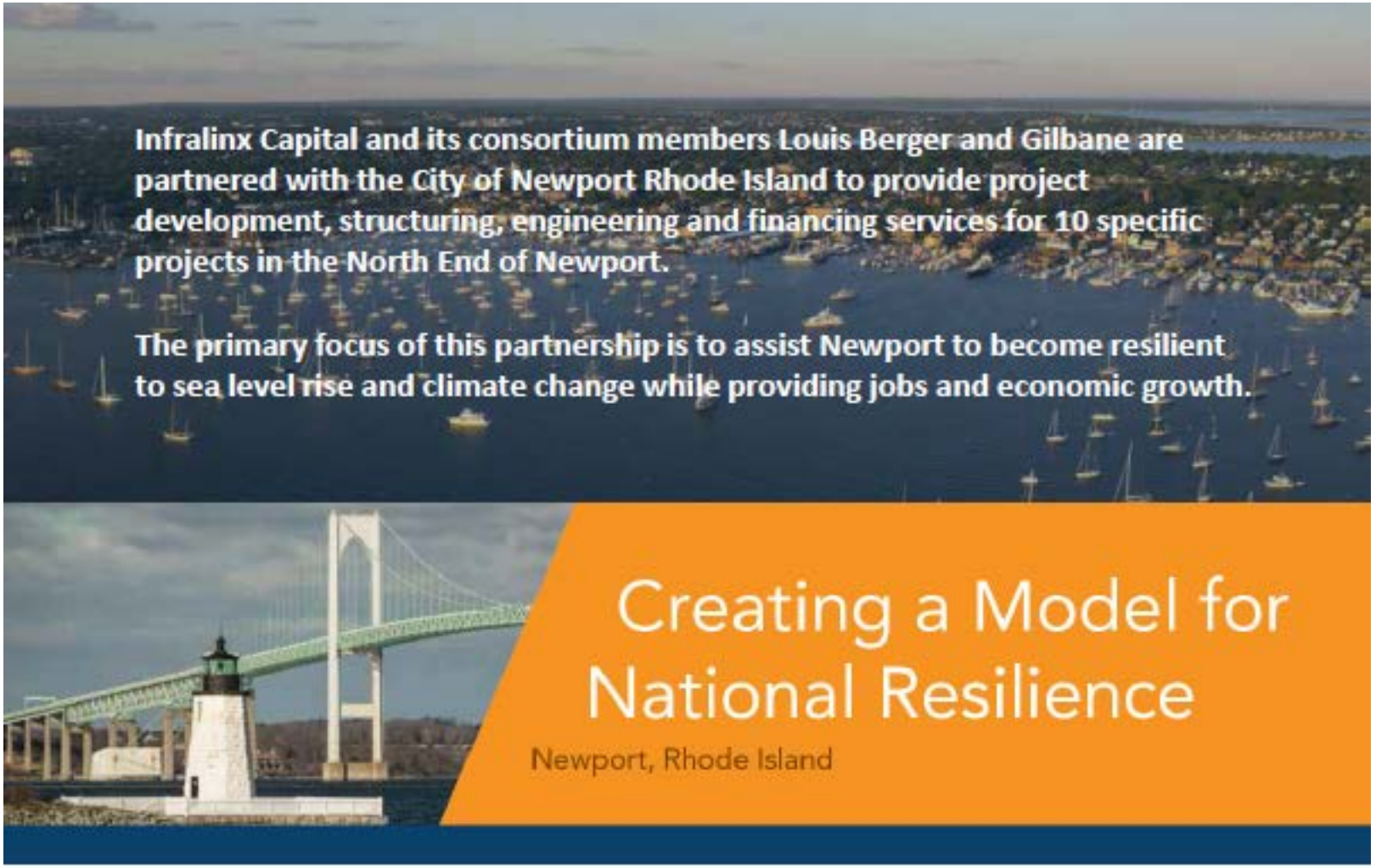
- Produces less than 1% of greenhouse gas emissions of conventional fossil fuel power plants.
- Eliminates greenhouse gas emissions by removing degradable material from landfills that produce toxic methane gas
- Produces clean sustainable energy products on a continuous basis (24/7)
- Major reduction of waste that must be disposed of in a landfill
- Efficiently recycles non-biomass materials (metals, glass, gypsum, etc.)
- A medium Btu (medium calorific value) synthesis gas having a high heating value
- A synthesis gas containing an order of magnitude less tar than other gasifiers of this type
- A synthesis gas having a consistent heating value and a high hydrogen content without further processing
- A carbon-free ash
- Over 90% of the energy in the incoming biomass recovered as synthesis gas and high value hot gas streams) with no other energy inputs required
- Low emissions profile
    - NO_x (nitrogen oxide) well below regulatory standards
    - Sulfur oxides and particulate emissions near zero
- Over 100 times lower greenhouse gas emissions when compared to landfilling residual materials
- A biomass energy system capable of competitively producing virtually any energy product desired (direct natural gas replacement, biopower, biofuels, biochemicals, or hydrogen)



OTHER MONTGOMERY PROJECT FACTS

- The proposed 300 DTPD Taylor biomass gasification Montgomery project will reduce our fossil fuel dependency by approximately 240,000 barrels or 10,000,000 gallons of oil per year producing 24MW gross renewable, alternative energy.
- The current Taylor-Montgomery plant is union affiliated with The International Laborers Union. The project currently employees 40 Union employees, down from the normal 50-60 employees due to the recent economic down turn. The biomass gasification expansion will add approximately 80 new union jobs.
- The construction of the Montgomery project will create approximately 400 temporary construction jobs for 18-24 months.
- The expanded Montgomery project will require the payment of approximately $1.1 in new taxes to the local town, school and fire district according to the Town Assessor's office.
- The Montgomery project proposes to take the MSW from the three existing Orange County operated transfer stations, local towns, cities and villages delivered to the Montgomery project, reducing long haul trucking, where it will be sorted, separated, recycled as feasible and prepare the organic biomass fraction into silos for storage and then into the biomass gasification process.
- This will produce renewable, alternative energy, generated locally and distributed into a nearby electric power substation reducing the need for new electric transmission power lines and corridors thru the area.
- The Montgomery project has township building and zoning permits; New York State DEC environmental permits; and a 20-year contract to sell all the electric power produced to the New York State Power Authority.
- The project will utilize a Engineer, Procure, Construct (EPC) contractor that meets USDOE LGP criteria.
- We must stop wasting our waste; it is a valuable resource.
- We can no longer continue to create those large mountains of waste that are never, ever going to go away.
- We now have a much more environmentally friendly local method for processing our waste with clean green sustainability
- We cannot continue to dump our waste into other people's backyards. We have learned how to manage our waste locally.
- We are most probably one of the first counties in the world to have a private company take in a waste stream within its normal service area (30 mile radius) such as construction & demolition debris, and recycle 97% of it into remanufactured products and have those 97% remanufactured products (including electricity).
- Taylor is now going to do the same concept with our municipal solid waste, commercial waste and waste wood.
- The Taylor-Montgomery facility is not in conflict with USDOT Federal Aviation Administration Advisory Circular 150/5200-33B. The Taylor-Montgomery facility is 5.2 miles from the end of the closest Stewart Airport runway.

CASE STUDY 3

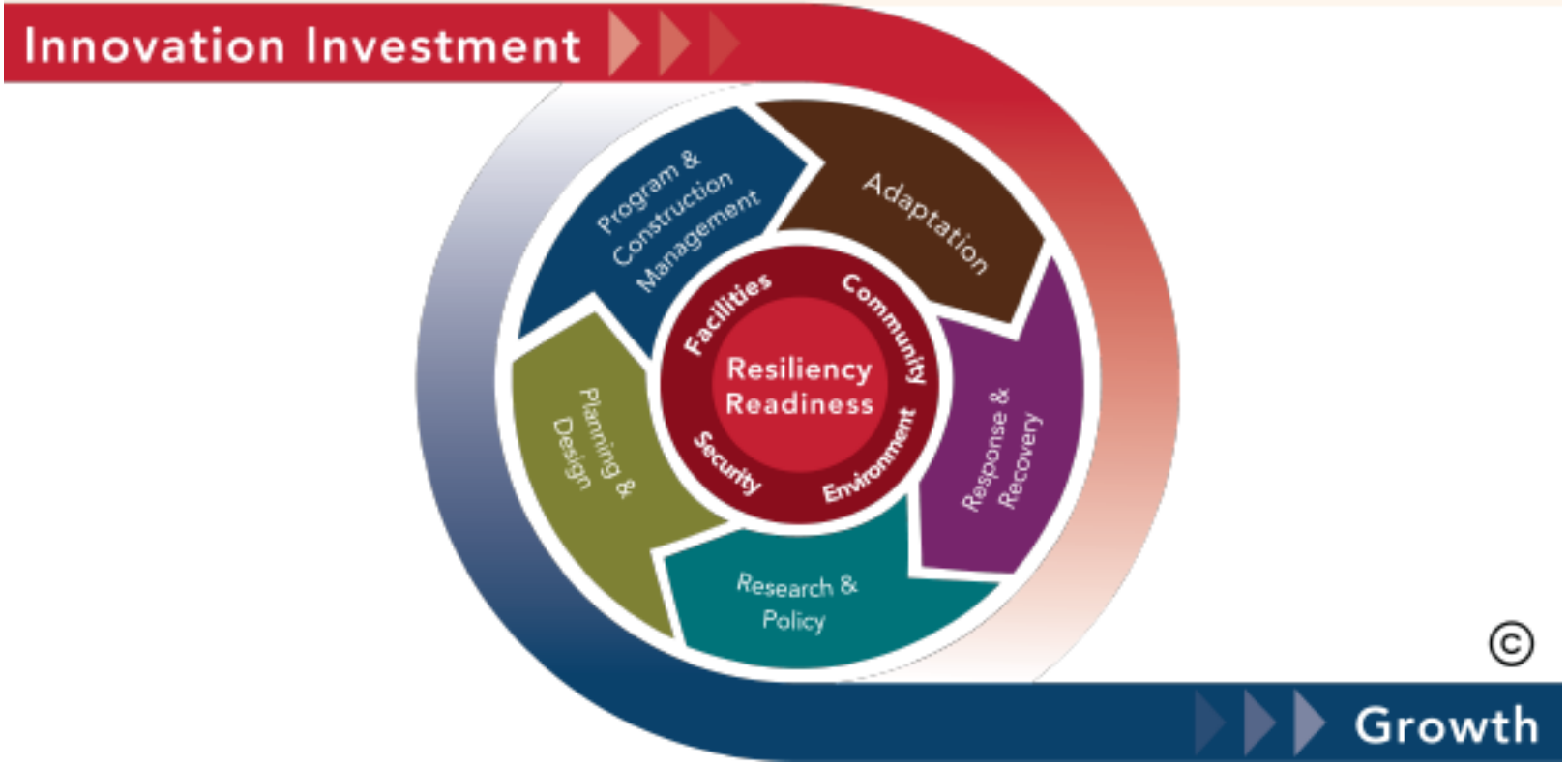


NEWPORT
PROJECT DEVELOPMENT COMPANY

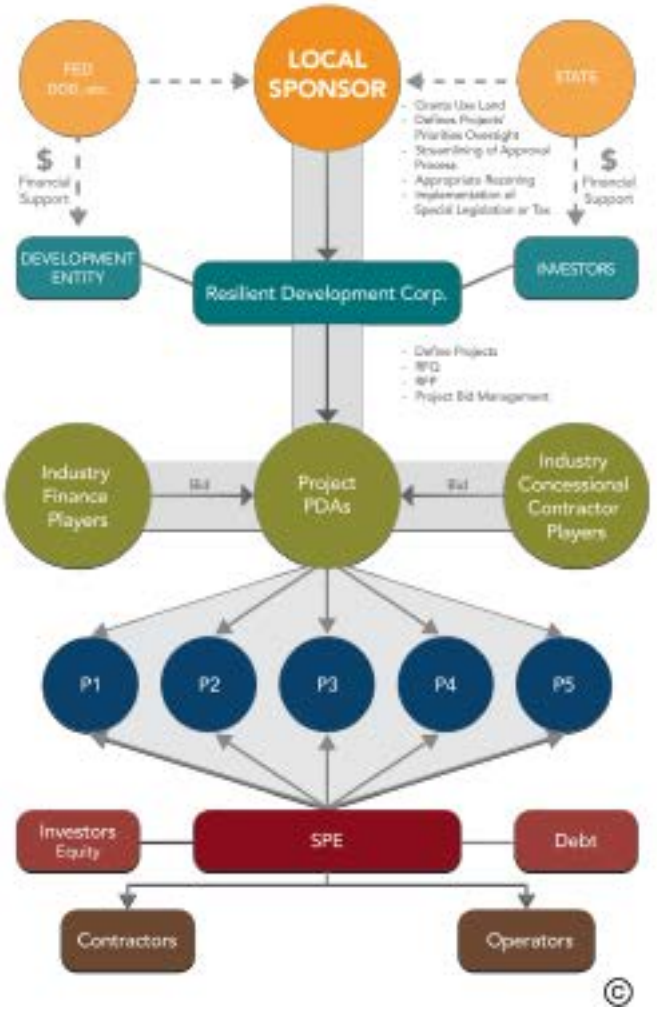
The Newport Resilience Engine

Newport has the security and resilience prerequisites, the data richness and technology innovation and a local government that is geared towards sustainable development.

No other City in the United States, or for that matter, globally can match Newport in its unique combination of these assets. It is perfectly positioned for investment that leverages upon these unique characteristics combining private and government resources.



Resilience Development P3 Framework




Development Opportunities
Providence, RI
Downtown Newport
Innovation Hub Redevelopment Sites
Microgrid Connected Facility
Hot Water and Steam Plant
Pell Bridge Ramp Realignment
Naval Hospital Redevelopment
Newport Waterfront Performing Arts Center (WPAC)
Newport Visitor Center
Innovate Newport
Urban Agriculture
Intermodal Center
Cyber Security
Green Infrastructure
Solar Power Opportunities

Clean City

MUN CON FY15, FY16, FY17

RECEIVED

JUL - 9 2014

Director of Public Services
City of Newport, RI

SOLID WASTE AND RECYCLING SERVICES AGREEMENT

Between the

RHODE ISLAND RESOURCE RECOVERY THE CORPORATION

And

THE CITY OF NEWPORT

THIS SOLID WASTE AND RECYCLING SERVICES AGREEMENT (Agreement), made and entered into as of this 1st day of July, 2014 by and jointly between RHODE ISLAND RESOURCE RECOVERY THE CORPORATION, ("The Corporation" or "Corporation") a quasi-public corporation organized under the laws of the State of Rhode Island, and **THE CITY OF NEWPORT**, (hereinafter "Municipality"), a municipal corporation organized and existing under the laws of the State of Rhode Island, with a business address at 43 Broadway Newport, RI 02840. In consideration of the mutual covenants, promises and payments set forth herein, The Corporation and Municipality do hereby agree as follows:

1. **TERM.** The term of this Agreement is a three–year period from July 1, 2014 through June 30, 2017. **The effective date of this Agreement shall commence on the date first appearing** above and end on June 30, 2017, unless sooner terminated or extended as provided herein. Fiscal Year 2015 is the one-year period from July 1, 2014 through June 30, 2015, Fiscal Year 2016 is the one-year period from July 1, 2015 through June 30, 2016, and Fiscal Year 2017 is the one-year period from July 1, 2016 through June 30, 2017.

2. **DISPOSAL OF SOLID WASTE.** For the term of this agreement and pursuant to Rhode Island General Law ("RIGL") Chapters 23-18.9-1 et seq. and 23-19-3,Municipality agrees to deliver for disposal to the Corporation's landfill in Johnston, R.I. (hereinafter "Landfill" or "Central Landfill"), one hundred percent (100%) of its Municipal Solid Waste as defined in RIGL §23-19-5(5) for which Municipality has undertaken the collection, transfer or disposal, (hereinafter "MSW"), and the Corporation agrees to accept and dispose of one hundred percent (100%) of Municipality's MSW.

   Municipality shall be deemed to have undertaken the collection, transfer or disposal of that MSW for which it:

   a. provides any of these aforementioned services through a contract or license, or by municipal employees, or

   b. pays for any of these aforementioned services with municipal funds, enterprise funds or the like, or

   c. assigns, subject to the Corporation's approval, all or part of its municipal waste cap for disposal at the Landfill to a third party.

   This Agreement shall not apply to the disposal of any other type of solid waste, including, but not limited to: 1) solid waste generated by residents of a municipality in the course of their employment; 2) solid waste generated by any manufacturing or commercial enterprise or, 3) solid waste for which Municipality has not undertaken the collection, transfer or disposal, as set forth above except where Municipality has implemented a commercial recycling program for which it has assumed responsibility for collection, either directly by municipal employees or through a

Commercial Solid Waste Estimates

Land Use Type	Number of Units	Estimated Solid Waste Generation Rate	Total Square Footage	Estimated Solid Waste per day (in lbs)
Offices	TBD	1lb./100 s.f./day		
Commercial/Retail	TBD	3.12 lbs./100 s.f./day	9,019,534	281,409.46
Restaurants	TBD	.005 lb./s.f./day		
Industrial/Warehouse	TBD	1.42 lb./100 s.f./day		
Schools	TBD	1 lb./student/day		
Hotel/Motel	TBD	4 lbs./room/day		
Public/Institutional	TBD	.007 lb/s.f./day		

Residential Solid Waste Estimates

Number of Households	Estimated Solid Waste Generation Rate	Estimated Solid Waste per day (in lbs)	Estimated Solid Waste per year (in lbs)	Estimated Solid Waste per year (in tons)
10,626	12.23 lbs./household/day	129,955.98	47,433,932.70	23,716.97

Total Daily Solid Waste

Daily Solid Waste (in tons)	222.58
TOTAL DAILY SOLID WASTE (dry tons) (Assumed 40% moisture content, not including biosolids)	133.55

Hourly Solid Waste (in tons)	5.5645
Estimate Power Potential (without biosolids)	6.12095

Considering 1.1 MW power generation potential per dr

Estimated Solid Waste per day (in tons)	Estimated Solid Waste per year (in tons)
140.70	51,357.23

/ ton per hour

CITY OF NEWPORT, RI WASTE TO ENERGY INITIATIVE

SUMMARY OF AVAILABLE INFORMATION OF EXISTING WASTE STREAMS

Waste Stream	Average Daily Amount of Waste (tons or cubic yard)	Average Weekly Amount of Waste (tons or cubic yard)	Average Monthly Amount of Waste (tons or cubic yard)	Annual Amount of Waste (tons or cubic yard)	Moisture Content	Component Weight Percentage (if available)	Disposal cost for the customer $/ton	Disposal cost for the customer $/cubic yard	Total Aggregate Monthly Disposal Cost (per waste stream)	Annual Disposal Cost	Ultimate Disposal Site (list if multiple; indicate disposal site owner/operator)	Municipal or Private Waste Hauler(s)?	Comments
MSW - municipal collection network	15.9 tons (from 04/15 to 03/16) 16.9 tons (FY14-15) 20.3 tons (FY13-14) 20.1 tons (FY12-13)	111.83 tons (from 04/15 to 03/16) 118.48 tons (FY14-15) 142.89 tons (FY13-14) 140.91 tons (FY12-13)	484.61 tons (from 04/15 to 03/16) 513.41 tons (FY14-15) 619.19 tons (FY13-14) 610.49 tons (FY12-13)	5815.34 tons (from April 2015 to March 2016) 6160.98 tons (FY14-15) 7430.33 tons (FY13-14) 7327.26 tons (FY12-13)	N/A	N/A	Landfill tipping fee: $32/ton for disposal of non-segregated MSW up to its annual cap tonnage $25.53/ton for use of transfer station (from July 1, 2015 through June 30, 2016) $25/ton for use of transfer station (from July 1, 2012 to July 1, 2013)	N/A	N/A	$985,263.44 (in 2014)	Disposal Site: Central landfill owned by RIRRC and located in Johnston, Rhode Island	Contractor/Private: Waste Management of Rhode Island, Inc.	Primary drop-off facility: Municipal DPW Yard (department of public work) (owned by the City) Secondary drop-off facility: Transfer Station (owned by Waste Management of Rhode Island, Inc.)
MSW - commercial collection network	An estimate of 140.78 tons	An estimate of 987.64 tons	An estimate of 4,279.77 tons	An estimate of 51,357.23 tons	N/A	N/A	Between $56 and $75 per ton	N/A	N/A	N/A	N/A	N/A	RIRRC has owned and operated the Central landfill since December 1980, and currently manages approximately 2,500 tons of residential and commercial waste per day in Rhode Island. However, this amount may include waste from other sources than listed in this table.
MSW - residential collection network	An estimate of 64.98 tons	An estimate of 456.1 tons	An estimate of 1,976.41 tons	An estimate of 23,716.96 tons	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
Yard waste - municipal collection network	N/A	N/A	N/A	1524.02 tons (in 2015) 131.31 tons (KY:2016)	N/A	N/A	$2,600.00/month for the first 1,200 tons in a base contract year + $26.00 for each ton over 1,200 tons in the base contract year $14.00 per ton for clean seaweed composting	N/A	N/A	$200,513.68 (in 2015)	Primary location : Wapping Rd site in Middletown and Glen Rd site in Portsmouth owned by RI Nurseries Secondary location: Transfer Station (owned by Waste Management of Rhode Island, Inc.) Waste Management segregates material and brings it to Rhode Island Nurseries to be composted, or brings it directly to RI Nurseries.	Contractor: Waste Management of Rhode Island Inc.	RIRRC processes about 40,000 tons of leaf and yard debris each year in Rhode Island through a windrow (row-like pile) process.
Yard waste - commercial collection network	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
Yard waste - residential collection network	N/A	N/A	N/A	349.74 tons (from Jan 16 to May 2016)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	City pays for municipal and residential yard waste collection.
Municipal C&D waste	N/A	N/A	N/A	N/A	N/A	N/A	$75 per load if under 10,000 lbs GVW $150 per load if over 10,001 lbs GVW	N/A	N/A	N/A	Drop off at Transfer Station (80 Halsey St., Newport)	N/A	Municipal C&D tonnage is considered MSW and is applied against the municipality's annual cap tonnage.
Commercial C&D waste	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
Storm clean-up waste	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
Biosolids (wastewater sludge)	2015: 4.85 % TS (Avg. % Solids) 5.52 DT (dry tons) 27,492 gallons 2014: 4.39 % TS (Avg. % Solids) 4.95 DT (dry tons) 27,568 gallons	2015: 38.07 DT (dry tons) 2014: 34.18 DT (dry tons)	2015: 164.98 DT (dry tons) 822,500 gallons 2014: 148.12 DT (dry tons) 813,625 gallons	2015: 1,979.78 DT (dry tons) 2014: 1,777.45 DT (dry tons)	N/A	N/A	Solids% content (0 - 5.9%): $483.93/ton Solids% content (6 - 7.9%): $421.87/ton Demurrage: $93.05 (1/2 hour) Tolt: $10.00 per load	N/A	N/A	2013: $488,568.45 2014: $819,546.33	N/A	N/A	
Creosote soaked wood/ rail ties/scrap tires	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
MRF residuals	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
Food/organic waste	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
Medical Waste	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	

N/A - Not Available

*Note that residential MSW quantities are estimates based on the number of households in Newport (average of 10,626 households)

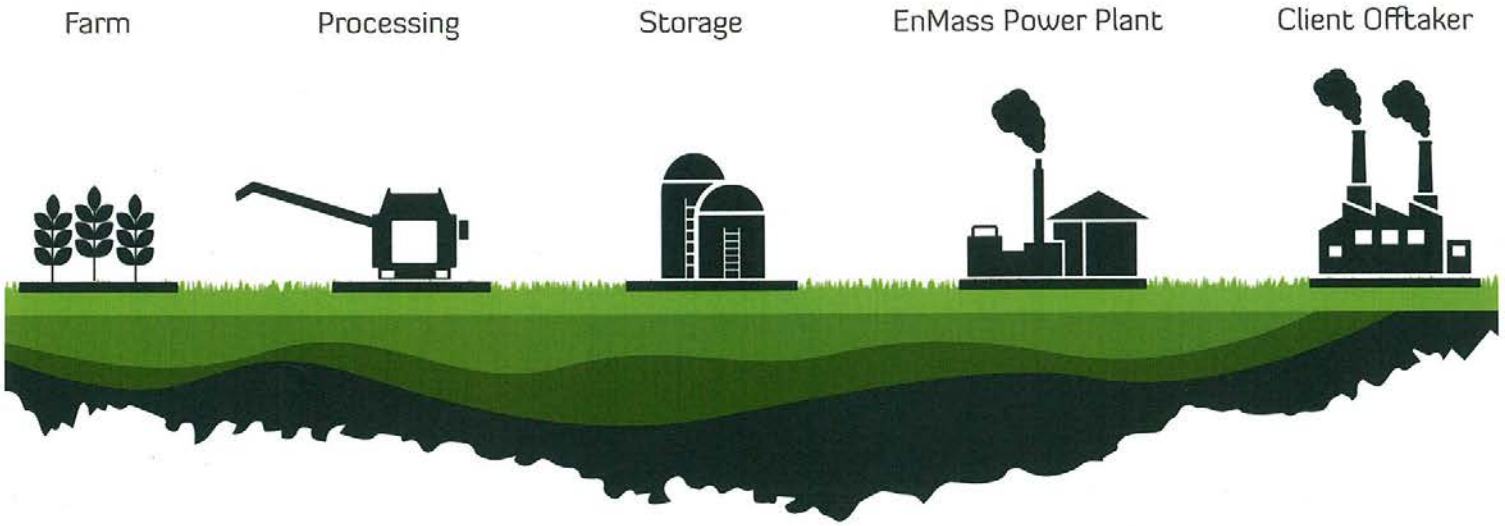
TOTAL DAILY SOLID WASTE (Assumed 40% moisture content, not including biosolids (approximately 5.52 dry tons))	133.55 dry tons

Estimate Power Potential [without biosolids]	6.1 MW	Considering 1.1 MW power generation potential per dry ton per hour

CASE STUDY 4

EnMass Energy Projects are a Closed Loop

We generate reliable energy from agricultural biomass waste in frontier markets.



Milestones & Metrics

Milestones Table

Milestone	Due Date	Who's Responsible	Details
Signed Letters of Intent with Clients	Completed	EnMass Energy Corporate Team	Signed first client Letters of Intent to purchase electricity for a total of 34 MW generation capacity
Partnership Agreements in Place	Completed	EnMass Energy Corporate Team	Supply Chain, EPC, Fabrication, and Manufacturing Partnerships Established.
Vendor Selection	Completed	EnMass Energy Corporate Team	3 month vendor selection process focused on ability to provide equipment and machinery, as well as number of established projects and ability to work with project client needs.
Technical Site Analysis Completed	May 02, 2016	EnMass Energy and PES International	Prospective project sites are selected based on technical analysis of surrounding infrastructure and client need
Power Purchase Agreements Signed	July 04, 2016	EnMass Energy	EnMass Energy and client sign 20-year binding purchase agreement for power generate on behalf of client
Technical Project Design Completed	August 01, 2016	PES International and Equipment Supplier	All technical aspects of project ahead of construction are completed
Financial Close of Projects	September 05, 2016	EnMass Energy	All public infrastructure debt, subordinated debt, and required private equity is allocated to project and project breaks ground.
Project Equipment Manufacture and Construction Commences	December 05, 2016	PES International, Equipment Supplier, and Local Fabricator	Civil works are started, project sites are readied for plant equipment, and procurement of non-site manufactured plant capital begins

Construction Completed	June 05, 2017	Local Fabricator	All necessary equipment is procured, constructed, and built on site.
Commissioning of Plants	September 04, 2017	EnMass Energy	Plant becomes operational.

Conclusion

- Mountains of waste and Wte solutions in rural areas in emerging markets can be solved by
  - Combination of classic Wte and for profit units with
  - Impact investors and
  - Multi-lateral bank, political and insurance coverage
  - Public leadership and vision and
  - Entrepreneurial business effort

INFRALINX

TOTAL IMPACT CAPITAL