



# *Sustainable SeaTransport for the Pacific Region*

*Workshop USP November 2012*

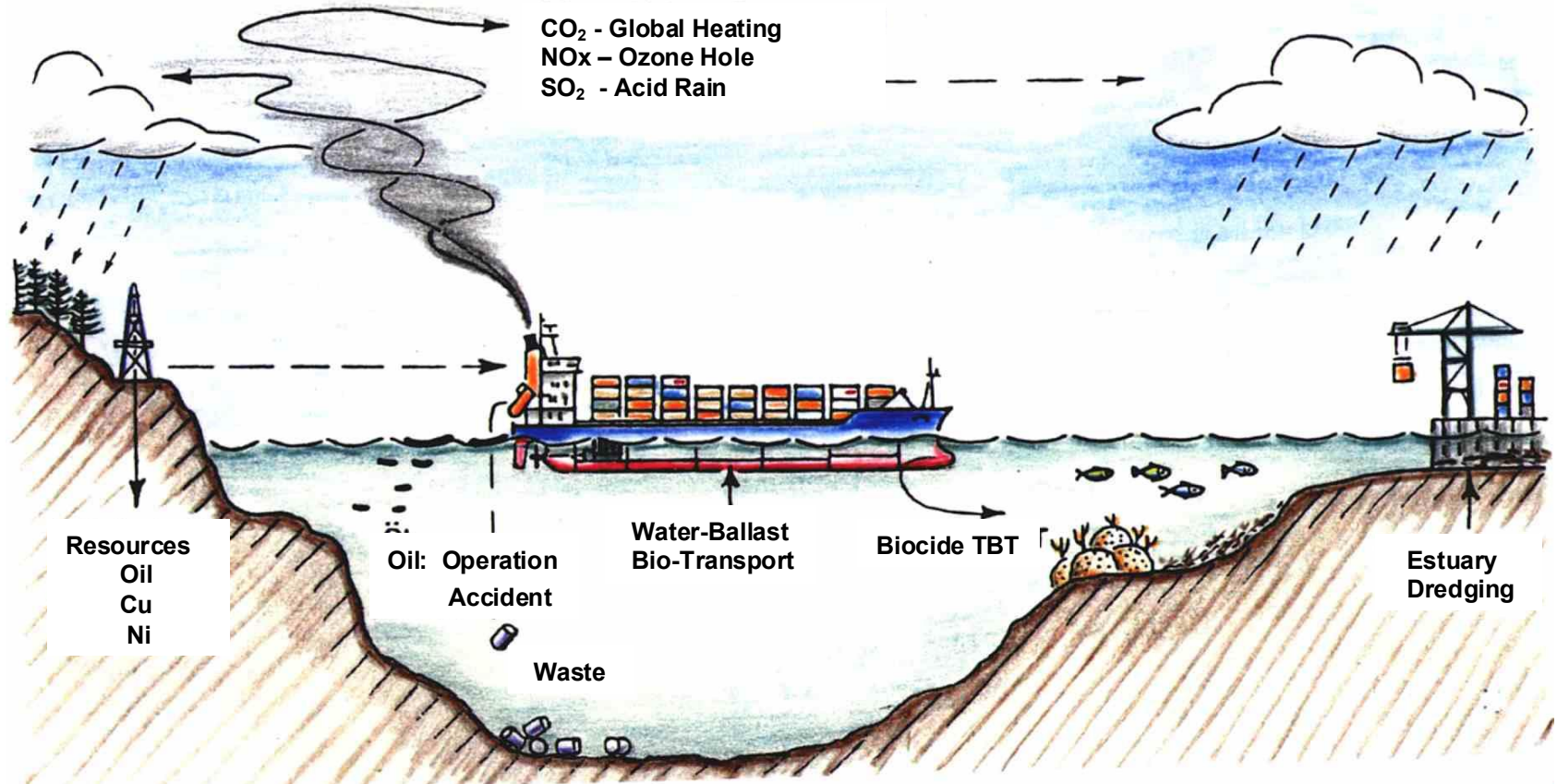
some remarks by: [peter@schenzle-hamburg.de](mailto:peter@schenzle-hamburg.de)



# Present Ocean Transport – *Sustainable?*

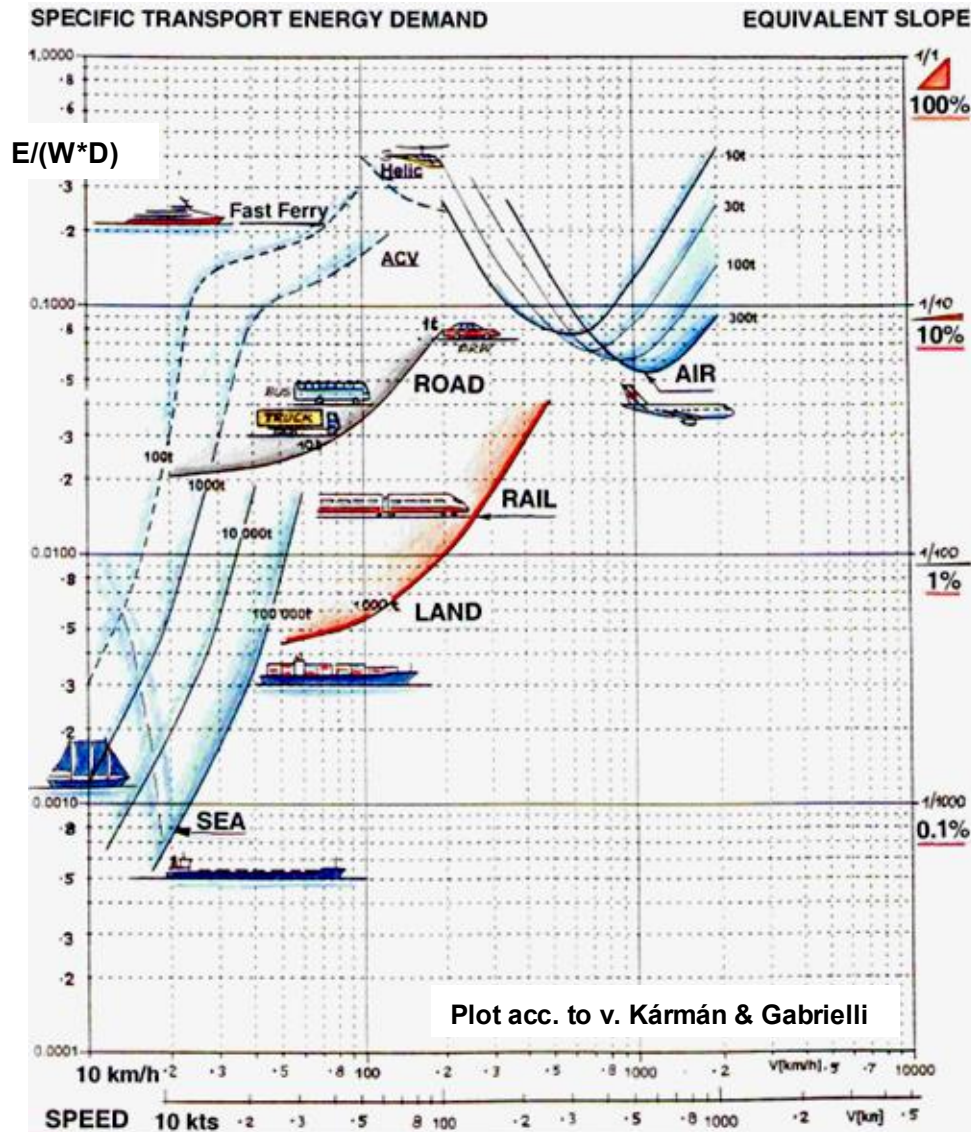
ENVIRONMENTAL IMPACT BY OCEAN TRANSPORT

Jürgen Isensee

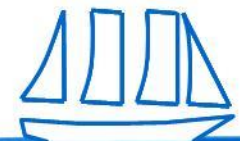


# Relative Energy Demand of Transport Modes

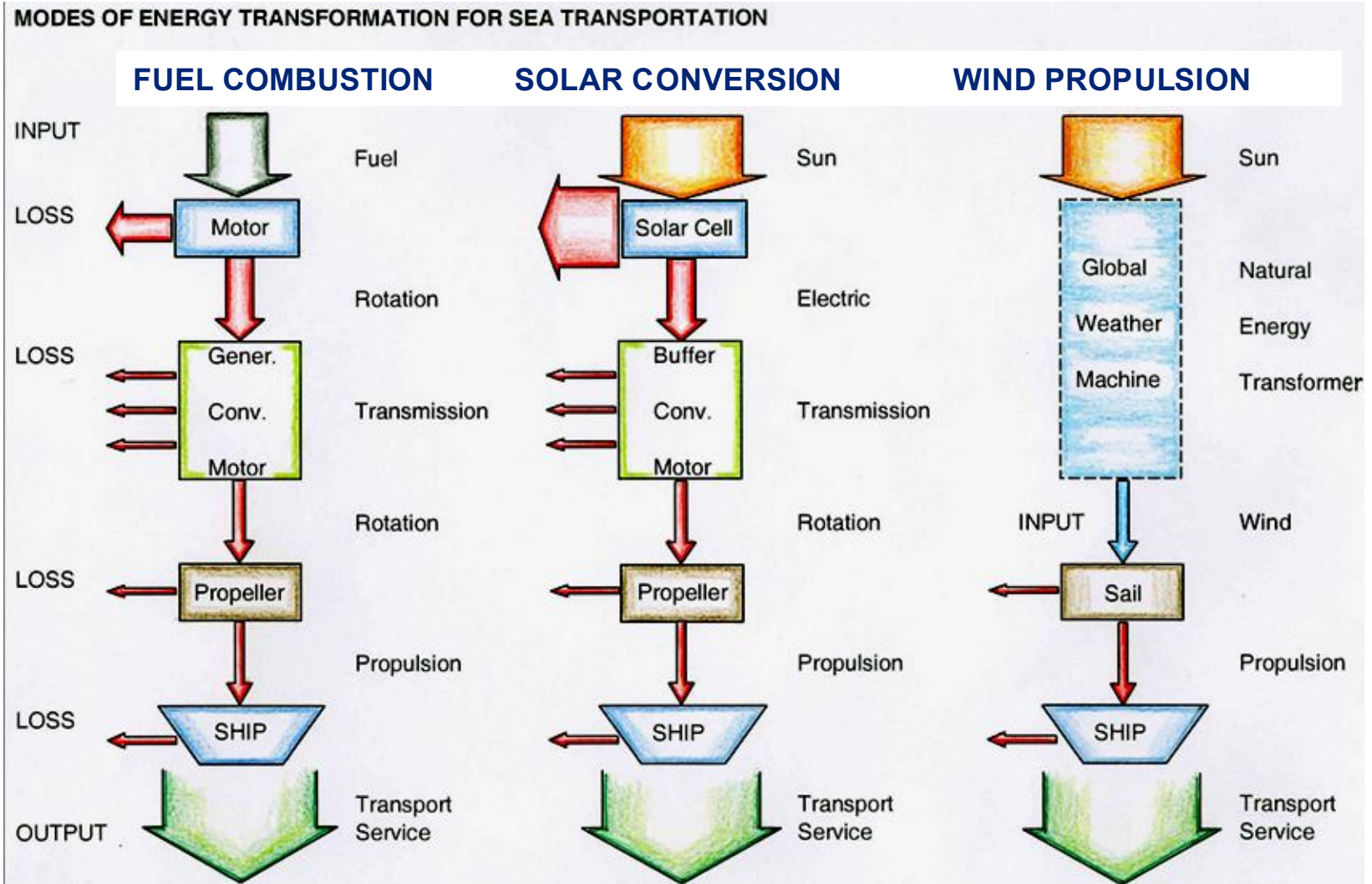
$$\left[ \frac{\text{Energy}}{\text{Weight} \cdot \text{Distance}} \right]$$



- The **Energy Demand** per transport service is rising with **Speed** and falling with **Size**
- **Sea Transport** is 10 times more efficient than **Land Transport** & 100 times more so than **Air Transport**



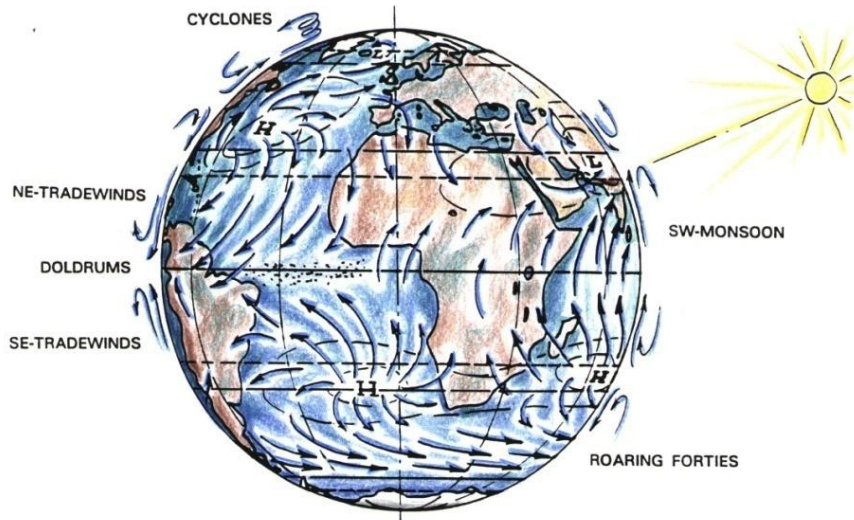
# Energy Transformation for Ocean Transport



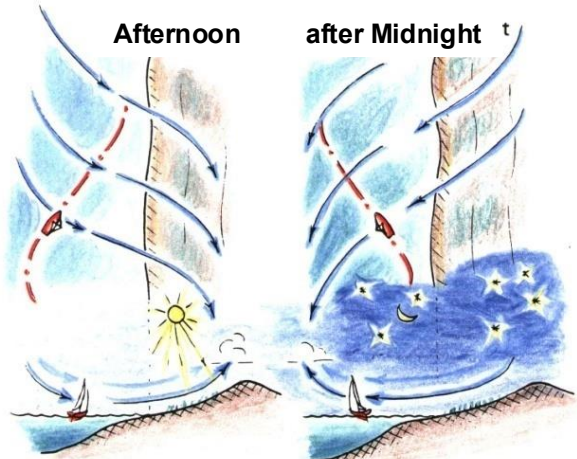
'Lossful' Energy Conversion or Direct use of Wind Propulsion?



# Global and lokal Wind Systems



Global Wind Systems in July



Coastal Thermal Winds

**Solar Radiation** is converted by the **'Global Weather-Machine'** into **Mechanical Flow Energy.**

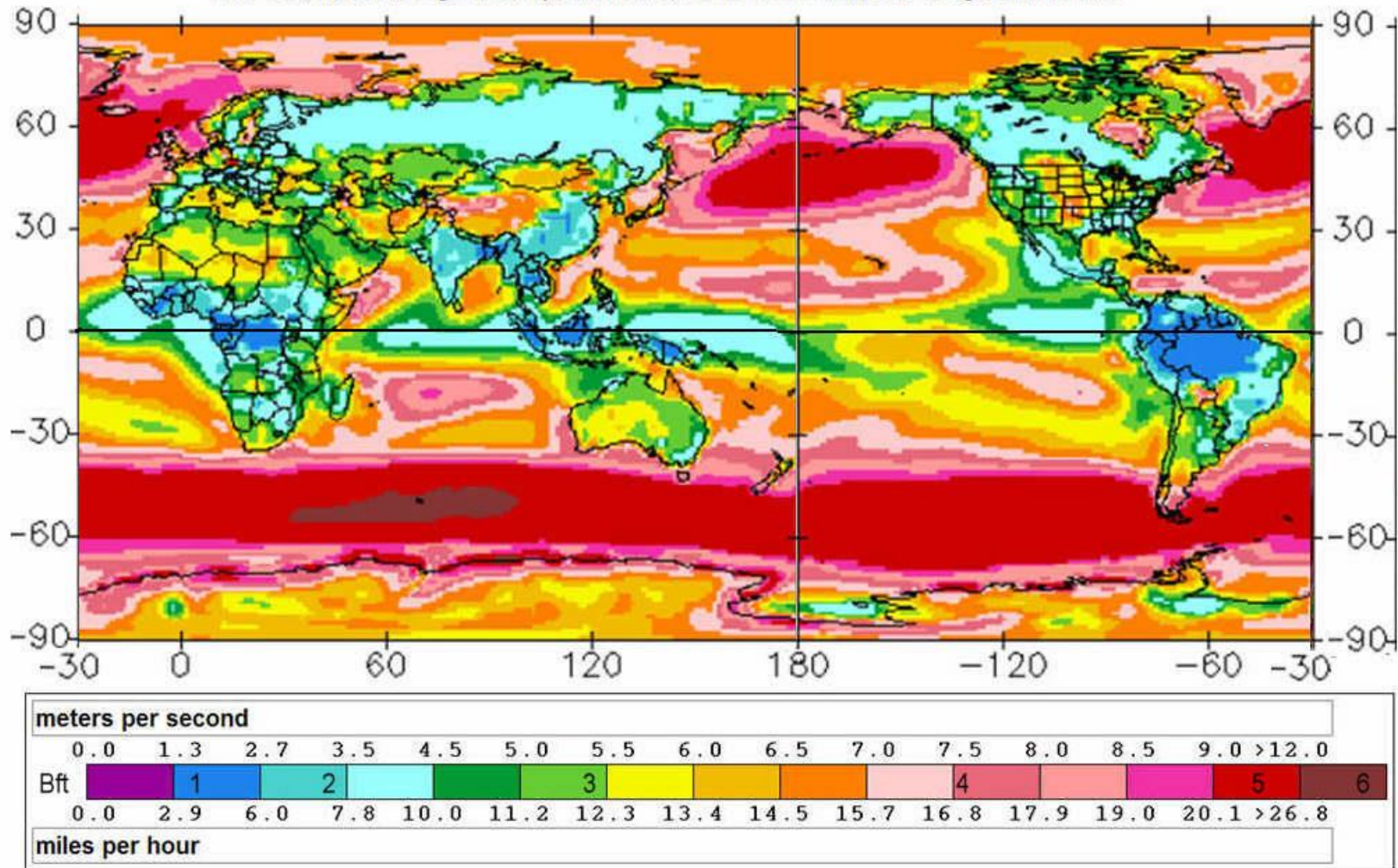
**Wind** can produce **Direct Ship Propulsion** without further **Energy Transformation.**

**(Solar Conversion** could cover **only 10%** of the demand.)



# Global Annual Average Wind Speed

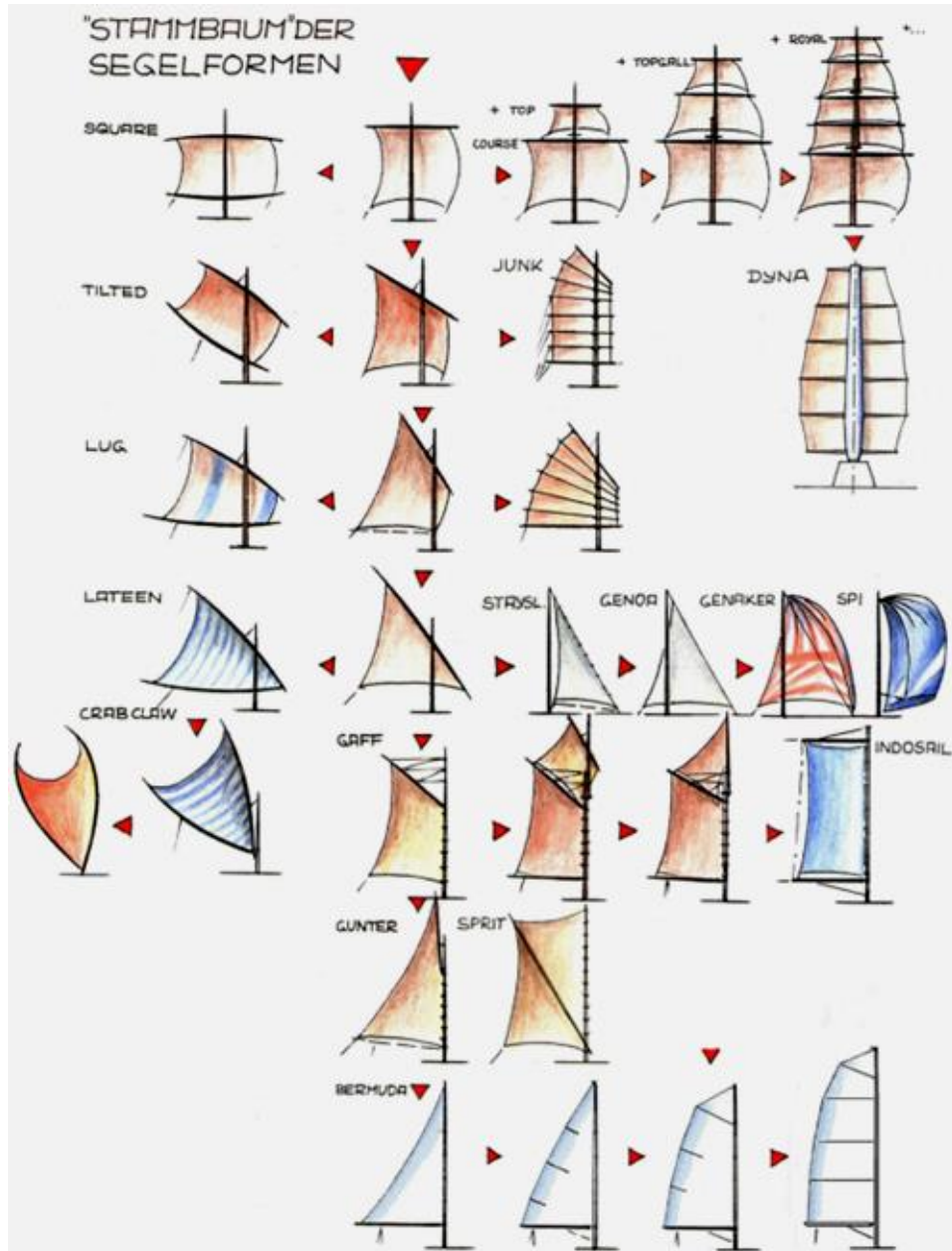
This is annual average wind speed measured 50 meters above the ground or sea.



Tropical Oceans are Regions of Light but Steady Wind Systems



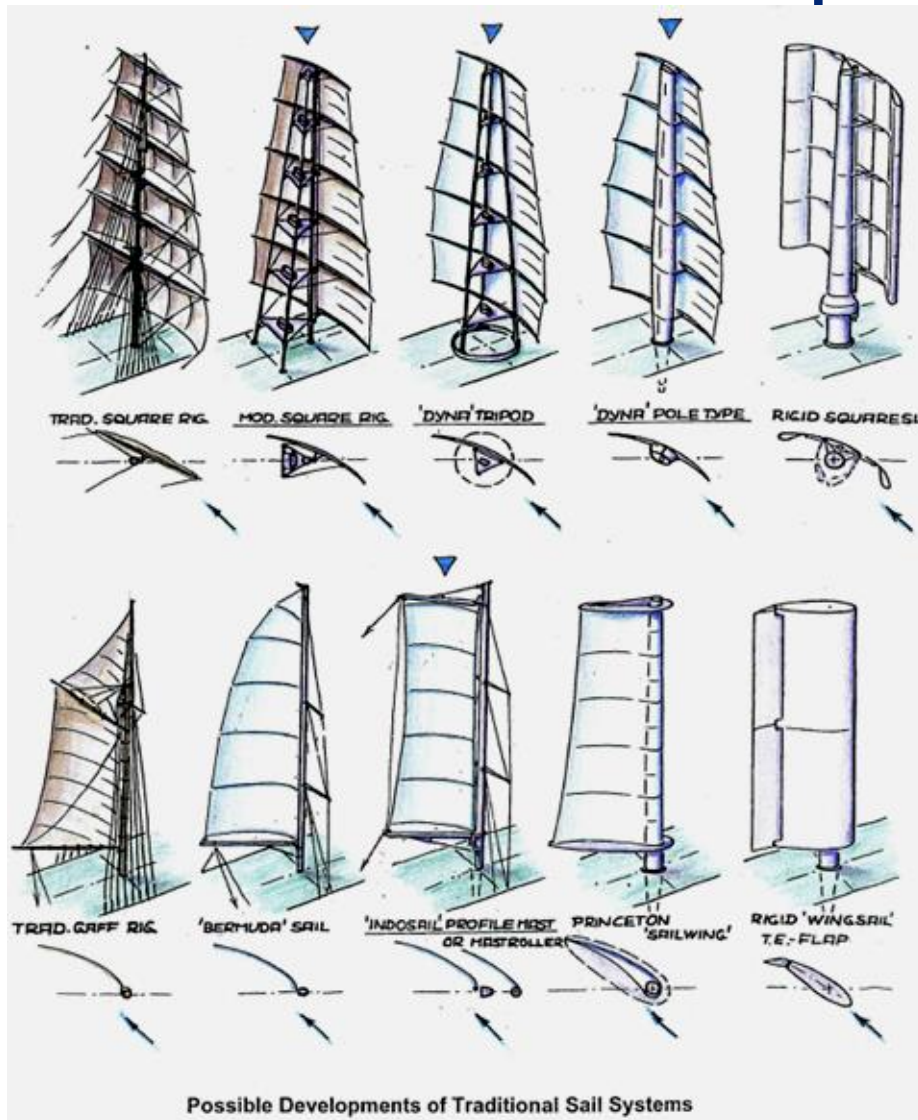
# Tentative Genealogy of Sail Types



- A wide **Spectrum of Sail Types** have developed on **Rivers, Coasts and Islands** with fascinating features in **Handling & Efficiency**, -
- facing the **Variety in Geography, Culture and Economy**.



# Menu of Wind Propulsion-Systems



- **Technical Options** are reaching from traditional **Sails** via soft **'Sail-Wings'** to hard **'Wing-Sails'**
- **(Active High-Lift Systems use Rotation, Blowing or boundary layer Suction.)**



# A wide Spectrum of Hybrid Motor- & Wind Propulsion



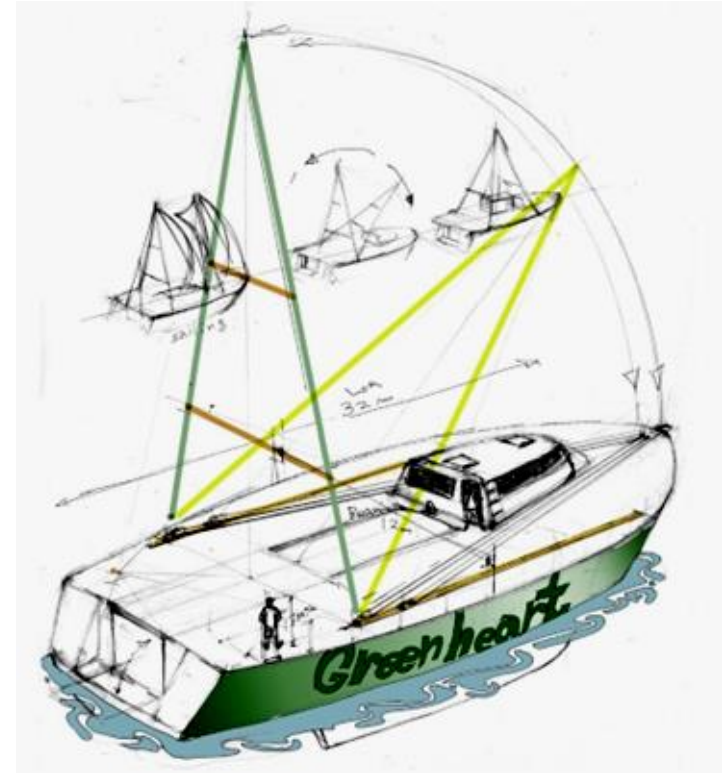
**„Wind-Assisted Motor-Ships“** are operated as normal **Motor-Ships** and use the **Wind** for **Engine Down-rating** under **favourable Wind Conditions**.



**„Motor-Assisted Wind-Ships“** use the **Wind for Main Propulsion** and an **Auxiliary Motor**, mainly for Port Operation, Calm Weather and Manoeuvring.



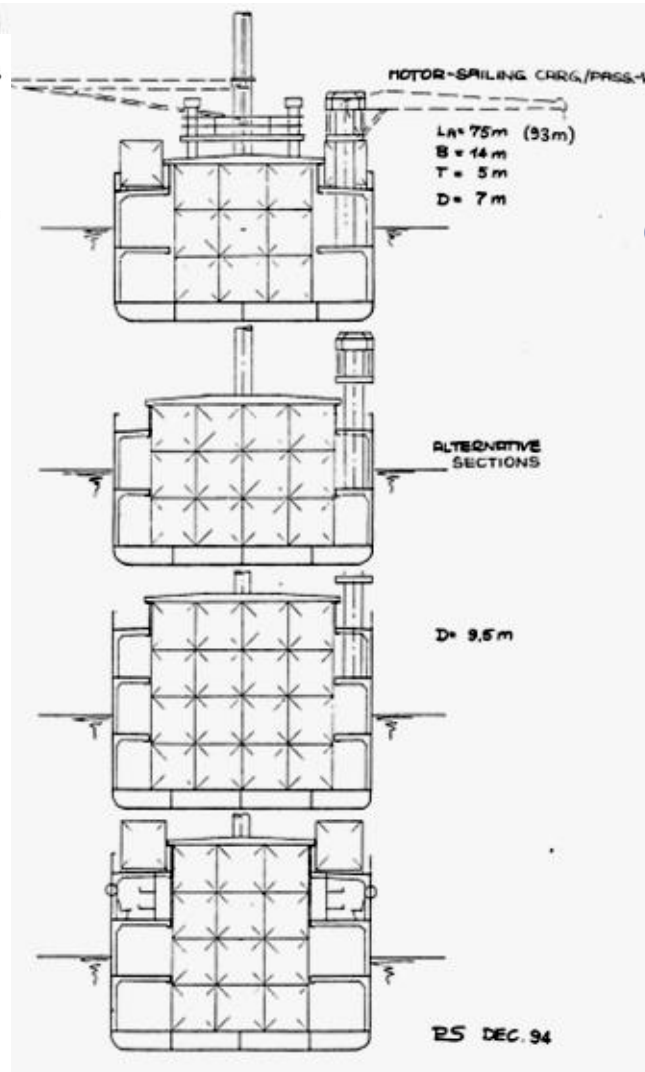
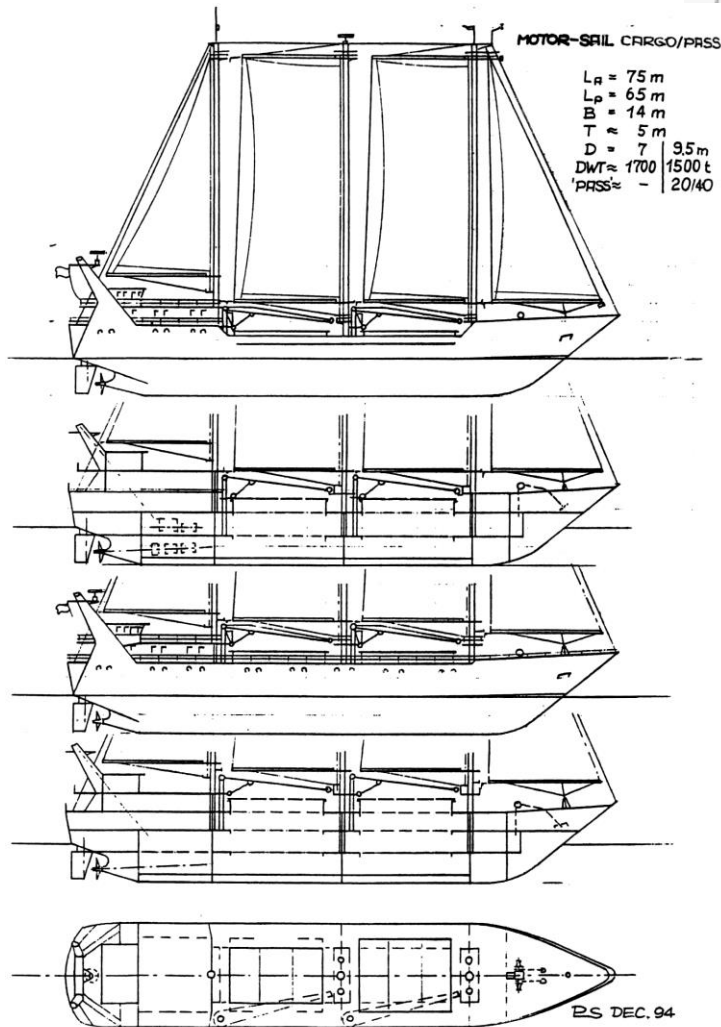
# Examples of appropriate Windship Projects



**Search for 'Appropriate Technology'** can produce a broad range of efficient Solutions for a vast range of tasks and boundary conditions.



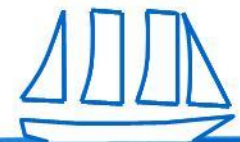
# Examples of small Windship Projects



**Small Motor-Sailing Cargo Vessel for Coastal and Inter-Island Trade.**

Options for Containers, Cargo Gear & Passengers.

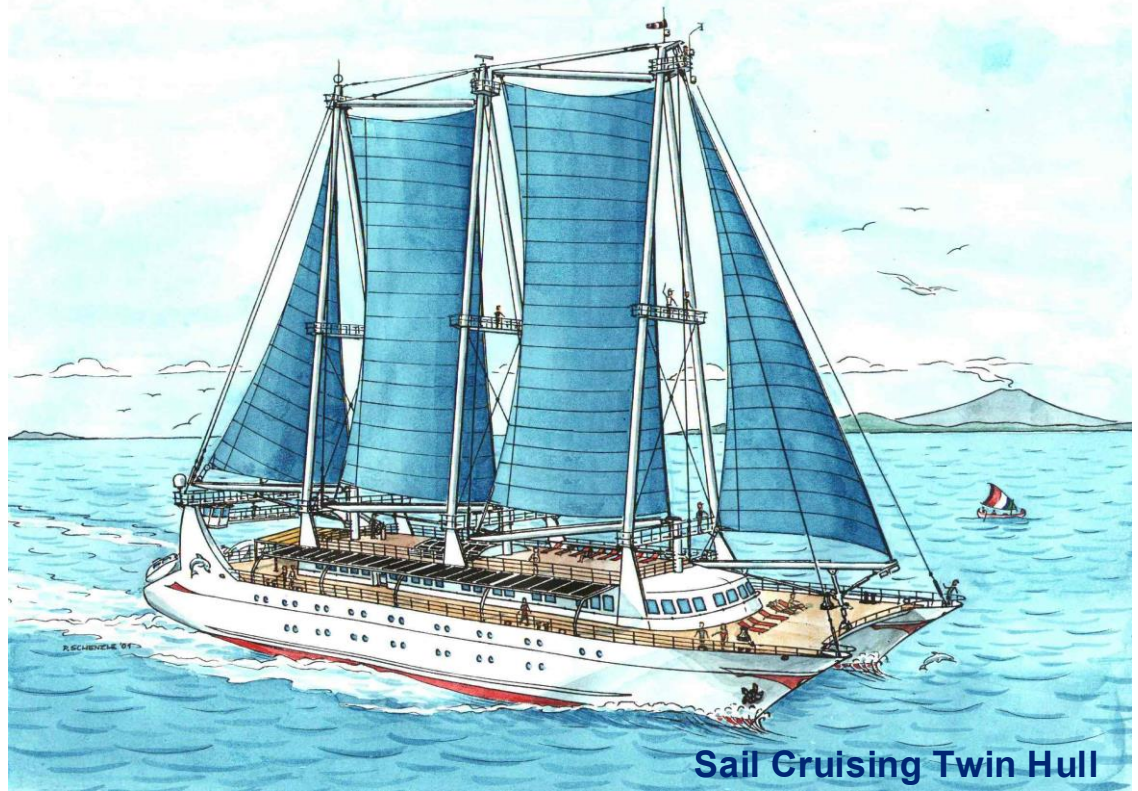
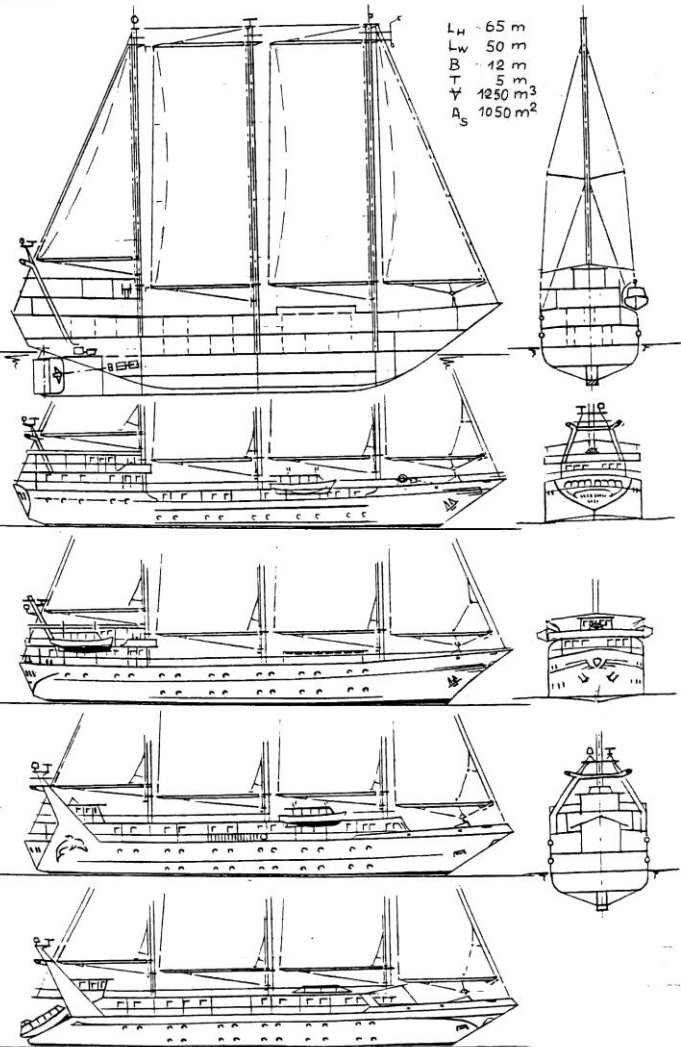
$L_A = 75\text{ m}$   
 $L_P = 65\text{ m}$   
 $B = 14\text{ m}$   
 $T = 5\text{ m}$   
 $D = 7/9.5\text{ m}$   
 $DW = 1700\text{ t}$   
 $Pax = 20/40$



# Examples of small Windship Projects

## Sail Cruising Vessels for Coastal and Inter-Island Waters

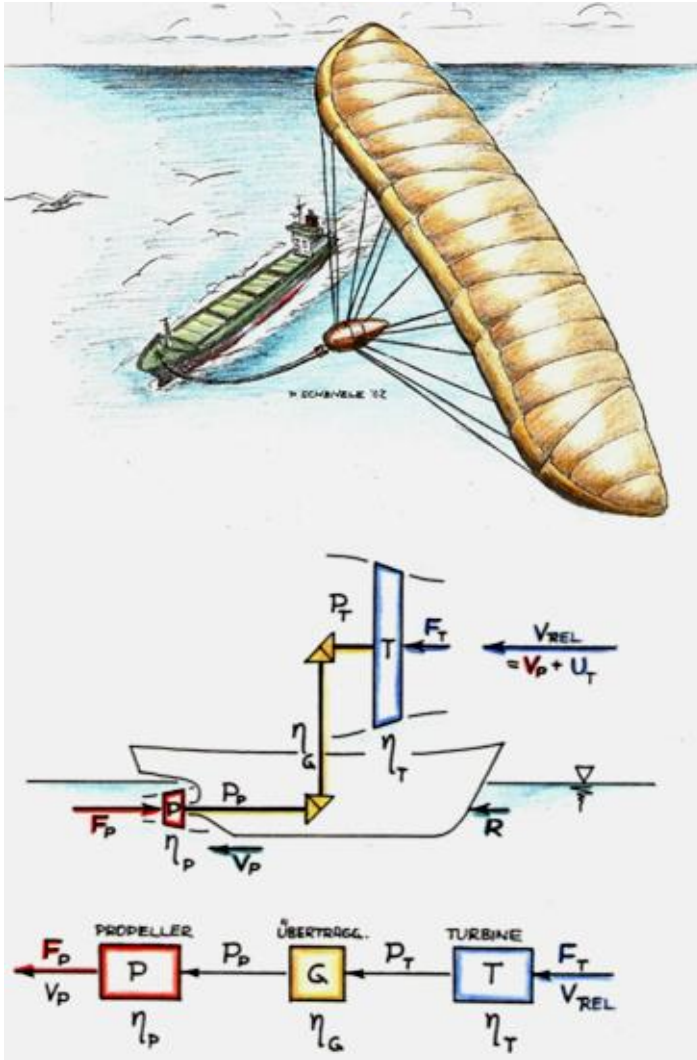
Soft Tourism close to Wind & Waves, to Flora & Fauna,  
to Reefs & Beaches and to Cultures and People.



**Modern Ship and Rig Technology**  
to extend Time Windows for Sailing.



# Special Wind-Propulsion Systems



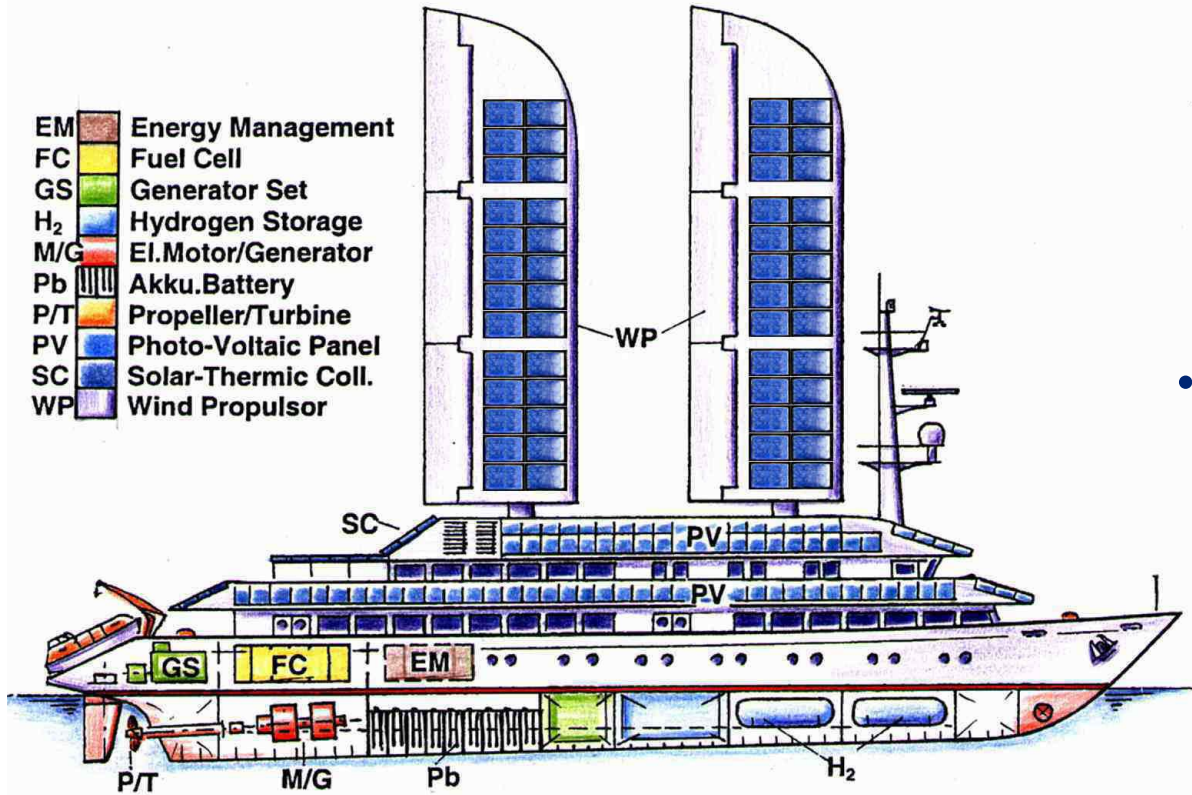
## PRO and CONTRA:

- Elevated Foils or Kite Sails** need no masts on deck and cause no heeling angles. **Kites** can be flown dynamically in stronger winds, but favourably **on reaching courses**.
- Windmills (-Turbines), driving a ship's propeller,** are the only way of 'sailing' **straight against the wind**. But multiple energy transformation and losses make it **inferior to direct wind propulsion on all other courses**.



# Combination of Complementary Regenerative Sources

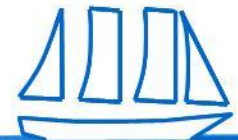
## Schematic Components of Sustainable Ship Operation



*If 'Zero Emission' is not possible at sea, - then not at all !*

- **Sea Transportation**, due to its uniquely **Low Energy Demand**, offers the chance of a high rate of supply by the low-density sources of **Wind and Sun**.

- **A future Ship-Operation System** would be a hybrid combination of **Wind-Propulsion** with electric and thermal conversion and use of **Solar Radiation** and supplemented by **Intelligent Energy Management**.



# A Future Dream only?



Solar Zero-Emission Economy, based on Income  
rather than Exhaustion



# Not only a Future Dream!



A small-scale **Demonstrator** is already operational:

**Combined Propulsion by Sun and Wind** is possible:

**Sydney ,SolarSailor'**

- **Globalisation cannot provide endless Resources.**
- **The Zero-Emission- 'Solar-Ship' could be the Future Market, rather than Energy- and Resource-Eating ,High-Speed' Projects.**





# Islands are Symbols of Chance & Danger

*Who else could Pioneer the way to a Sustainable Future?*



# Our Blue Planet is a precious Island of Life



- circling the **Sun** in a **Narrow Zone** between **Burning Heat** and **Freezing Cold**.
- **We** could **Preserve** our **Island of Life** with our *Knowledge, Courage and Imagination* -  
or we can **Destroy** it with our *Greed?*

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