Tactical Electric Power
Now and for the Future

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Project Manager

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New Orleans, LA
Tactical Electric Power

Now...

Powering the Force
PM MEP Strategic Framework

- **Values**
  - Integrity – Quality - Innovation

- **Mission**
  - Provide standardized tactical electric power and environmental control capabilities to the Department of Defense in support of National Security

- **Vision**
  - Recognized as the Department of Defense leader for innovative power and environmental control solutions; known for the quality of our products and the excellence of our people
PM MEP Executive Agent Mission

Deputy Under Secretary of Defense (Logistics and Material Readiness)

Standardization

Assistant Secretary of the Army (Acquisition, Logistics and Technology)

Program Execution

Army
102,493 Gen Sets (82%)
1,264,105 kW (60%)

Marine Corps
7,698 Gen Sets (6%)
179,802 kW (9%)

Navy
1,594 Gen Sets (1%)
84,588 kW (4%)

Air Force
13,340 Gen Sets (11%)
576,547 kW (27%)

DOD Total Requirements
125,125 Generator Sets
2,104,952 kilowatts (kW)
Exorbitant Demand for Electrical Power

Excessive Proliferation: 2,000 different makes, models, and sizes

Ineffective Logistical Support

1965
Southeast Asia

1967
DOD Ad Hoc Working Group Established

Vietnam

- Identified need for a Department of Defense Standard Family of Mobile Electric Power Generating Sources
- US Army designated as lead standardization activity
- Established Project Manager Mobile Electric Power to execute mission
- Codified in Department of Defense Directive and Joint Operating Procedures
Meeting Operational Needs

- **Operation in harsh environments**
  - High and low ambient temperatures
  - Dust
  - Reduced acoustic and thermal signatures
  - Low noise

- **High performance, rugged systems**
  - EMI/EMC/EMP
  - Shock resistance
  - Noise and vibration
  - Resistant to nuclear, biological, and chemical (NBC)

- **Deployability and flexibility**
  - Interoperability with NATO equipment
  - Fully transportable and mobile
  - Reliability and maintainability

- **Advanced control systems and human-machine interfaces**
  - Prognostics and diagnostics
  - Automatic sequencing and paralleling
Power Generation and Distribution Programs

Military Tactical Generator

Tactical Quiet Generators

Deployable Power Generation & Distribution System (DPGDS)

Power Units/Power Plants (PU/PP)

Power Distribution Illumination System Electrical (PDISE)
Small 2kW Military Tactical Generator

**CHARACTERISTICS/PERFORMANCE:**

- **Fuel:** Diesel/JP-8
- **Noise:** 79 dBA
- **Reliability:** 500 hrs MTBF
- **Weight (Wet):** 138 lbs DC / 158 lbs AC
- **Size:** 5.95 cu ft
- **Operating Temp:** -50° to +120°F
- **Altitude:** 2kW @ 4000ft/120°F de-rated up to 8000ft
- **Fuel Capacity:** 4 hours @ 100% Load
- **Fuel Consumption:** 0.33gal/hr

**ORD – LT2kW 14 Jul 1992**

**EQUIPMENT USES:**

- Modern Burner Unit, Mobile Kitchen Trailer (MKT)
- RQ-7A Tactical Unmanned Aerial Vehicle (TUAV)
- Enhanced Position Location Reporting System (EPLRS)
- High Mobility Artillery Rocket System (HIMARS)
- Assault Hose System (AHS)
- Woodworking Set
- M77A2 155mm Howitzer

**CONTRACTOR:**

Dewey Electronics, Oakland, NJ
CHARACTERISTICS/PERFORMANCE:

Fuel: Diesel/JP-8
Noise: 70 dBA @ 7m
Reliability: >560 hrs MTBOMF
Weight (Wet): 326 lbs
Size: 15.05 cu ft
Operating Temp: -25° to +120°F
Altitude: 3kW @ 1000ft/107 F
de-rated up to 8000ft
Fuel Capacity: 8 hours + Auxiliary
Fuel Consumption: .33gal/hr

ORD – CGSA ROC w/Revision 1995

EQUIPMENT USES:

- Mobile Subscriber Equipment (MSE)
- Joint Biological Point Detection System (JBPDS)
- Patriot/Terminal High-Altitude Area Defense (THAAD)
- Lightweight Water Purification (LWP) System
- Maintenance tent lights and battery charging system

CONTRACTOR:

DRS Fermont, Bridgeport, CT
Medium (5-60kW) Tactical Quiet Generators (TQG)

**CHARACTERISTICS/PERFORMANCE:**
- Decreased weight and cube
- Improved mobility/transportability
- Improved survivability
- Single fuel on the battlefield (diesel/JP-8)
- Reduced fuel consumption
- Increased interoperability
- Increased reliability
- Improved ease of operation/maintenance/repair
- Stringent power quality
- Sustained power output in extreme climatic and environmental conditions

Compared to MIL\STD generator sets which TQGs replace

**EQUIPMENT USES:**
- Command Posts
- Weapon Systems
- Aviation Ground Support
- Water Purification Systems
- Laundry Units
- Bakery Plant
- Printing Plant
- Refrigeration Systems

**CONTRACTOR:**
- DRS Fermont, Bridgeport, CT
- L-3, Tulsa, OK
# Large 100/200kW Tactical Quiet Generator

## Characteristics/Performance:

<table>
<thead>
<tr>
<th></th>
<th>100 kW</th>
<th>200kW</th>
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<tbody>
<tr>
<td>Fuel</td>
<td>Diesel/JP-8</td>
<td>Diesel/JP-8</td>
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<tr>
<td>Fuel Tank Capacity (gal)</td>
<td>66</td>
<td>128</td>
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<tr>
<td>Fuel Consumption (gal/hr)</td>
<td>7.8</td>
<td>13.9</td>
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<tr>
<td>Oil Capacity (quarts)</td>
<td>30</td>
<td>36</td>
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<tr>
<td>Dimensions (L-W-H)</td>
<td>106” - 40” - 65”</td>
<td>114” - 50” - 75”</td>
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<tr>
<td>Size (Cu ft.)</td>
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<td>250</td>
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<td>Weight (lbs)</td>
<td>6100</td>
<td>9300</td>
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<tr>
<td>Noise</td>
<td>74 dB@7m</td>
<td>78 dB@7m</td>
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<tr>
<td>Voltage</td>
<td>120/208V Three Phase</td>
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<td></td>
<td>240/416V Three Phase</td>
<td>240/416V Three Phase</td>
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<tr>
<td>Frequency</td>
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<td>Reliability</td>
<td>1250 hrs MTBF</td>
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<td>Operating Temp</td>
<td>-25°F to +120°F</td>
<td>-25°F to +120°F</td>
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<tr>
<td>Altitude</td>
<td>Rated power to 4000ft/95°F</td>
<td>Rated power to 4000ft/95°F</td>
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</table>

## Equipment Uses:

- Medical Facilities
- COSCOMs
- Hospitals
- Homeland Defense
- Military Intelligence
- Special Operations Command
- IBCT

## Contractor:

DRS Fermont, Bridgeport CT
Deployable Power Generation & Distribution System (DPGDS) 840kW (Prime Power)

**CHARACTERISTICS/PERFORMANCE:**

Fuel: Diesel/JP-8
Fuel Tank Capacity (gal): 120
Fuel Consumption (gal/hr): 60
Oil Capacity (gal): 13
Dimensions (L-W-H): 277” – 98” – 122”
Size (Cu ft.): 1920
Weight (lbs): 30000
Noise: 85 dBa@7m
Voltage:
- 2400/4160V Three Phase
- 2200/3800V Three Phase
Frequency: 50/60 Hz
Reliability: 950 MTBF
Operating Temp: -25°F to +125°F
Altitude: Rated power to 4000ft/95°F

**EQUIPMENT USES:**

- Prime Power (249th EN BN)
- Forward Operating Bases
- THAADS
- JLENS
- AVCRAD
- MUSE

**CONTRACTOR:**

DRS Technical Services, Herndon VA
PU/PP PRODUCT DESIGN

- **Power Unit (PU)**
  - One generator set mounted on one trailer
  - 5kW, 10kW, 15kW, 30kW, and 60kW TQGs mounted on 1T, 2½T, or 5T trailer, towed by HMMWV, 2½T, or 5T truck
  - 20 separate models

- **Power Plant (PP)**
  - Two generator sets with switchbox and ancillary equipment mounted on one or two trailers (depending on generator set size and weight)
  - 3kW, 5kW, 10kW, 15kW, 30kW, 60kW and 100kW TQGs mounted on 1T, 1½T, 2½T or 5T trailer, towed by HMMWV, 2½T, or 5T truck
  - 14 separate models

TQG = Tactical Quiet Generator
HMT = High Mobility Trailer
HMMWV = High Mobility Multi-purpose Wheeled Vehicle
CHARACTERISTICS/PERFORMANCE:

Two feeder systems (M200 & M100)
Two distribution systems (M40 & M60)
Utility receptacle and lighting system (M46)

Operating Temp: -25 F to +140 F

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Weight (lbs)</th>
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<tbody>
<tr>
<td>M46</td>
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<tr>
<td>M200</td>
<td>140</td>
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<tr>
<td>M100</td>
<td>77</td>
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<td>M40</td>
<td>55</td>
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<tr>
<td>M60</td>
<td>45</td>
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<tr>
<td>Utility Kit</td>
<td>85</td>
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</table>

Line distance from generator to load is 300 ft (91.4m) at maximum load.

EQUIPMENT USES:

- Used extensively throughout the Army

CONTRACTOR:

Fidelity Technology Corporation, Reading PA
Benefits and Savings

- Soldier Safety
- 24/7 operation of mission-critical equipment
- Reduction in spare parts, maintenance, fuel consumption
- Organically supported
- Reduce Division fuel consumption by 275k gallons per year
- Reduce Division maintenance by 71k hours per year
- Reduce carbon dioxide emissions by 2400 tons per year

Total Net Present Value Savings

- $5 million: 15 year peacetime scenario
- $150 million: 10 year peacetime/5 year low intensity conflict
- $200-250 million: 10 year peacetime/5 year high intensity conflict
2008 Accomplishments

- Produced 9,923 generators
- Issued 11,577 generators
  - Fielded 130 Units with 1,798 generators
  - Completed 562 supply transactions with 5,674 generators
- Filled 274 customer orders with 4,105 generators
  - Other Services - 189 orders with 2,818 generators
  - Foreign Military Support – 16 orders with 163 generators
  - Other Army – 69 orders with 1,124 generators
- Trained 298 maintainers and 321 operators
Power and Environmental Control Migration

**Past**
- Environmental Control Units
  - Military Standard Environmental Control Units

**Electric Power Generation**
- Military Standard Generators

**Electric Power Distribution**
- Distribution Illumination Systems Electrical (DISE)

**Present**
- Improved Environmental Control Units
  - Tactical Quiet Generators
  - Power Distribution Illumination Systems Electric (PDISE)
  - Central Power Solution

**Future**
- Central Cooling Solution
  - Co-Generation
  - Next Generation Power Sources
    - AMMPS
    - LAMPS
    - STEP
  - Alternative/Hybrid Energy
  - Intelligent Power Distribution
   - Technology Driven
   - Warfighter Focused
Tactical Electric Power
...the Future

Powering the Force
Hierarchy of Tactical Electric Power Requirements

WARFIGHTER REQUIREMENTS

Future Years Defense Plan FY 12-17

Future Concepts FY 17+

DOTLMPF Solutions (Programs of Record)

Joint/Army Concepts

Capability Needs Analysis

Future Operational Capabilities

Development Programs

AMMPS LAMPS STEP

S&T Programs

Concept Demonstrations University Research ATO/SBIR

DOTLMPF: Doctrine, Organizations, Training, Leader Development, Materiel, Personnel and Facilities
AMMPS: Advanced Medium Mobile Power Sources
LAMPS: Large Advanced Mobile Power Sources
STEP: Small Tactical Electric Power

S&T: Science and Technology
ATO: Army Technology Objective
SBIR: Small Business Innovation Research
Advanced Medium Mobile Power Sources (AMMPS)

- Third generation of Mobile Electric Power Generating Sources
- Replaces Tactical Quiet Generators (TQG)
- Employs advanced technologies to enhance power generation capability, improve engine control to achieve improved fuel efficiency, increase system reliability, reduce system size and weight, increase survivability for military applications, and reduce total ownership

- 5kW-60kW
- Multi-fuel (JP-8, JP-4, DF-1, DF-2, DF-A)
- Reduced noise and IR signature
- More reliable
- Less weight
- HAEMP protected
- Total package fielding (logistically supportable)
- Power Units/Power Plants
- Less cost (procurement, support cost)
- Transportable (External Airlift Transport [EAT], 5 & 10kW air drop)
Improved Environmental Control Units (IECU)

- Form, fit and function replacement of MIL-STD ECUs
- Use R-410A refrigerant, the commercial industry’s standard
- Fully operable up to 125 °F
- Ruggedized for military environments
- Reduced power consumption up to 25%
- Reduced weight up to 30%
- Increased reliability 200% over current MIL-STD ECUs
- Soft start, limited inrush current
- NBC compatible and EMI protected
- Embedded diagnostics
Project Objective:
- To develop a general Hybrid Intelligent Power Management architecture that demonstrates:
  - Feasibility of Autonomous source and load side management
  - Compatible interface and operation with legacy equipment
  - Reduction in fuel consumption by >25%
  - Fault tolerance and ability to handle transient events
  - Ability to automatically parallel multiple sources
  - Scalability/Flexibility from 2kW – 200kW
  - Plug and Play Capability

Project Execution:
- OSD funded
- PM MEP Program Lead
- CERDEC Technology Lead
- Support contracts
  - Electricore, Inc.
  - I-Power Energy Systems, LCC
Intelligent Power Management

Vehicles: Connect as Mission Requires

Compatible with existing line of PDISE
Automatically balances loads in CP

Project Objective:
- Power management for Command Posts
- Reduced training needed to establish and maintain an effective power grid
- Improved utilization of power assets
- Reduced fuel consumption
- Compatibility with current line of PDISE power distribution equipment
- Automatic Phase Load Balance
- Input Qualification & Power Management
- Rugged Design for Environmental Survivability

Project Execution:
- Defense Acquisition Challenge Program co-funded by PM-MEP
- PM MEP will transition to production and fielding in 2011.
Net Zero Plus (NZ+) Joint Capabilities Technology Demonstration

**Project Objective**: Demonstrate a Forward Operating Base operating on reduced energy consumption.

**DEMAND**
Enduring energy efficient structures and technologies reduce energy consumption through minimized air infiltration, low power devices, and efficient environmental control.

**INFRASTRUCTURE**
A system of distribution that precisely measures, analyzes, and connects the flow of power between energy consuming and producing devices.

**SUPPLY**
Reduces fuel consumption by generating power through a combination of renewable, traditional and alternative power generation.

**Project Execution:**
- Operational Manager: CENTCOM
- Technical Manager: OSD PSTF
- Transition Manager: PM MEP

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**ENDURING ENERGY EFFICIENT STRUCTURES**

- Monolithic Domes
- External Insulation for Temporary Structures

**INFRASTRUCTURE**

- Intelligent Power Management
- Utility Survey
- Remote Metering/Assessment

**SUPPLY**

- Renewable/Hybrid Power
Enhanced-Tactical Hybrid Electric Power System (eTHEPS)

Project Execution:
- Project Manager, Mobile Electric Power Initiative with Department of Energy National Renewable Energy Lab
- “Power Block” based on advanced power electronic interfaces
- Follow-on to initial THEPS effort by the Rapid Equipping Force and leveraging microgrid efforts underway at TARDEC, Corps of Engineers, and Defense Logistics Agency

Project Objective:
- Single Point-Source System, but can interface with other sources
- Hybrid Capability
- Plug & Play connectivity
  - Sources
  - Loads
- Intelligent control
  - Source management
  - Load management
    - Load shedding
    - Peak shaving
    - Load prioritization
    - Phase balancing
- Phase balancing
- Legacy interoperability
Cooperative Research and Development Agreement with DRS Inc.
Based on hybrid electric HMMWV technology
75kW rating with additional 18kW peak capability
Li-ion battery backup

Enable full-load/high efficiency operation; engine off power at low loads
Intelligent control system for load prioritization and source control
System to be tested Spring 2009 to quantify benefits

Similar Systems Approach And Capabilities across the Power Spectrum for Mobile and Fixed Applications

Hybrid Energy HMMWV (XM1124)

Tactical Intelligent Power System
Battlefield Power Architecture Vision

- **Approach**
  - Holistic Power Architecture
  - Scalable, Integrated Micro-grids
  - Intelligent Power Management
  - Distributed Power Sources
  - Plug-and-Play Capability

- **Benefits**
  - Increased Capability
  - Improved Efficiency
  - Reduced Fuel Consumption
  - Smaller Logistics Footprint
  - Power Surety
Battlefield Electric Power Integration
## OSD Energy Strategic Objectives

- Maintain or enhance operational effectiveness while reducing total force energy demands
- Increase energy strategic resilience by developing alternative/assured fuels and energy
- Enhance operational and business effectiveness by institutionalizing energy considerations and solutions in DoD planning and business processes
- Establish and monitor Department-wide energy metrics

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
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</thead>
<tbody>
<tr>
<td>2007</td>
<td>ESTF analysis results in $300M+ plus-up in Power &amp; Energy</td>
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<tr>
<td>2008</td>
<td>DSB releases Final Report on DOD Energy Strategy</td>
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<tr>
<td>2008</td>
<td>Congress directs OSD establish an “energy czar” position</td>
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<tr>
<td>2008</td>
<td>Army establishes Energy Security Task Force to develop way-forward</td>
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<tr>
<td>2008</td>
<td>Army establishes Senior Energy Council &amp; establishes a Senior Executive position responsible for energy activities</td>
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</table>
Generators are the Army’s single largest user of fuel on the battlefield during wartime.*

<table>
<thead>
<tr>
<th>Category</th>
<th>Peacetime OPTEMPO</th>
<th>Wartime OPTEMPO</th>
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<tbody>
<tr>
<td>Combat Vehicles</td>
<td>30</td>
<td>162</td>
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<tr>
<td>Combat Aircraft</td>
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<tr>
<td>Tactical Vehicles</td>
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<td>173</td>
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<tr>
<td>Generators</td>
<td>26</td>
<td>357</td>
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<tr>
<td>Non-Tactical</td>
<td>51</td>
<td>51</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>291</strong></td>
<td><strong>1040</strong></td>
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Battlefield Electric Power Challenges

- Integrated and Intelligent Battlefield Power Management
- On-board Vehicle Power (APUs, hybrids, energy storage)
- Large Power Sources
  - Forward Operating Bases/Combat Outposts
  - Prime Power/Directed Energy Weapons Systems
- Low Power Systems
  - Soldier power (battery replacements or hybrids)
  - Battery standardization
  - Unattended ground sensors power
- Fuel reduction and use of alternative renewable energies
PM MEP Initiatives

- Designated as the Army’s System of Systems Integrator for Battlefield Electric Power
  - Identify current and planned electric power generation/consumption requirements
  - Identify/characterize Forward Operating Base/Combat Outpost power requirements
  - Develop integrated battlefield electric power architecture

- Establishing Product Director for Batteries
  - Central authority for development and acquisition
  - Develop standard family of batteries for military application

- Developing improved Intelligent Power Management and Hybrid-Intelligent Power (HI-Power) systems architectures

- Developing Prototype Hybrid Energy Systems
Business Opportunities

Powering the Force
<table>
<thead>
<tr>
<th>Year</th>
<th>AMMPS</th>
<th>IECU</th>
<th>STEP</th>
<th>LAMPS</th>
<th>60k BTUH</th>
<th>9, 18, 36k BTUH</th>
<th>120k BTUH</th>
<th>2kW MTG</th>
<th>3kW TQG</th>
<th>5, 10, 15kW TQG</th>
<th>30 &amp; 60kW TQG</th>
<th>100 &amp; 200kW TQG</th>
<th>HI-Power</th>
<th>PDISE</th>
<th>TQG Cascade Program</th>
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Planned Upcoming Business Opportunities

- 120k BTUH Co-generation: market survey 3QFY 2009/prototype procurement 4QFY 2009
- HI-Power Phase II BAA: contract awards 3QFY 2009
- Tactical Quiet Generator Cascade Program: RFP 3QFY 2010/contract award 1QFY 2011
- Small Power Sources Production Rebuy (2 & 3kW generators) FY2011
- Advanced Medium Mobile Power Sources (AMMPS) competitive re-buy: FY2011 or 2012
- Large Advanced Mobile Power Sources (LAMPS) development: contract award 3QFY 2010
- Small Tactical Electric Power (STEP) systems development: contract award 1QFY 2012

BTUH – British Thermal Units per Hour
RFI – Request for Information
BAA – Broad Area Announcement
RFP – Request for Proposal
Wrap-up

Powering the Force
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