

ASEAN Ports and Shipping Conference 2023

Plan Port for Decarbonization – Unleash Financial Benefits

1 November 2023



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About Surbana Jurong



Our Global Footprint

Who we are

16,000+

EMPLOYEES

40+

COUNTRIES

120+

OFFICES

100+

NATIONALITIES

7,000+

ACTIVE PROJECTS

S\$ 2 bn

2022 REVENUE



We support **urban, industrial** and **infrastructure** developments through **multidisciplinary** expertise to deliver solutions across the entire project lifecycle

delivering global expertise locally

Complete Value Chain Services

Our value proposition



PLAN & DESIGN

Concept & Feasibility Studies
Master Planning
Development &
Project Financial Services
Sustainability &
Environmental Consultancy



DEVELOP

Architecture & Landscaping
Engineering & Specialist Services
Quantity Surveying &
Cost Management



DELIVER

Project Management
Construction Engineering
Site Supervision
Contract Advisory



OPERATE & MANAGE

Smart City Solutions
Facilities Management
& Asset Enhancement
Safety & Security Services
Defence Services &
Training Solutions

SUPPORTED BY OUR FAMILY OF SPECIALISTS



Singapore Policies to Decarbonize Ports

Singapore Policies to Decarbonize Ports



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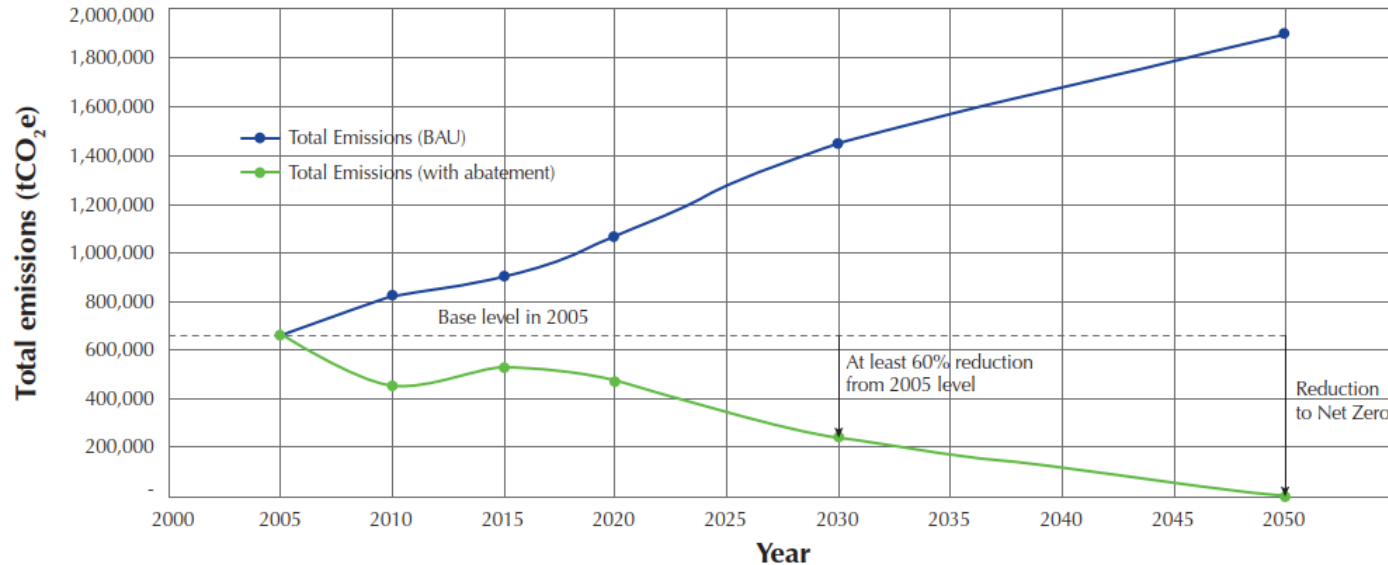
Focus Area 7
Carbon Awareness,
Carbon Accounting,
and Green Financing

*Source: Content Page of
Maritime Singapore
Decarbonization
blueprint Working
towards 2050, MPA*

Singapore Policies to Decarbonize Ports

Port Terminals: Total Emissions (BAU vs with abatement)

Abatement Measures	2010-2015	2015-2020	2020-2030	2030-2050
	Electrification of port equipment (RTG, PMs, luffing cranes etc)	Electrification of port equipment (AGVs) Energy optimisation, smart grid, solar energy Green buildings	Electrification of port equipment Low/zero-carbon fuel for port equipment (forklifts, AGVs) Energy optimisation, smart grid, solar energy, green electricity Green buildings	Electrification of port equipment Low/zero-carbon fuel for port equipment & vehicles Energy optimisation, smart grid, solar energy, green electricity Green buildings



Focus Area 1 – Port Terminals

Cost of Decarbonizing Ports – Qualitative Assessment

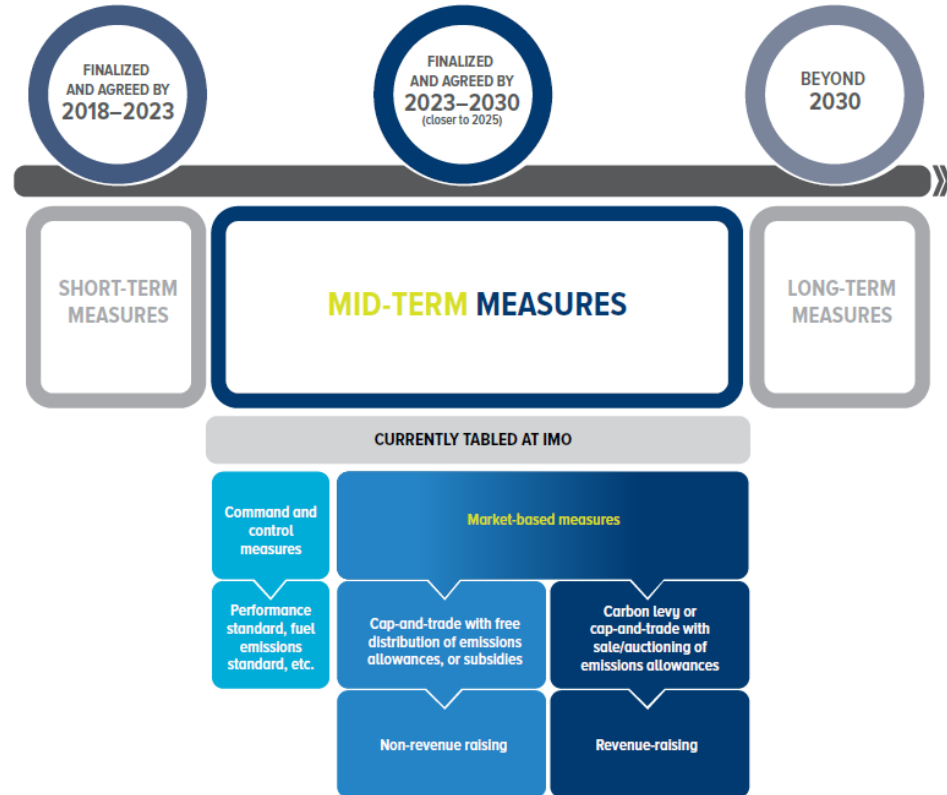
Electrification and Automation of Port is the Key point. Is it costly ?

Cost of Upgrading Port / Cost of new Green Port		Cost of doing nothing / Cost of new Traditional Port	
Green Financing – Low cost of debt; more Finance options; easy availability	+ve	Increase carbon tax – additional Financial burden each year	-ve
High CAPEX	-ve	No upfront cost / Comparatively Low CAPEX	+ve
Low OPEX	+ve	Continue operate under high OPEX	-ve
Economic of scale may reduce CAPEX in Future providing additional financial advantage	+ve	Increasing tax on use of fossil fuel – International / national government Pressure which question sustainability of The terminal.	-ve

Even though initial investment will be high in electrification and automation of ports, the long-term financial benefit will be achieved.

IMO mid-term Measures – Carbon Tax

- IMO mid-term measures suggest to implement carbon levy and generate revenue out of it. Most of ASEAN countries being IMO member,
- Carbon tax in Singapore **currently is 5 S\$ per tonne**, likely to be increased to **50 S\$ to 80 S\$ per tonne by 2030**.
- Based on emission reported in PSA Singapore sustainability report, at current rate, the **carbon tax** is around **1.7 million SGD**. If nothing is done, this could go up to **27 million SGD by 2030**.
- Currently there is **no direct carbon tax** in most of ASEAN countries except Singapore, however, based on the reports it is likely to be implemented in next few years.
- As mentioned in technical paper by world bank titled “Carbon Revenues from International Shipping”, the mid-term measures is expected to generate revenue of **USD 3.7 trillion by 2050**.



Tuas Mega Port – Planning Features

Tuas Mega Port – Planning features



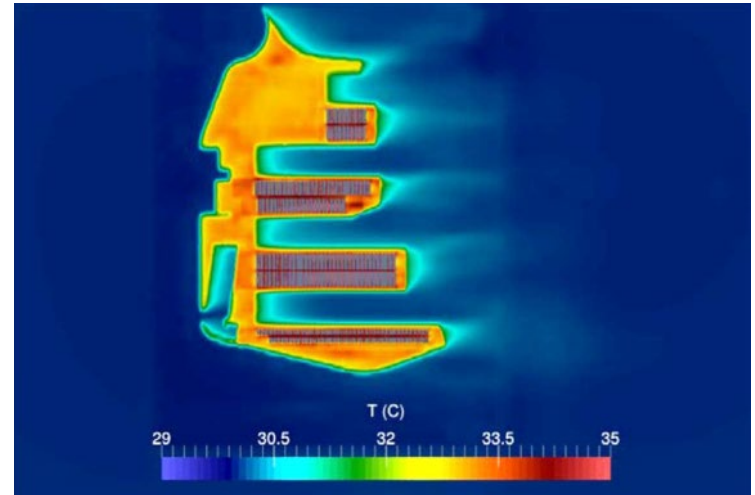
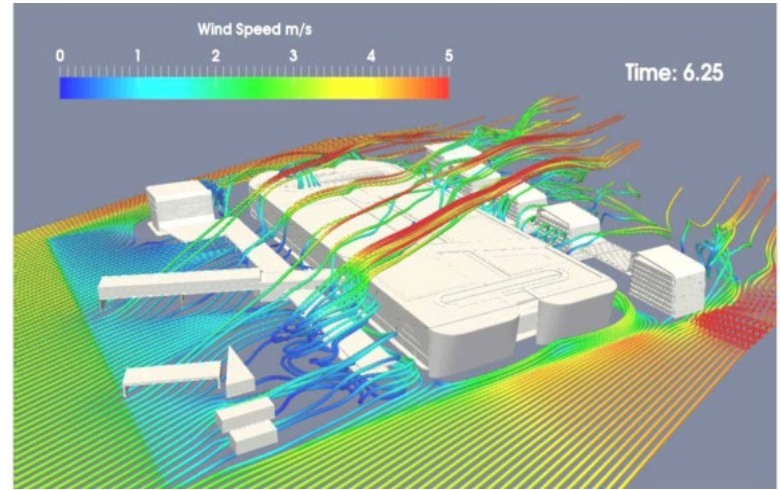
- Overall development in 4 phases – estimated to be completed by 2040, with total capacity of **65 million TEU** per annum. Estimated cost of **over 20b SGD**
- As of today, 5 berths of Phase I is under operation and remaining berths for Phase I and reclamation work for Phase II is under construction.
- One mega port – reduces the **inter terminal haulage of the containers, reducing GHG emission, cost of operation.**
- Minimum water depth of **23m** to accommodate largest container vessel. **Eliminate need of feeder vessel** thereby reducing operating cost and GHG emissions in Singapore waters
- Top level considers sea level rise up to the year 2100.
- Total berth length of 26 km i.e., ~ **2500 TEU per m berth** length per year.
- Approx. 1050 ha for container storage when complete. i.e., ~ **more than 6 TEU/m²** per year



Excluding Tuas Port, Currently Singapore has 55 container berths with total annual capacity of 50 million TEU

Tuas Mega Port – Planning features

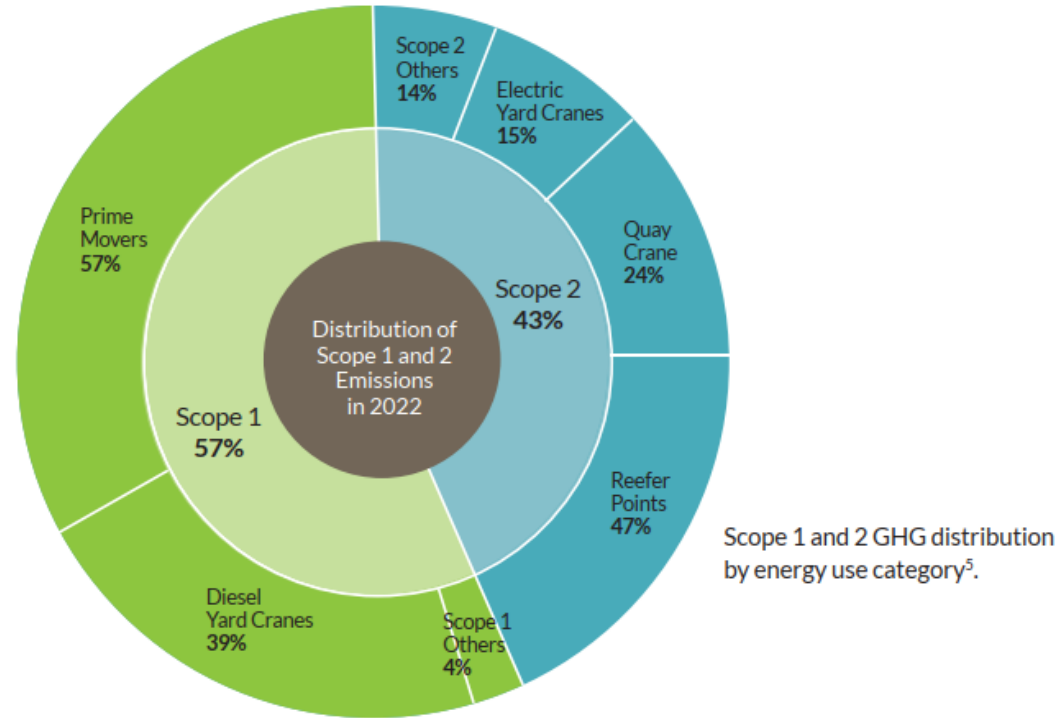
- Equipment at Tuas port are **fully electrically operated**.
- **Thermal and aerodynamic study** during planning stage to better orient the structures – lead to long term benefit of energy consumption.
- Use **more than 50%** of reclaim material as recycled material, either from **dredging or other land excavation** during construction; cost saving of about **SGD 2 billion**.



Total Cost of Ownership – Sample calculation (AGV vs Prime Movers)

Total Cost of Ownership – AGV vs Prime Mover

- Why AGV and Prime Mover are selected for this exercise?
- PSA Singapore Sustainability report mentions 57% of GHG emission is associated with operation of Prime Mover.
- Replacing Prime Mover with AGV will reduce GHG emission substantially.
- Is it economical to use AGV instead of Diesel Operated Prime Movers ?

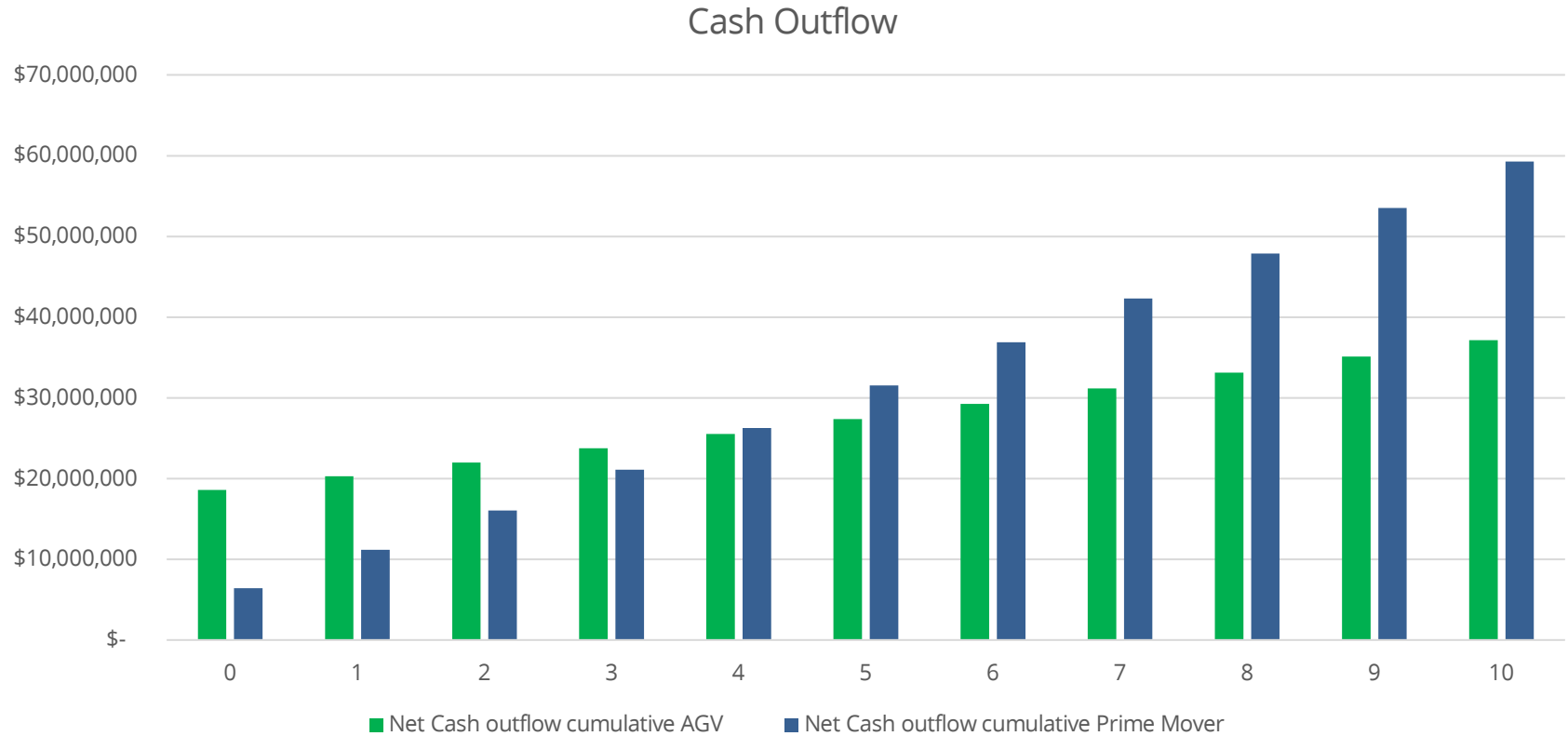


Source: PSA Singapore Sustainability Report 2022

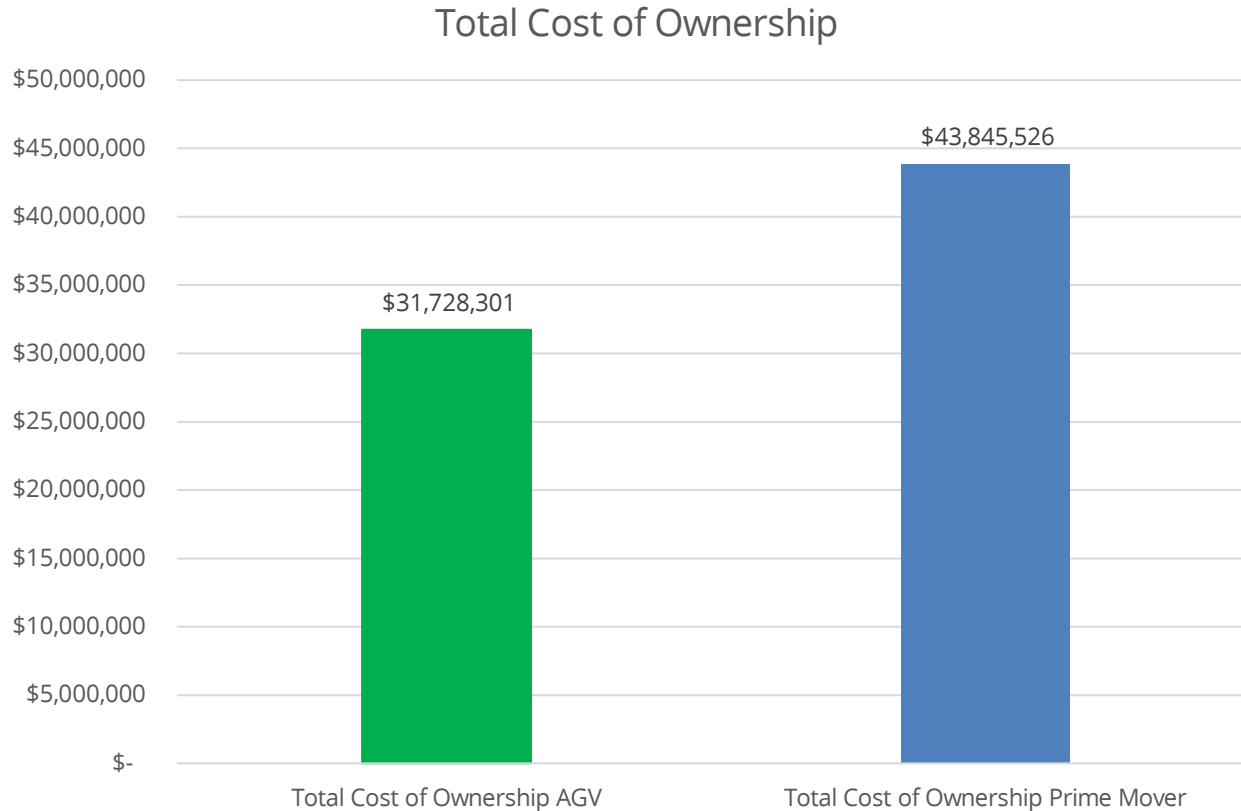
Total Cost of Ownership – AGV vs Prime Mover

Description	Parameters	Reference
<u>General</u>		
Period of Evaluation	10 years	From the year 2023 to 2033
Average inflation rate considered	1.78%	https://www.rateinflation.com/inflation-rate/singapore-historical-inflation-rate/
Discount rate	6%	Assumed
Number of vehicles considered per berth of about 400m length	24	Assumed same number of AGVs and Prime Movers per berth. 4 STS Cranes per berth; 6 AGVs or Prime Movers per crane.
Corporate tax in Singapore	17%	https://www.iras.gov.sg/quick-links/tax-rates/corporate-income-tax-rates
Depreciation method	Straight line	No salvage value is considered at the end of 10 years
CAPEX and OPEX	AGV and Prime Movers	Only related to the prime movers and AGVs. CAPEX and OPEX of other supporting infrastructure such as charging station, electricity generating units, fuel station, insurances etc. is not considered.

Cash Outflow



Total Cost of Ownership



- TCO is calculated as present value of cash outflows
- Cost of Prime Mover will be around 40% higher than AGV in terms in long run.

Discussion Points

- Need for Decarbonizing port operation is real and important to achieve global GHG emission target.
- Automation and electrification are the key to decarbonize port. Plan for dedicated energy production units for the terminal either solar or in future through ammonia or hydrogen.
- Understand the environment and align with it to obtain benefits. Thus, thermal and aerodynamic study is important at planning stage to best align the infrastructure to economies the use of energy.
- Reuse of construction material provides benefit not only in the CAPEX, but it has positive impact on the environment. Planning of material availability during early stage of the project benefits in reducing GHG emission during construction.
- Reduction in cargo movement within and outside terminal optimize the use of energy, thereby reducing OPEX and GHG emission.
- CAPEX could be high for the development of automated port; however, long term financial benefit can be achieved with proper planning of the port.
- Uncertainty in future carbon levy. Traditional port may attract heavy carbon levy, which can create additional operation cost burden to the terminal.

Thank you

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