

PPA CONFERENCE 2017

'AFFORDABLE ELECTRICITY FOR
ALL'

- INNOVATIVE SOLUTIONS TO
REDUCE COST OF ELECTRICITY

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Unit
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ORGANISATIONAL BRIEF



- New Zealand's largest energy infrastructure group
- Operating since 1908 with over 600,000 customers
- Owner/operator of NZ's largest electricity and gas distribution network
- Annual turnover in excess of NZ\$1B and 2200+ employees and contractors
- Installed base of over 400 residential battery and solar systems, a
- Proposed 13 MWh of batteries for network deployment
- 1.1 million smart meters installed across New Zealand and Australia.

Portfolio of businesses include:

- Infrastructure Management
- Network Services
- Energy Smart Metering
- Telecommunications
- Solar + Storage

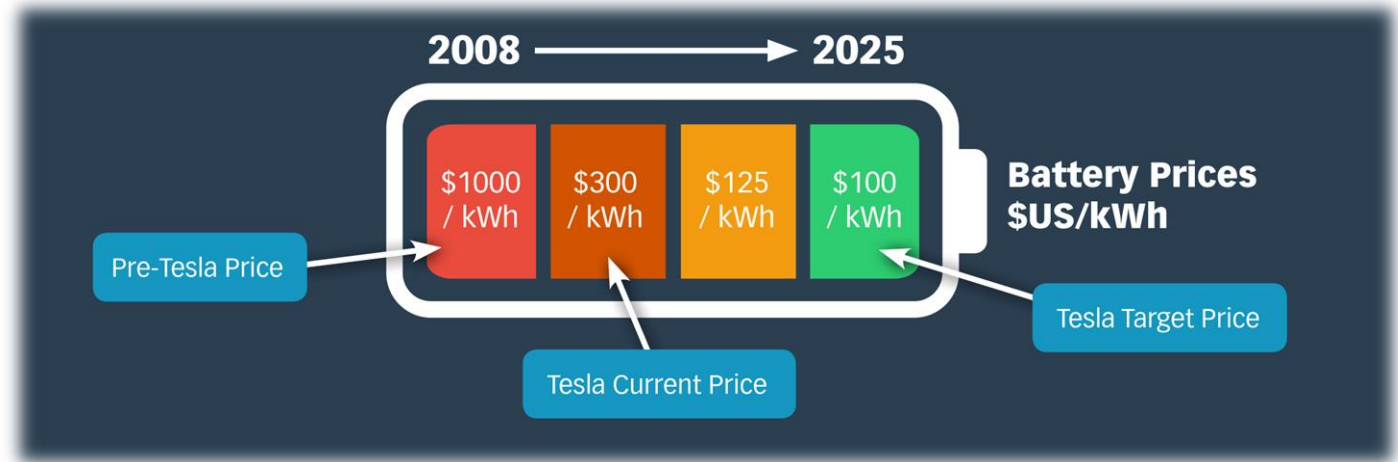


- Vector owned multi-award winning organisation
- New Zealand's largest and premier specialist solar power systems integrator
- EPC with ability to design, install, commission and project manage
- Well established with Australasian photovoltaic industry experience and track record
- In excess of 4 MW/ 32 MWh of installed energy generation and storage systems in the region

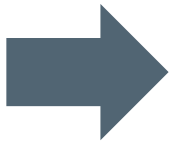
Core business includes:

- Engineering, Procurement and Construction (EPC) of solar power systems across the region
- Long-term Power Purchase Agreements (PPA)

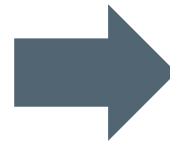
TECHNOLOGY LANDSCAPE FOR BATTERIES IS CHANGING DUE TO MASS PRODUCTION OF ELECTRIC VEHICLES



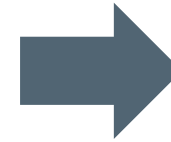
Li-ion cell



Tesla S
7104 cells



Powerwall
800 cells



Powerpack
12,800 cells (16 Powerwalls)



ZONE SUBSTATION UPGRADE

GRID CONNECTED
BATTERY ENERGY
STORAGE SYSTEM (BESS)



THE WORLD'S FASTEST GROWING CITIES

(ANNUAL GROWTH %)



Suzhou, China

5.57%

Population: 5.25m*



Tianjin, China

3.09%

Population: 10.92m*



Auckland, New Zealand

3.05%

Population: 1,42m



World average

1.13

%

Auckland is a fast growing city with NZ\$2B to be invested in its networks over the next 10 years...

Prompt, cost efficient, flexible and sustainable solutions are required

CHALLENGE'S FOR AUCKLAND'S UTILITY SECTORS

(WEEKLY GROWTH RATES)



825

new residents



137

additional seniors
over 65



2.5

additional doctors



472

new jobs



52

additional students



17 / 3.5

additional buses / trains filled



278

new dwellings



2

additional teachers



825

additional cars



39

equivalent
Metropolis
buildings a year



1

new school
every 9 weeks

SITE OVERVIEW

Substation established in 1959 with 2 x 12 MVA Transformers (22/11 kV)

Impacts of status quo

Load expected to exceed capacity in the next few years with a real risk to N-1 security requirement

Traditional reinforcement options

Replacement/ addition of transformers and sub-transmission underground cables



Costly investment will lead to higher electricity bills for consumers

- May need another upgrade in 5 years time due to uncertainty of growth

Lack of flexibility as solution will be based on projected growth rather than actual

- Additional network benefits would be beneficial

High-levels of disruption to customers during construction

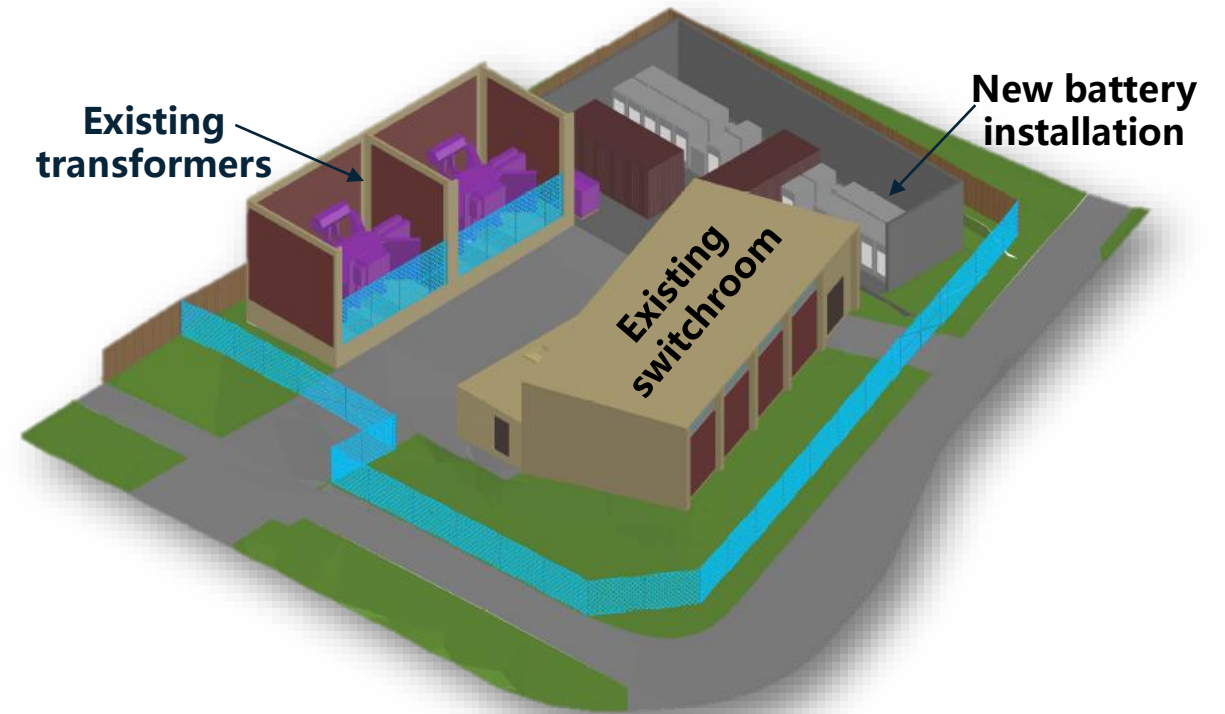
- 6-8 months

Risk of stranded assets using traditional approach

- ⁷ Projected growth may not eventuate – Not readily scalable or transferable



SOLUTION OVERVIEW



Selected solution:

- Installation of a 1 MW / 2.3 MWh Powerpack Battery Energy Storage System (BESS)
- Utilises 24 Tesla Powerpacks
- Containerised inverter and switchroom/control room
- Civil works designed to mitigate impacts on the community.
- Architectural enhancements to the existing substation.

DESIGN AND CONSTRUCTION

Project design work flow managed in-house

Concept Design

- Project requirements
- SLD
- SiD
- P&ID
- Geotech
- Noise and fire assessment
- Functional specification
- Safety in Design



Consenting

- Outline plan of works
- Building consent
- Resource consent



Detailed Design

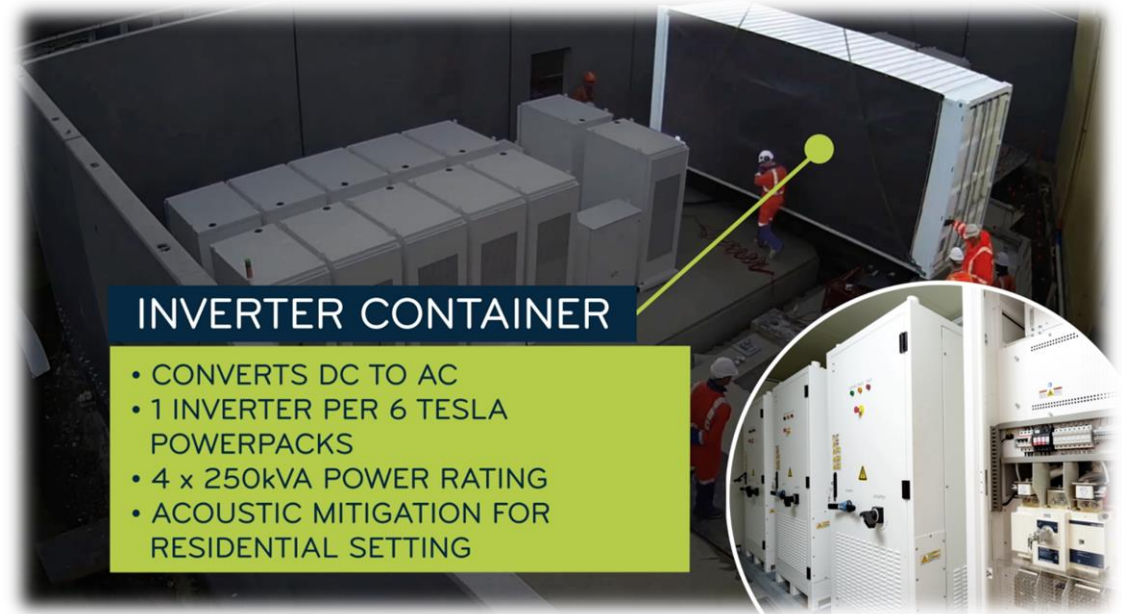
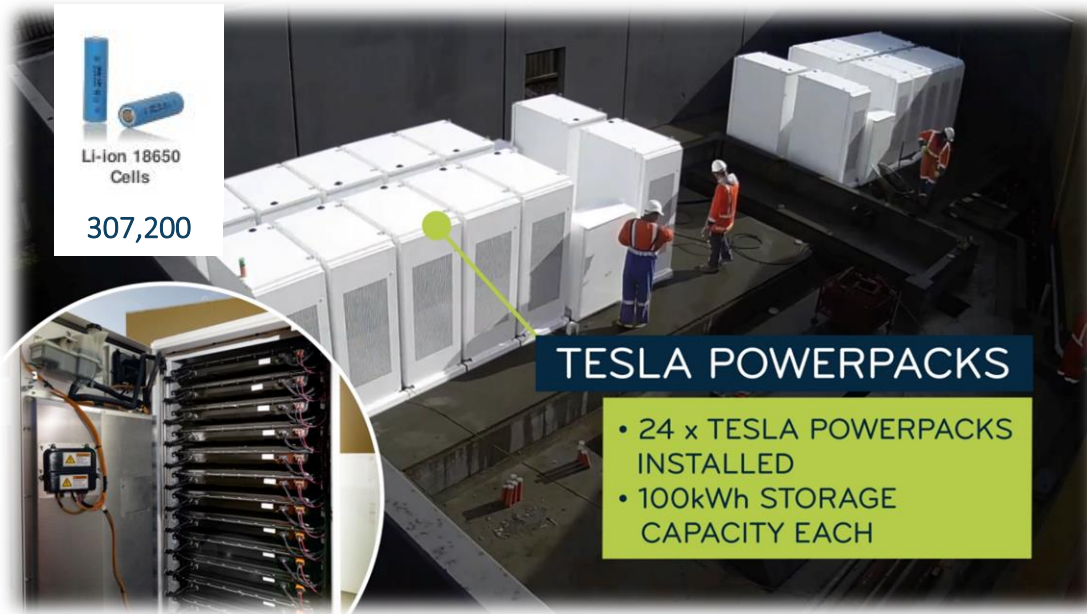
- Civil
- Primary Electrical
- Secondary Electrical
- Control System
- SCADA
- HMI interface
- HAZOP

CIVIL WORKS, FOUNDATION AND ACOUSTIC WALLS



PORTABLE SOLUTION





- The BESS is being deployed onto Vector's network to:
- Reduce peak demand,
 - Extend the life of the substation,
 - Defer capital expenditure and
 - Provide supplementary power to the Glen Innes region

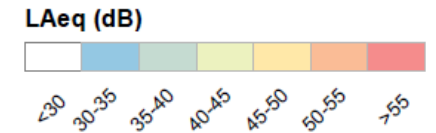
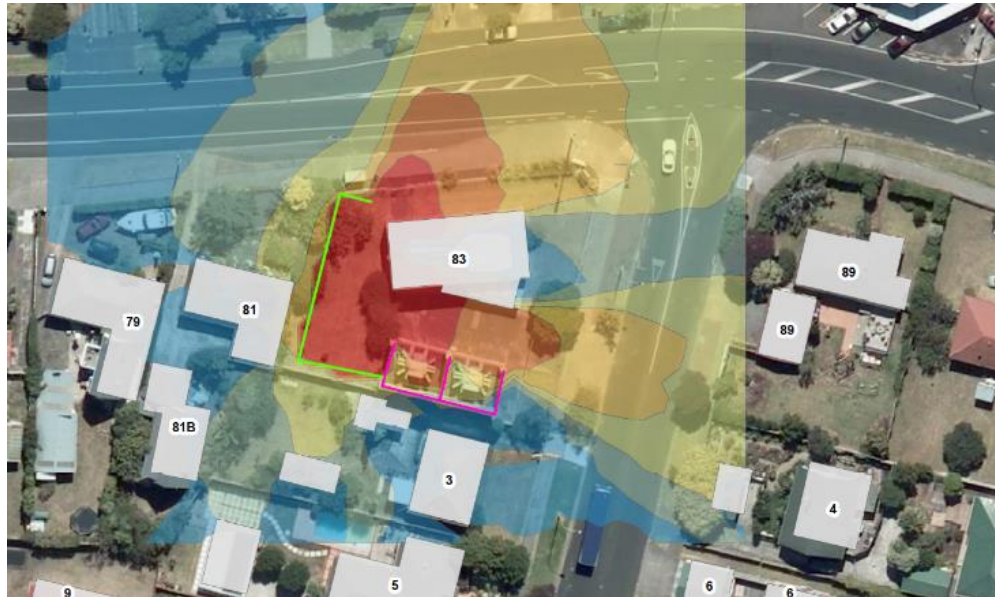
HEALTH SAFETY AND ENVIRONMENT CONSIDERATIONS

Mitigated by:

- Safety in Design and HAZOP workshops
- Engagement with manufacturer on fire compliance
- Engagement with the New Zealand Fire Service
- Detailed noise assessment carried out to ensure all council requirements were met

Noise sources

- Existing transformers
- Inverter
- Powerpack fans
- Modelling shows worst case (i.e. all fans operating at max speed – unlikely scenario in Auckland).



Glen Innes Acoustic Survey results - 6th March 2017

Noise levels from the BEES system were 40 dB LAeq or less within all neighbouring residential sites.

COMMUNITY ENGAGEMENT



Early engagement with neighbours and community leading to significant improvement to the landscaping of the site.



GLEN INNES - OUTCOME

Allows Vector to continue to provide a secure, reliable power supply and defer a conventional upgrade to the substation making the overall supply of electricity affordable for its consumers

Overall savings

- NZD5M vs NZD12M

Offers great flexibility

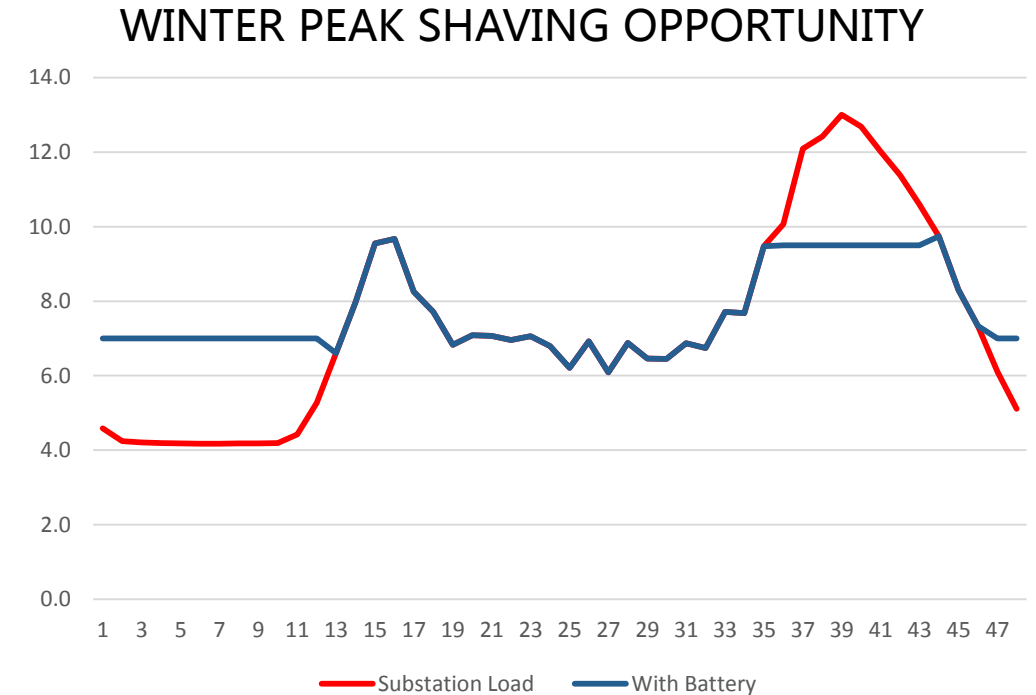
- Portable and moveable solution – Capital deferment
- Additional network benefits – Peak Shaving, Load Shifting, extending life of the substation
- Back-up power for up to 450 homes for 2.3 hours

Limited disruption to the local community

- Construction period of 4 months vs 6-8 months

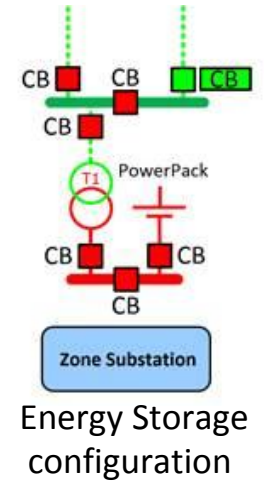
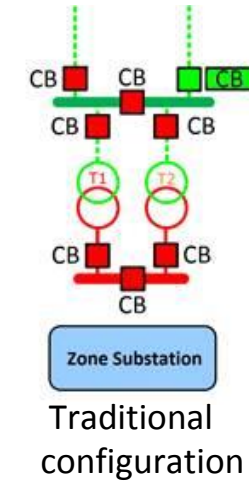
Stranded asset - long term growth remains uncertain

- Addressing actual load demands – Capital deferment

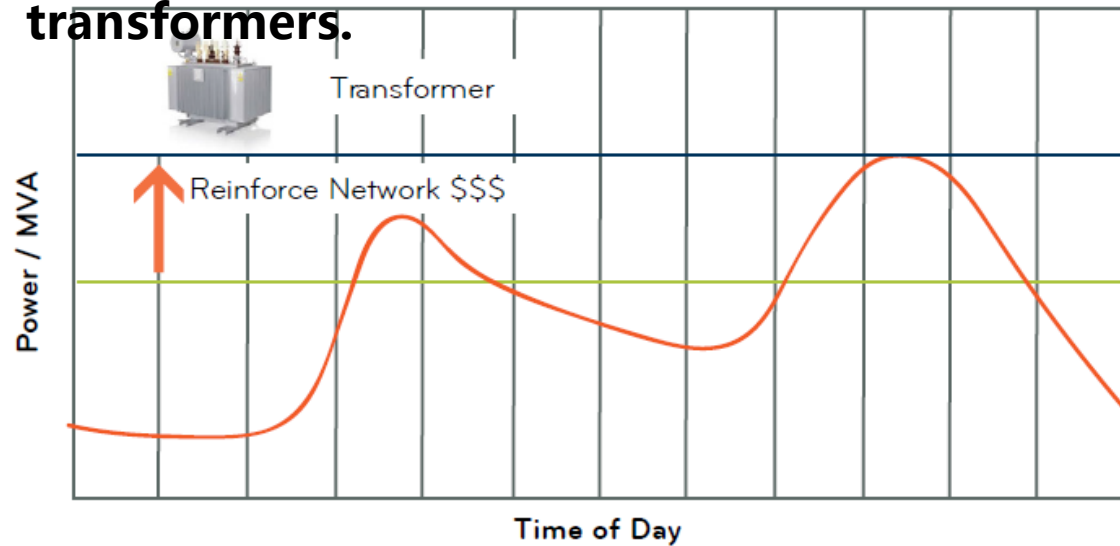


FIVE MORE NETWORK CONNECTED ENERGY STORAGE PROJECTS IN THE PIPELINE....

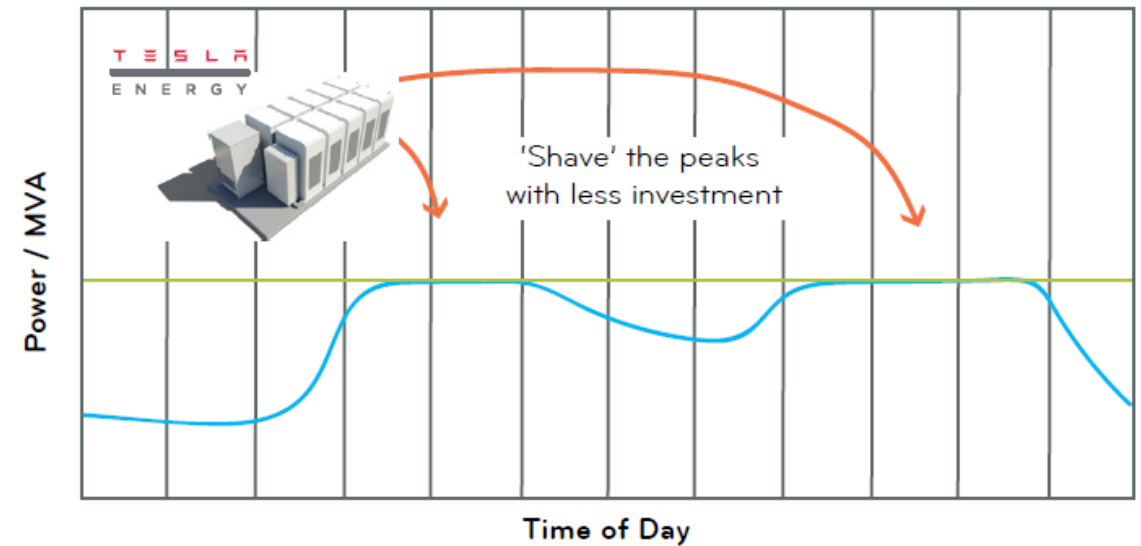
- Vector's **probabilistic** security of supply standard is based on having network full back-up capacity available for 95% of the year for residential customers
- We are updating our security supply standards to include energy storage



By utilising the BESS on our network, stored energy will be used to 'shave' peak demand, ensuring the same amount of energy is supplied without traditional reinforcement of the substation through transformers.



— Actual Load — Network Capacity — Reinforced Capacity



— Network Capacity — Altered Load

THANK YOU

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