

HDR



Learning to Love Three Dimensional Whack-a Mole

Implementing Conversion
Technologies in the 21st Century



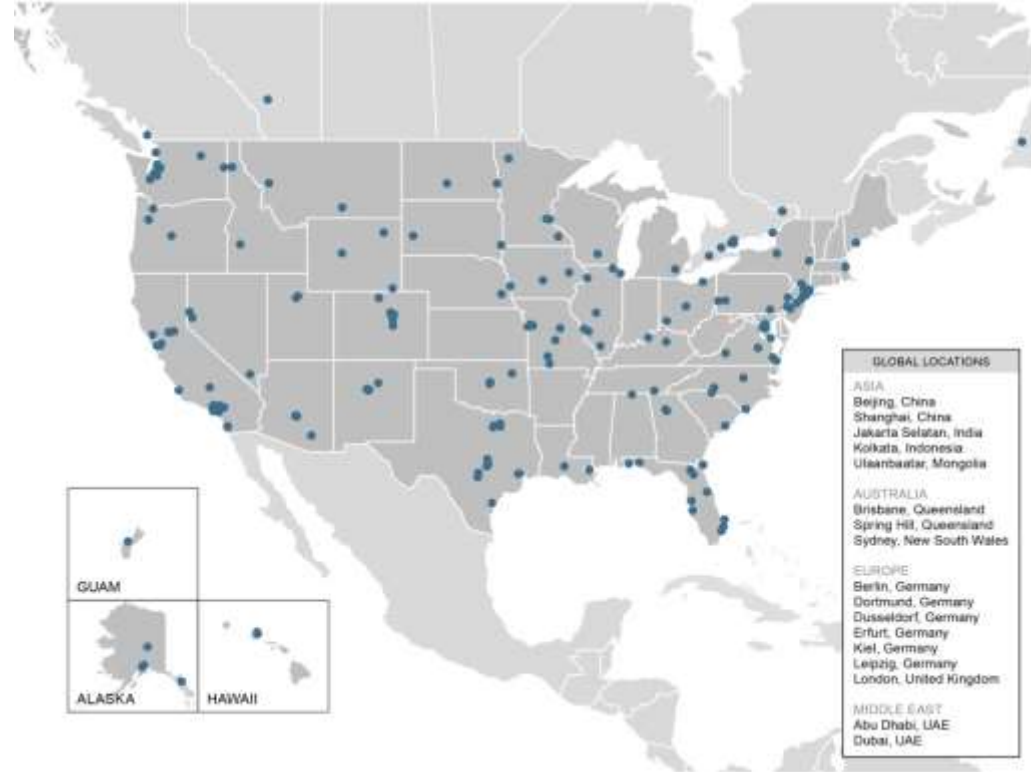
Introducing HDR

- More than 9,200 Staff
- 225 locations across the globe
- Multidiscipline engineering focus

- Dedicated **Solid Waste Resource Management Group** combining expertise in:
 - Solid Wastes
 - Industrial Wastes
 - Municipal Wastewater

- Clients include City of New York, Los Angeles, Honolulu, Durham/York and Peel Regions, Dutchess, Islip, and Clarkstown

- Half dozen offices in New York State, over 500 employees





Overview

**Key Elements of a Successful
Program**

Key Steps Involved

Lessons Learned

What's Next?

Overview

Communities want greater diversion from landfills

- Many communities adopting greater diversion level goals
- 75% diversion and “Zero Waste” common goals
- Example communities:
 - New York City- One New York– Zero Waste to Landfill by 2030
 - Los Angeles – 90% by 2025
 - San Francisco –Zero waste by 2020



Common Themes

- Waste is a resource resulting from inefficiency
- There is no “away”
 - Options for “disposal” are land, sea or air
- We need to treat residuals responsibly
 - Close to the source of generation
 - Consider impacted communities (Environmental Justice)
- It is not waste until you waste it!



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Key Elements of a Successful Program

Elements of Successful Projects

Project Champion and Political Support



Technology



Waste Supply



Residuals Management



Funding



Markets



Site



Education/Outreach

Overview of Key Project Elements

- Site
- Waste Supply & Characteristics
- Technology
- Energy/Materials Market
- Residuals Management Capacity
- Economics & Business Case
- Project Champion(s)
- Procurement Process
- Experienced and Capable Vendor(s)
- Implementation Team
- Local, Regional, Provincial & Federal Support
- Regulatory Framework
- Education, Communications, and Consultation
- Major Milestones
- Ownership?

Importance of clarity & transparency in data; evaluation; decision making processes; and, project structure.

Risk Allocation

- Ownership
- Siting
- Technology & Vendor Experience
- Project size
- Construction & Capital Cost
- Operation & Maintenance
- Financing
- Energy & Recovered Materials
- Waste Commitment & Residuals Management
- Regulatory changes
- Environmental Approvals



Allocation of Risks Depends on Project Structure

Project Structure:

For A Typical DBO Process

Ownership and supplier of Site

= Public

Ownership of Facility

= Public (some Private)

Waste Supply and Composition

= Public

Arrange for residual disposal

= Public or Private

Provider of technology

= Private

Buyer of energy or byproducts

= Independent third parties

Financing of project

= Public, Private or Joint

Environmental Approvals

= Public

Type of procurement

= Two-Stage (RFQ/RFP)

Some Attributes and Uncertainties

Attributes

- Ownership
- Size
- Access
- Utilities
- Approvability
- Location

Uncertainties/Risks

- Vendor or Public Site
- Approvability
- Subsurface conditions
- Pre-existing environmental conditions
- Political and Public Acceptance



Need to Understand Appropriate Risk Allocation

Some Attributes and Uncertainties

Attributes

- Permits
- Location
- Capacity
- Responsibility for Management
- Host Community

Uncertainties/Risks

- Types & Quantities
- Environmental Characteristics
- Disposal Location & Costs
- Beneficial Reuse Options



There Are Always Residuals

Some Attributes and Uncertainties



Attributes

- Availability/need/price of power
- Other Energy Users (steam, hot water, fuel)
- Other By-Product Users
- Competition

Uncertainties/Risks

- Quality of products
- Quantity of products
- Environmental character
- Availability/Sustainability of markets
- Price

Technology Choice Affects Market Uncertainty

Some Attributes and Uncertainties



Attributes

- Type and Source of waste
- Waste collection practices
 - public vs. private
 - source separated

Uncertainties/Risks

- Control of waste stream
- Quantity
- Composition & Quality
 - Btu content
 - Contaminants
- Impacts of current and future diversion programs
- Regulations

Must Have Supply of Acceptable Waste

Some Attributes and Uncertainties

Attributes

- Waste Stream Dependent
- Best-Fit Technology Class
- Site Requirements
- Performance Guarantees
- Environmental Performance

Uncertainties/Risks

- Costs
 - Capital
 - Operations & Maintenance
- Schedule for construction
- Vendor Experience/Capabilities
- Readiness
- Performance



The Technology Must Work

Overview of Conversion Technology Treatment Options



What are the Options for Post Recycling Residuals?

Alternative technology

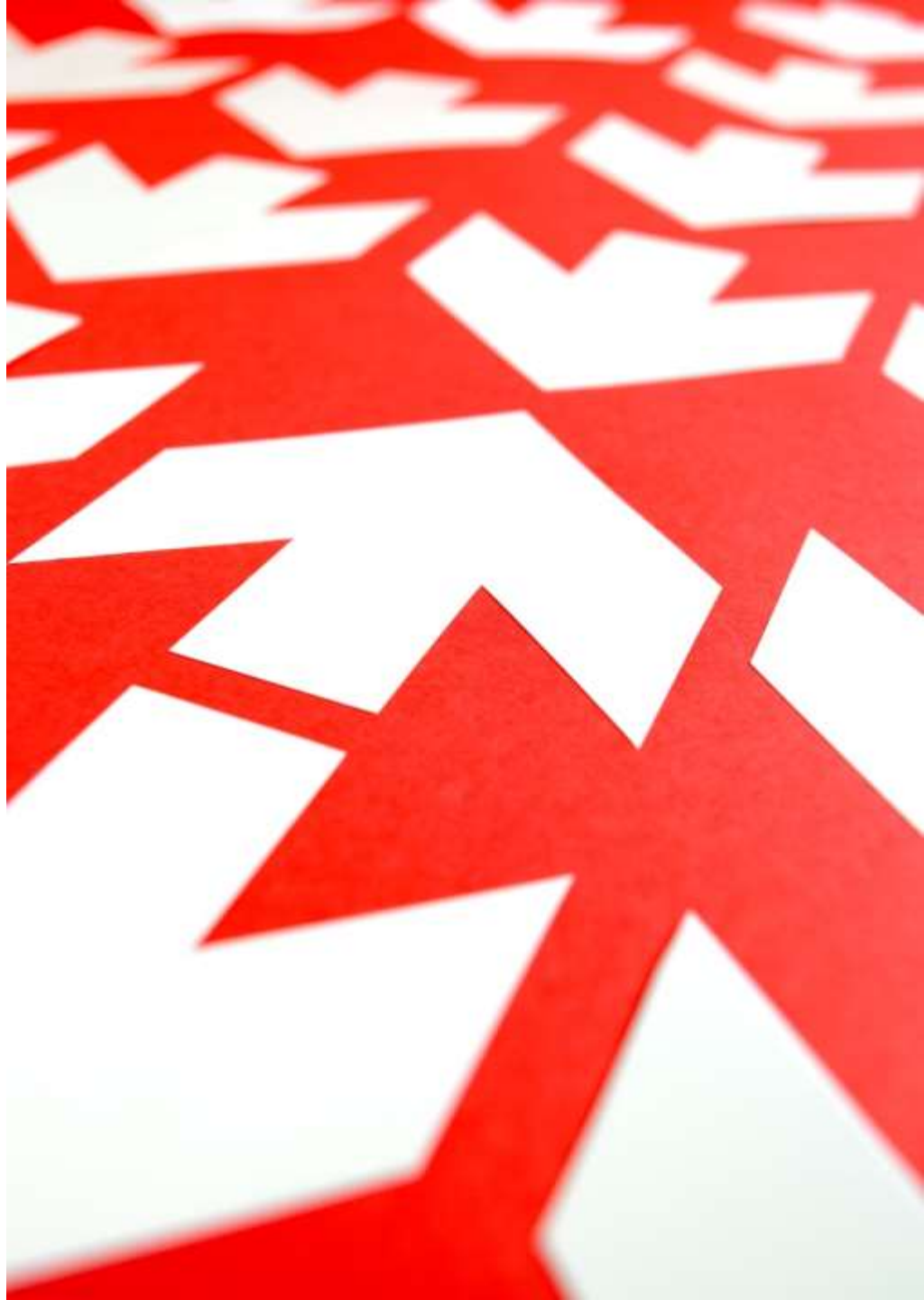
- In some cases “emerging”
- Shows promise for reducing impacts of organics

Landfilling

- Creates landfill gas and leachate
- Could be appropriate for inorganic or treated residuals

Traditional WTE

- Proven and predictable
- Impacts can be mitigated



Conversion Technologies

Conversion technologies considered

- Anaerobic Digestion
- Composting
- Gasification
- Hydrolysis
- Pyrolysis
- Steam Classification

Transfer Station is often foundation to integrated waste management system

Introduction to Technology Options

Clarify Goals Before Engaging Technology Options

- Why?– Market Drivers, Purpose/Goals
- What? – Feedstock, Technology, Output/Efficiency, By-products, Experience
- How? – Differ, Perform, Compare, Qualify

Why? - Clarification of Purpose/Goals of Facility

- Landfill Diversion/Recycling Hierarchy
- Power Production, Renewable Power/Energy
- Clean Fuels
- Sustainability/Green Vision
- Reduce Greenhouse Gases
- Financial Terms and Issues, Life Cycle Analysis
- Changes to Collection, Policies and Programs
- Waste Management Responsibilities



What are We Treating? - Feedstock Types

Mixed Municipal Solid Waste (MSW)

- Prevalent but potentially challenging

Construction and Demolition (C&D) wastes

- High Btu values but commodity driven

Industrial Wastes

- High Btu values but commodity driven

Source Separated Organics

- Simplifies facility but at added collection cost and capacity

Ranges of Quantities (very small to large)

Types of Technologies

- Mechanical
 - Recovery
 - RDF
- Thermal
 - Proven (mass burn, RDF)
 - Emerging (gasification, pyrolysis, plasma arc)
- Chemical
 - Emerging (hydrolysis, catalytic depolymerization)
- Biological
 - Somewhat Proven (anaerobic digestion aerobic)



Will Want to Kick The Tires with Steel Toed Boots!

- Where is the technology working at a comparable scale?
- How does the technology or process fit into your solid waste system?
- What feedstock(s) has the technology demonstrated it can reliably process? How does that compare to your waste stream?
- How much will it cost? And, what's included in those costs?
- What financial backing does the contractor/vendor if it does not work as planned or fails?
 - Parent Guarantees?
 - Other Financial Backers?
- What are the metrics used to determine the successful demonstration of the technology or process?

Some Attributes and Uncertainties



Attributes

- Public Funding – reserve fund, grant, loans
- Private Financing – debt, equity
- Possible Revenue Streams – tipping fees, energy revenues, by-product sales, general taxes

Uncertainties/Risks

- Availability of Public (e.g. P3 Canada) or Private Funds/Grants
- Interest Rates
- Repayment of Debt
- Financial capacity of vendors
- Product/By-product pricing

03

Key Steps in Securing a Successful Project

Technical Analysis - Performance

- **Proof of Technology Using Defined Feedstock**
 - » Similarity of feedstock to committed feedstock
 - » Performance history related to feedstock
 - » Likely variability in feedstock over time (Btu, moisture, etc.)
- **Throughput Capacity**
 - » Ideal throughput capacity per key facility component
- **Scale-up/down Factors**
- **Availability Factors**

Technical Analysis – By products

- **Power Generated (Gross and Net)**
 - » Parasitic power requirements (feedstock specific)
- **Heat Reuse**
- **Marketable Products**
- **Residuals**
 - » Ash/Slag
 - Treatment required for beneficial use
 - Geographic/regulatory affect on market value of ash/slag
- **Digestate**
- **Air Emissions**
 - » Toxic Air Contaminants
 - » Criteria Air Pollutants
 - » GHG
- **Effluent**

Technical Analysis – Company Credibility/Strength

- Operational History
- Experience with Regulatory Framework
- International Support
- Guarantees
 - » Design
 - » Construction
 - » Operations
 - » Power Purchase
- Externalities

Financial Analysis

- **Parent Company Net Worth**
 - » Commitment of Equity
 - » 'Skin in the game'
 - » Not shielded by LLC or JV
- **Bonding Capacity**
- **Financial Partners/Assurance Guarantors**
- **Bankable Project Team**
- **Financeable Project**

Addressing Regulatory and Institutional Issues

- **Educating Regulators**
- **Air (Emission Levels, Offset Credits, GHG, etc.)**
- **Water and wastewater (Requirements, Discharge Rates, etc.)**
- **By-Products/Residuals (State/Federal Definitions re Hazardous, Beneficial Use, etc.)**
- **Land Use**
 - » **Traffic**
 - » **Aesthetics**
 - » **Noise**
- **Environmental Justice**
- **Educating Stakeholders**

Conversion Technology Risk Allocation



Possible Risk Takers

- Taxpayers
- Stockholder
- Investors
- Communities
- Technology Firm
- Guarantor
- Product Buyers
- Bondholders
- Insurance Companies
 - » Casualty
 - » Performance



Risk Allocation – Private Responsibility

- Demonstrated Facility Performance Treating Similar Feedstock
- Proof of Scale-Up
- Design/Performance Guarantees
- Environmental & Emission Performance
- Securing Permits
- Realistic Economics
- Private Sector Champion

Requires a Viable Technology

Risk Allocation – **Public** Responsibility

- Defined Quantity of Feedstock at Set Fee (Put or Pay Risk)
- Defined Range of Feedstock Composition
- Political Willpower / Public Sector Champion

Requires Waste Flow Commitment/Support

Risk Allocation – Shared Responsibility

- Site Selection
- Environmental Review/Land Use
- Power Purchase Agreements
- Political Support
- Financial Commitment

*Requires Cooperation and Championing from both
Public and Private*

Risk Allocation - **Uncontrolled**

Uncontrollable Circumstances are events beyond anyone's control that have a material adverse effect on performance and costs.

Uncertainties/Risks

- Change-in-Law
- Hurricanes, tornados, fire, floods, etc.
- Terrorism, insurrection, war
- Strikes
- Macro-economic conditions

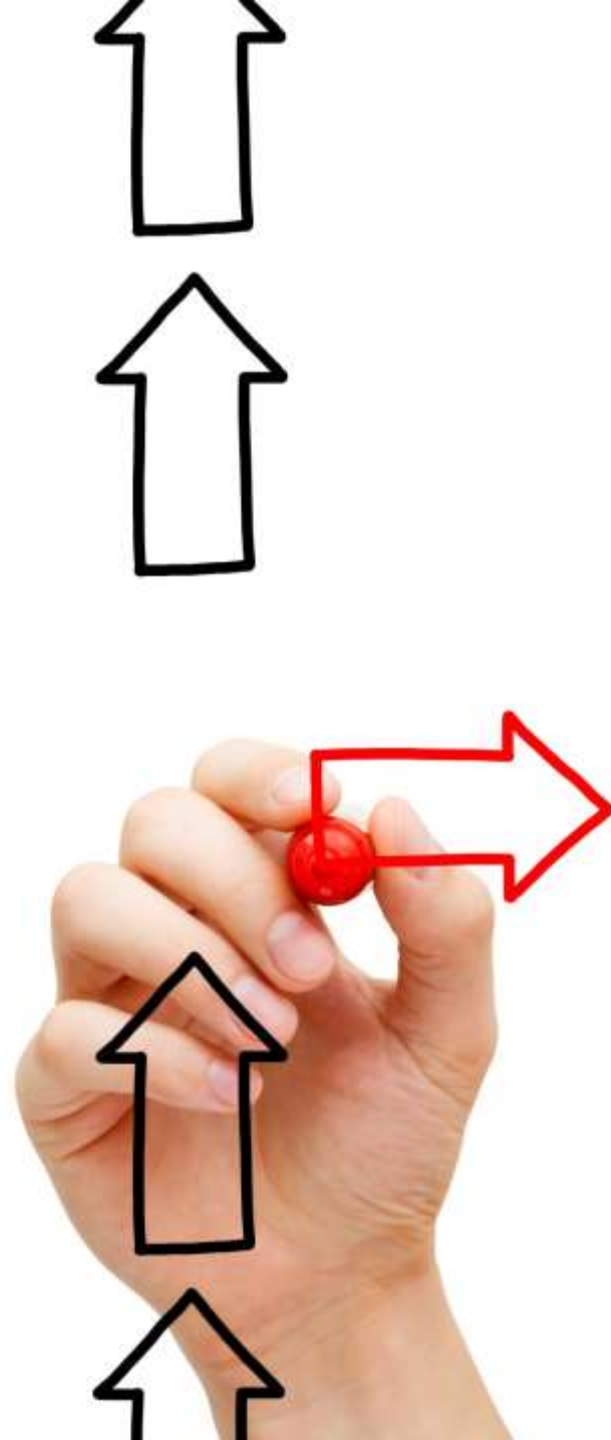
Possible Risk Taker

- Public
- Insurance/Joint
- Joint
- Negotiated
- Joint – (price indices & pass through costs)

Project Challenges

A project of this magnitude involves:

- Aligning the priorities of the State and municipal governments.
- Engaging a strong commitment from all parties involved in the project.
- Developing public trust built on an “open-and-transparent” process.
- Developing and maintaining a solid financial strategy.



Key Issues to Expect

- Competition with Waste Diversion
- Energy/Materials Output and Efficiency
- Costs and Economic Viability
- Facility Ownership and Operational Responsibility
- Residue Management
- Impacts to Human Health
- Impact to Ecological Health
- Air Emissions
- Cumulative Effects
- Truck Traffic Impacts
- Impacts to Local Agricultural Operations
- Compliance and Monitoring
- Impact to Property Values

Understanding when, how and to what degree to respond is critical

“Moles”

Things that can go Bump in the Middle of the Night

Materials Market
Tanks

Change in tax code

Change in environmental regulations

Condos go in next door

Waste “Disappears”

Corporate Board moves in a new direction

Shale Gas Discovered in your back yard

End of Above Market Energy Contract /Loss of Energy Market

Change in administration

Demonstration Unit Fails

Company goes Bankrupt

Financial Markets Dry Up



Don't End Up Blind River without a Paddle!!!

- *Small town of Blind River caught up in Plasco fallout — to tune of \$17M*
- *Plasco-investing Blind River now faces 22 years of loan payments — plus \$22M one-time sum*



04

Lessons Learned

Lessons Learned

- Purpose: Define the Overriding Goal/Purpose Prior to Considering Conversion Technology
 - Anticipate need to resolve waste flow control
 - Cost
 - Diversion hierarchy
 - Value of public support
- Understand Conversion Technology Limitations Due to Differences in Feedstock
- Consider the need for flexibility to be Assured of Facility Performance Over Time

Lessons Learned - Continued

- Allocate Risk According to the Entity Controlling Performance
- Technology Provider/Development Partner
 - Technical performance and related guarantees should be assumed by a strong Private Guarantor that offers
 - Financial Strength
 - Expertise Operation of the Technology
 - Construction strength
 - Sufficient Contractual limits of liability
- Both Parties Should Secure Performance Relief for Uncontrollable Circumstances (UCCs)

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Lessons Learned - Continued

- Know your waste stream
- WTE/Wtf is the last piece of the puzzle
- Make sure that the Facility is “right sized”
- Communicate, communicate, communicate!
- Location, Location, Location!
- Identify a Political Champion
- Establish a process that will withstand several election cycles

Getting it Done on the Public Side

- Know your needs
 - Quantity and Characteristics of Your Waste over the planning period
 - Anticipated changes in System
- Know your assets
 - Do you have a site?
 - How will you fund the capital costs?
 - How strong is your team?
- Know your Risk Appetite
 - Know your stakeholders
 - Identify your “third rails”
- Assemble your team
- Engage Stakeholders early and often

The clearer you are in defining your needs, the better your chance for success!

Getting it Done on the Private Side

- Know the Players
 - Understand the System- your role as part of an integrated resource management system
 - Understand the Regulatory Framework
 - Understand the Politics and Process
- Bring your A Game
 - Assemble as many of the key ingredients as you can
 - » Technology
 - » Team
 - » Funding
 - » Site?

The more you bring to the party, the better your chance for success!

Summary

- Things always take longer than you think
- Where you end up depends on where you started from
- Negotiation is a full contact sport
- If you don't sweat the small stuff, you'll lose the big stuff
- She who controls the pen controls the outcome
- Time waits for no one, least of all a waste project!
- Think Circular Economy !!!!!

05

What's Next?

What is needed to move WTE/WTF forward?

- Continued need for education at all levels on potential impacts and benefits.
- Need for recognition of where WTE/WTF fits within waste hierarchy, the definition of waste diversion and recovery.
- A clearer understanding of where WTE/WTF will fit as a “renewable” form of energy and what that means.
- Cooperation amongst all levels of government



What does the future hold?

- The next few years will still be a struggle.
- Natural gas prices have impacted the price point for energy/fuels
- The role of new and emerging technologies will evolve
- Continued changes and uncertainty in the regulatory environment complicates progress on facility design
- Progress has been made, through regulatory change and the perseverance of innovative municipalities and corporations.
- The public is becoming more aware of the alternatives and their role in living by the 4R's.

Conclusions

- Movement towards greater Diversion
- Conversion technologies are becoming a more viable option
- Pilot and demonstration projects needed
- When proven feasible, conversion technologies can be part of the solution for more sustainable waste management





Thanks

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