PRE FEASIBILITY STUDY FOR A

IMaR conference 2024

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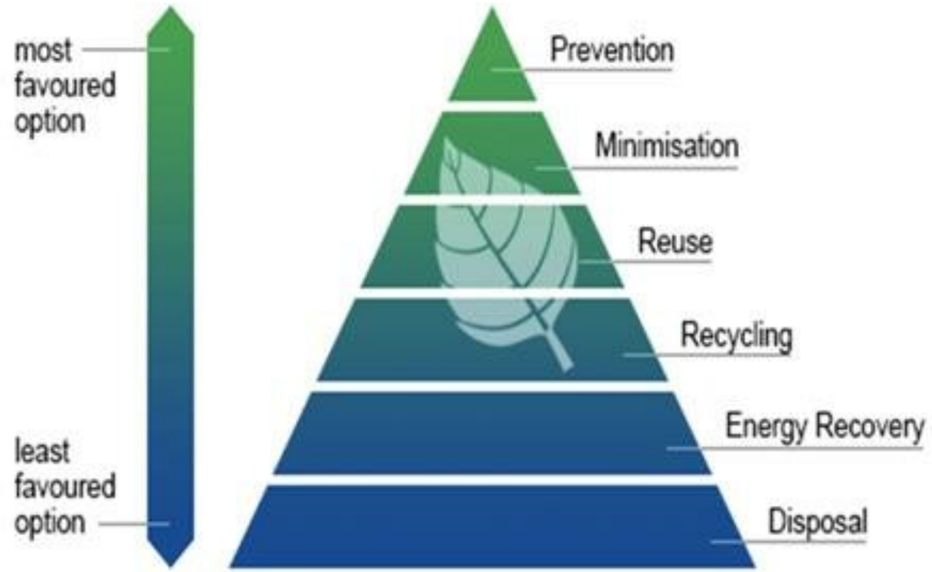
TOPICS

- The context, and our goals
- On the chosen methodology
- CAPEX and working with uncertainty
- Answering the initial question.... and another crucial question
- What next?

THE CONTEXT AND OUR GOALS

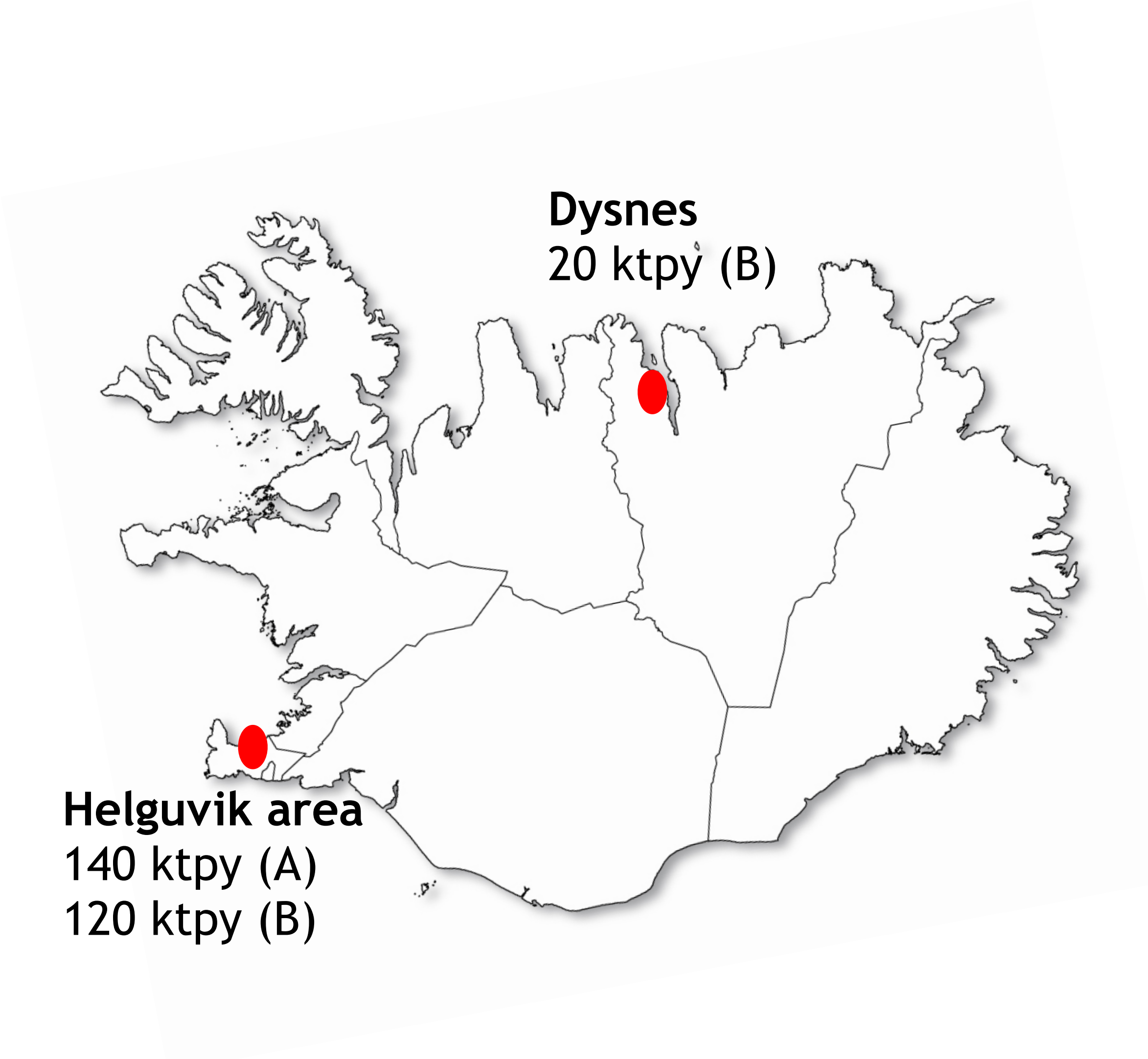


<u>December 2021</u>
"Pre feasibility study on a future solution for the handling of combustable waste to replace landfilling"

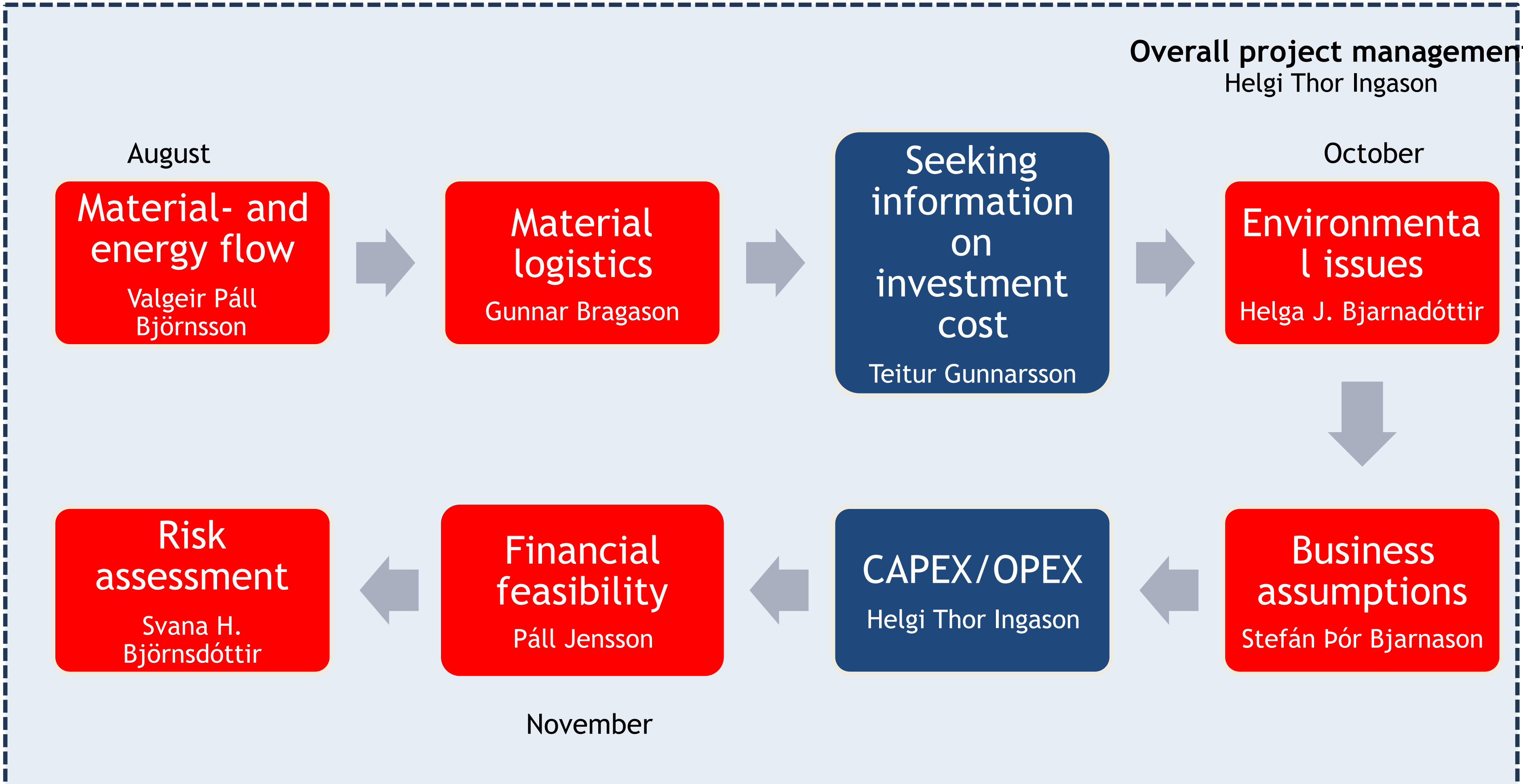
THE CONTEXT AND OUR GOALS

- The necessary processing capacity 2035 is 140 ktpy
- **Case A** is a single WtE plant in the Helguvik area
- **Case B** is a 120 ktpy plant in the Helguvik area and a 20 ktpy plant in Dysnes
- Look at CAPEX, transport arrangements and –cost
- Include environmental aspects and risk
- What is the better alternative?

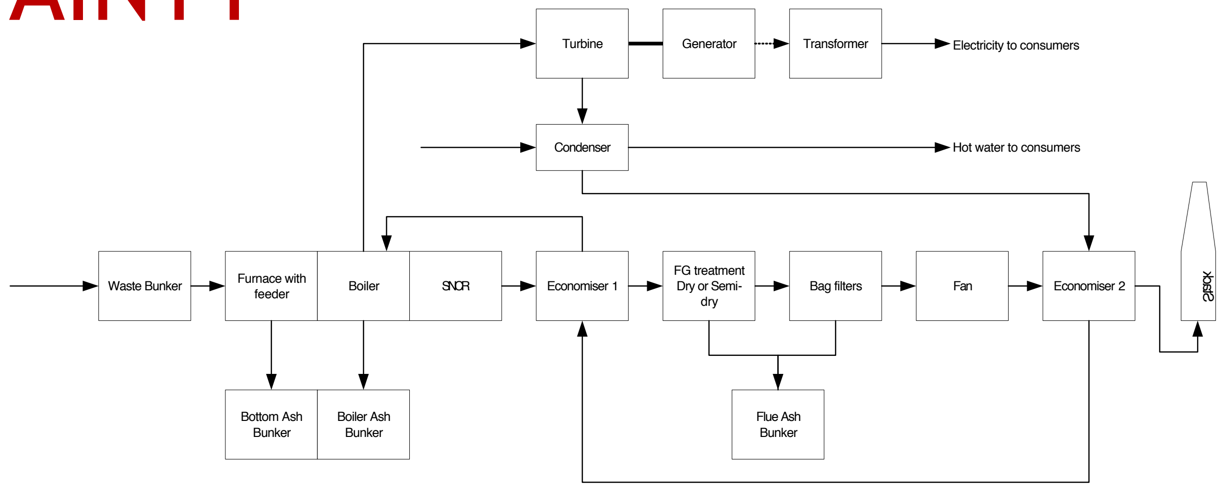
- Another question emerged; what about export?



ON THE CHOSEN METHODOLOGY



CAPEX AND WORKING WITH UNCERTAINTY



We contacted six respected world-wide supplier of WtE plants, and asked for estimates of the CAPEX and OPEX for i) 140.000 tpy plant, ii) 120.000 tpy plant and iii) 20.000 tpy plant

- Energos, Norway
- Babcock & Wilcox Vølund, Danmark
- Sumitomo & Woima, Finland
- Hitachi Zosen INOVA, Switzerland
- Standardkessel Baumgartner, Germany
- Steinmüller Hitachi Zosen INOVA, Switzerland

CAPEX AND WORKING WITH UNCERTAINTY

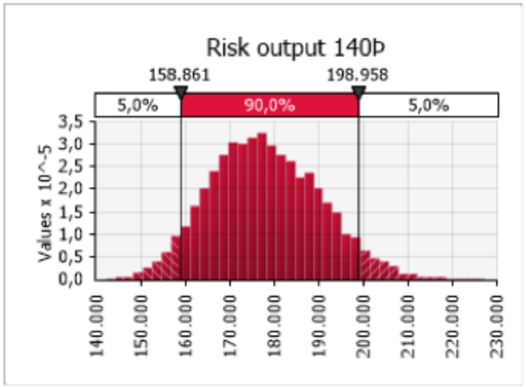
- We used Babcox & Wilson (“turn-key EPC”) as a basis
- We used other suppliers for comparison and for 3 point estimate
    - Hitatchi
    - Energos
    - Sumitomo
- We have no concrete information on cost of carbon capture, it is thus omitted (and is not relevant for our comparison)
- COWI (Mannvit) delivered cost estimates for buildings
- We applied AACE 18R-97 reference document
    - Cost Estimate Classification System–As applied in engineering, procurement, and construction for the process industries

CAPEX AND WORKING WITH UNCERTAINTY

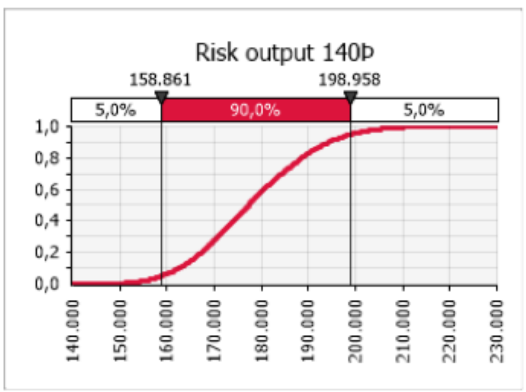
Liður	x 1000 evrur	Skýring
VÉLBÚNAÐUR		
Ketill	42,490	Byggt á minnisblaði B&W, "turn-key EPC" verð fyrir allan vélbúnað - og skýrslunni 2021 (uppreiknað m.v. PPI index og stærðarhlutföll)
Rafbúnaður	13,902	
Hreinsibunaður fyrir afgas	14,969	
Gufuhverfill og tengdur búnaður	22,501	
Annar búnaður	6,138	
LANDSVÆÐI		
Kaup á landsvæði	4,685	Byggt á skýrslunni 2021, uppreiknað m.v. byggingarvísitölu
MANNVIRKI		
Aðstaða (aðstöðusköpun)	615	Byggt á minnisblaði Mannvits
Byggingar	25,704	Byggt á minnisblaði Mannvits og minnisblaði B&W
Lóðarfrágangur	1,251	Byggt á minnisblaði Mannvits
SÉRFRÆÐIVINNA OG STJÓRNUN		
Undirbúningskostnaður	1,276	Miðað við 1% af kostnaði við vélbúnað og mannvirki
Hönnun		Skoðast innifalið sbr. EPC (B&W) og minnisblað Mannvits
Verkefnastjórnun	6,677	Miðað við 5% af kostnaði við vélbúnað og mannvirki
FJÁRMAGNSKOSTNAÐUR		
Fjármagnskostnaður á byggingartíma	16,825	Reiknað út frá 8% vöxtum, 36 mánaða byggingartíma og línulegu fjárstreymi
SAMTALA – MEÐ FJÁRMAGNSKOSTNAÐI	157,033	"engineering estimate"

- 140.000 plant
- But is the "engineering estimate" a good reference?
- What about uncertainty?

CAPEX AND WORKING WITH UNCERTAINTY



Summary Statistics	
Statistic	Value
Minimum	141.985,86
Maximum	227.028,07
Mean	177.931,97
Std. Deviation	12.174,29
Variance	148.213.341
Skewness	0,2267
Kurtosis	2,7592
Median	177.282,38
Mode	177.419,96
Left X	158.860,54
Left P	5%
Right X	198.958,12
Right P	95%



Percentiles	
Percentile	Value
1%	152.727,15
2,5%	155.834,77
5%	158.860,54
10%	162.608,63
20%	167.280,85
25%	169.127,83
50%	177.282,38
75%	186.467,41
80%	188.559,14
90%	194.134,94
95%	198.958,12
97,5%	202.701,62
99%	206.974,24

- 3 point estimate - assess the pessimistic, optimistic and likely value for each cost item
- Run a Monte Carlo simulation, create a probability distribution for the total cost, based on the uncertainty of each item
- For a 140 ktpy plant, the P50 value is **177** m euro
- The P99 value is **207** m euro
- The P1 value is **153** m euro
- Almost impossible to deliver the project on the engineering estimate

CAPEX AND WORKING WITH UNCERTAINTY

Case A is a single 140 ktpy WtE facility in the Helguvík area, delivering hot water and electricity

- CAPEX is 22 – 30 billion ISK (P50 = 26 billion ISK)

Case B is a 120 ktpy facility in the Helguvík area (hot water and electricity) and a 20 ktpy facility in Dysnes (hot water)

- CAPEX for the 120 ktpy plant is 20 – 28 billion ISK króna (P50 = 24 billion ISK)
- CAPEX for the 20 ktpy plant is 9 – 14 billion ISK (P50 is 11 billikon ISK)
- Total CAPEX 29 – 42 billion ISK

ANSWERING THE INITIAL QUESTION

- The Helguvik area and Dysnes are industrial sites, both suitable for this kind of operation
- Case B is much more expensive than case A, both for CAPEX and OPEX
- And the reduced total transport cost for case B is far from balancing this out
- Gate fees in Dysnes would be more than 3 X for Helguvik
- Gate fees in Case B – assuming same fees for both plants- would have to be 36% higher than in Case A.
- Multiple risks associated with operating two WtE plants compared to one
  - financing of two plants
  - possible competition for the amount of waste
  - regarding operational efficiency and higher gate fees
- This is a clear and decisive answer!

ANSWERING ANOTHER CRUCIAL QUESTION

- As a base case, an infrastructure fund will build and own the plant (50% loan)
- What if the municipalities and/or the state build and own the plant?
- In that case, the interest rate is lower
- Assuming a state owned plant and 100% loan, the gate fees would be 18% lower.

ANSWERING ANOTHER CRUCIAL QUESTION

- What about the comparision of export vs operating one 140 ktpy facility in the Helguvik area?
- We see that exporting is more expensive than processing in a 140 ktpy facility in Helguvik
  - total cost including transport and gate fee is 195 EUR/ton or 29,3 kr/kg
  - for comparison, case A would be 27,5 kr/kg
- But a closer look at this comparison is needed

ANSWERING ANOTHER CRUCIAL QUESTION

- How does it look from the perspectives of different municipalities?
- We have found out that balanced transport fee for the whole country would have to be 6,4 ISK/ kg

		Capital area		Rangárþing ytra		Snæfellsbær		Akureyri		Balanced fee
		Export	Case A	Export	Case A	Export	Case A	Export	Case A	Standardized transport fee
Cost item	ISK/kg									
Preparing / packaging	19,70	19,70		19,70		19,70		19,70		
Domestic transport ≤ 120 km	3,30		3,30							
Domestic transport ≤ 280 km	7,70			7,70	7,70					
Domestic transport ≤ 500 km	13,80					13,80	13,80			
Ship transport Akureyri	18,50								18,50	
Balanced transport fee	6,40									6,40
International transport Reykjavík - Scandinavia	14,90	14,90		14,90		14,90				
International transport Akureyri - Scandinavia	17,80							17,80		
Gate fee Helguvík	27,50		27,50		27,0		27,50		27,50	27,50
Gate fee - Scandinavia	11,10	11,10		11,10		11,10		11,10		

NEXT STEPS

Phase and Step		Purpose and Issues to Consider	Duration
Feasibility Phase	Prefeasibility Study	Waste quantities, calorific values, capacity, siting, energy sale, organization, costs, and financing	6 months
	Political Decision	Decide whether to investigate further or to abort the project	3 months
	Feasibility Study	Waste quantities, calorific values, capacity, siting, energy sale, organization, costs, and financing in detail	6 months
	Political Decision	Decide on willingness, priority, and financing of incineration plant and necessary organizations	6 months
Project Preparation Phase	Establishment of an Organization	Establishment of an official organization and an institutional support and framework	6 months
	Tender and Financial Engineering	Detailed financial engineering, negotiation of loans or other means of financing, and selection of consultants	3 months
	Preparation of Tender Documents	Reassessment of project, specifications, prequalification of contractors and tendering of documents	6 months
	Political Decision	Decision on financial package, tendering of documents and procedures in detail and final go-ahead	3 months
Project Implementation Phase	Award of Contract and Negotiations	Prequalification of contractors. Tendering of documents. Selection of most competitive bid. Contract negotiations.	6 months
	Construction and Supervision	Construction by selected contractor and supervision by independent consultant	2 1/2 years
	Commissioning and Startup	Testing of all performance specifications, settlements, commissioning, training of staff, and startup by constructor	6 months
	Operation and Maintenance	Continuous operation and maintenance of plant. Continuous procurement of spare parts and supplies.	10–20 years

Rand T., Haukohl J., Marxen U. (2000). Municipal solid waste incineration: Requirements for a Successful Project. The World Bank, Washington, DC.

NEXT STEPS

Minimum 7 years from a decision, assuming Helguvik area

If the site is still undecided, the minimum time is 9 years!

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NEXT STEPS

- ❑ Create the group, form a company
- ❑ Experienced project manager and strong steering group!
- ❑ A contract with an energy company for energy production and sales
- ❑ Active conversation and transparency with the community
- ❑ Negotiations with investors
- ❑ Negotiations with the communes to secure the material
- ❑ Plan for processing of bottom ash
- ❑ Site selection
- ❑ Choice of procurement method
- ❑ Preparations for environmental assessment

Thank you!

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