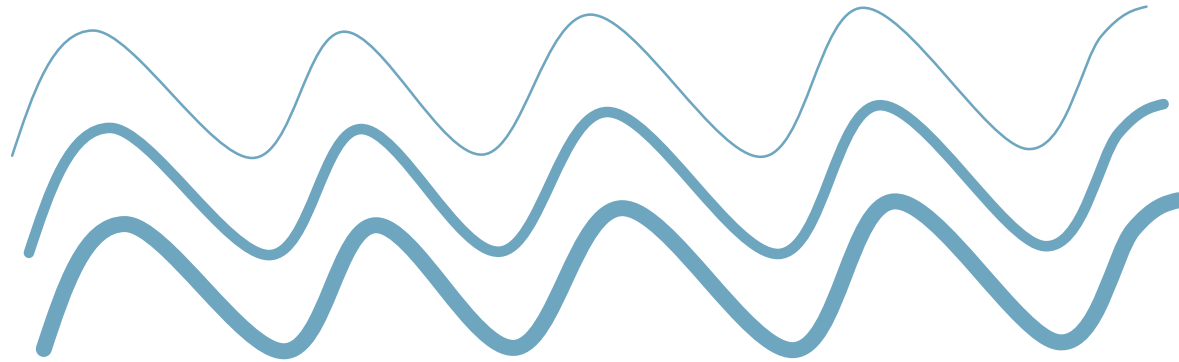


# **SWEA's Strategy for Ocean Energy**



# About the strategy

- **A strategy for the Swedish Energy Agency's support of ocean energy**
  - Mutual strategy for research, funding and support
  - With the purpose to increase efficiency and customer benefits
  - To give guidance on priorities and new activities



# Why ocean energy?

## **Ocean energy has positive features**

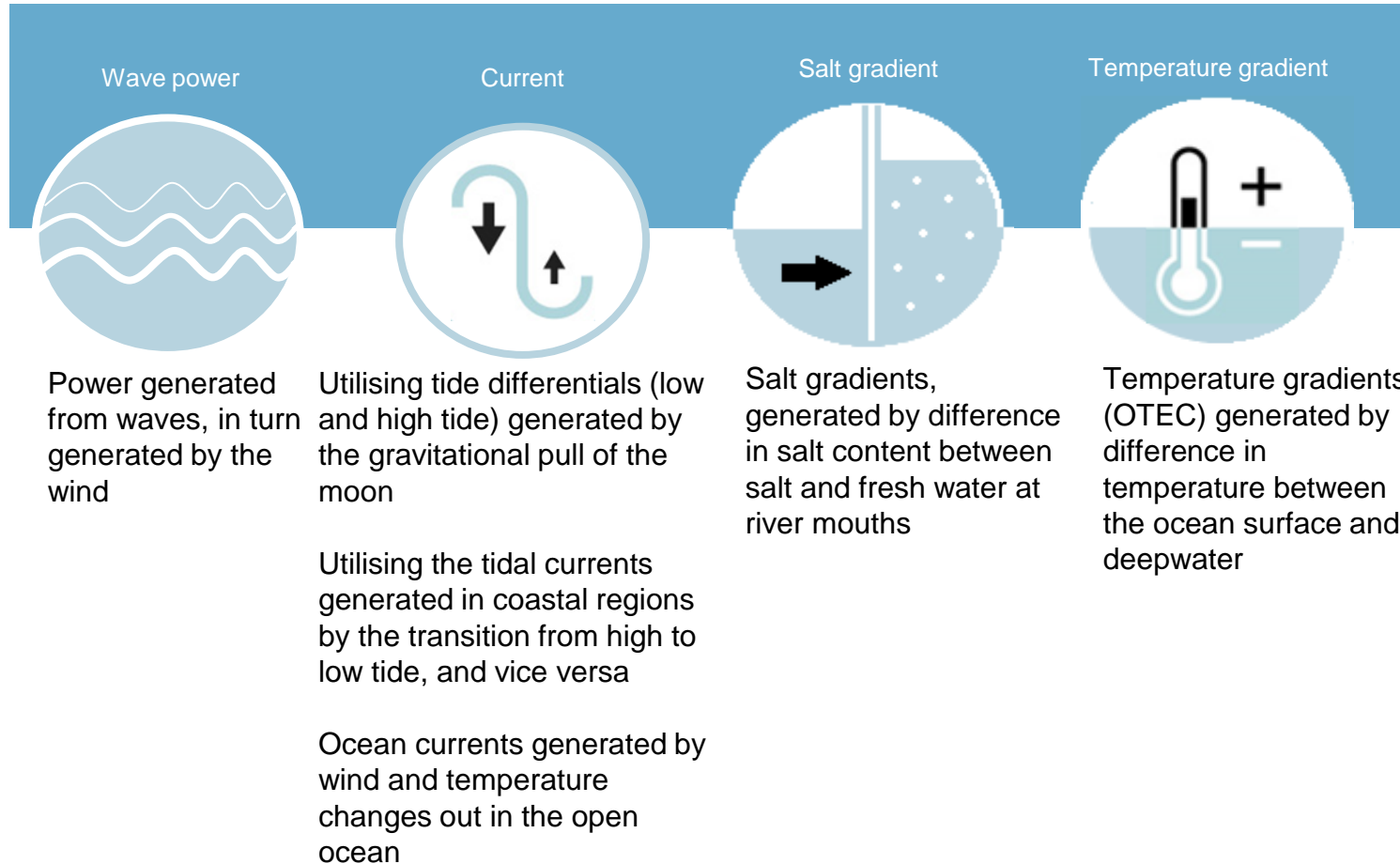
- An abundant and largely untapped energy source, but with clear geographical boundaries
- Relatively even production, can deliver benefits to the electricity system
- Can be built out of sight
- Potential environmental benefits (wave power in particular) from forming reefs for marine life

## **Swedish innovations can make a difference**

- Sweden has leading and globally recognised researchers, scientists and companies in ocean energy
- There is strong competence in supporting and adjacent industries (e.g. energy, manufacturing och off shore)
- Increasing level of cooperation among developers

# Ocean energy technologies

Ocean energy primarily include the generation of energy from:

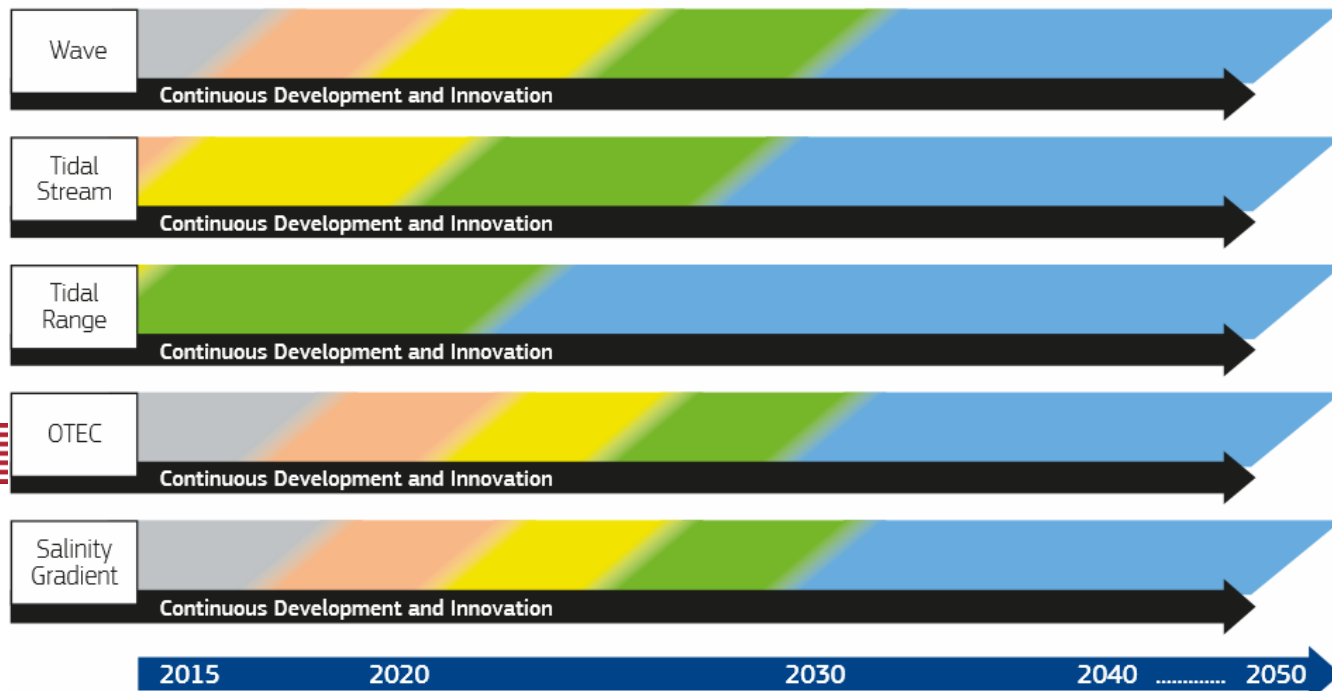


# Technology maturity

Countries with larger installations (operational)



R&D Prototype Demonstration Pre-Commercial Industrial Roll-Out



**R&D**

- Small-scale device validated in lab
- Component testing and validation
- Small/medium-scale Pilots

TRL 1-4

**Prototype**

- Representative single-scale devices with full-scale components
- Deployed in relevant sea conditions
- Ability to evidence energy generation

TRL 3-6

**Demonstration**

- Series or small array of full-scale devices
- Deployed in relevant sea conditions
- Ability to evidence power generation to Grid
- For OTEC and salinity gradient: full functionality down-scaled power plant

TRL 5-7

**Pre-Commercial**

- Medium-scale array of full-scale devices experiencing interactions
- Grid connected to a hub or substation (array)
- Deployed in relevant/operational sea conditions
- For OTEC and salinity gradient: scalable

TRL 6-8

**Industrial Roll-Out**

- Full-scale commercial ocean energy power plant or farms
- Deployed in operational real sea conditions
- Mass production of off-the-shelf components and devices

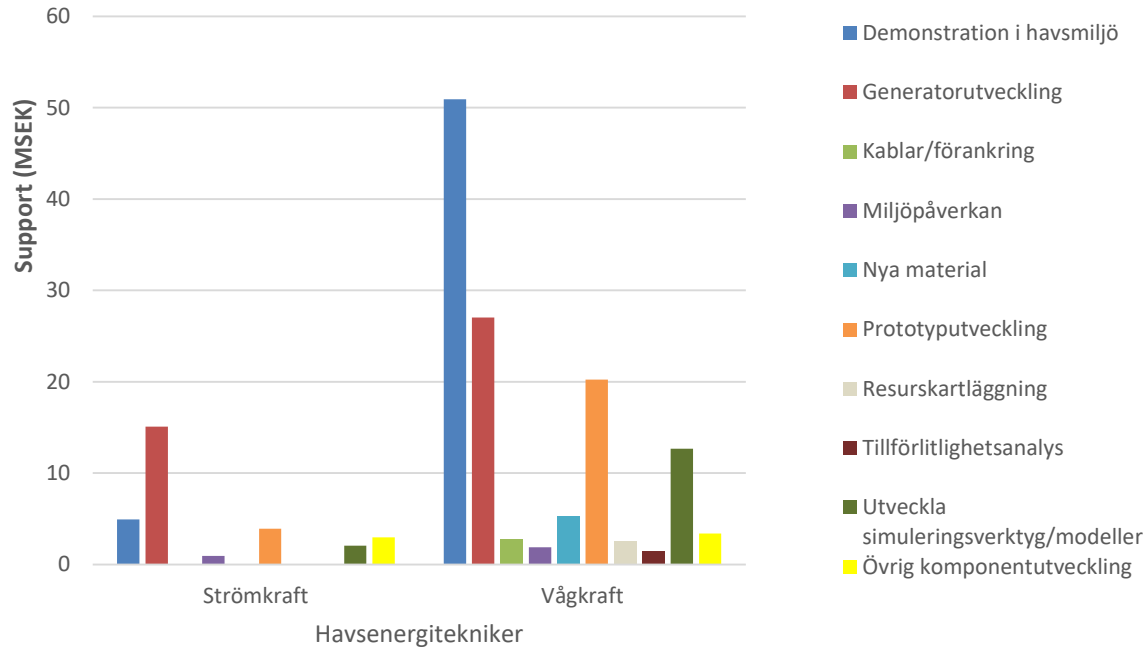
TRL 7-9

Ocean energy technologies are at a relatively early development stage och significantly more expensive than solar and wind. Costs are expected to fall as installed capacity increases.

Källa: [Ocean Energy Forum, Ocean Energy Strategic Roadmap, November 2016](#), [IEA OES, Annual Report Ocean Energy Systems 2016](#)

# The Swedish Energy Agency's support of ocean energy

SWEA's granted funding for different ocean energy technologies and R&I areas 2005-2016\*



\*excl. specific demonstration project (Sotenäs)

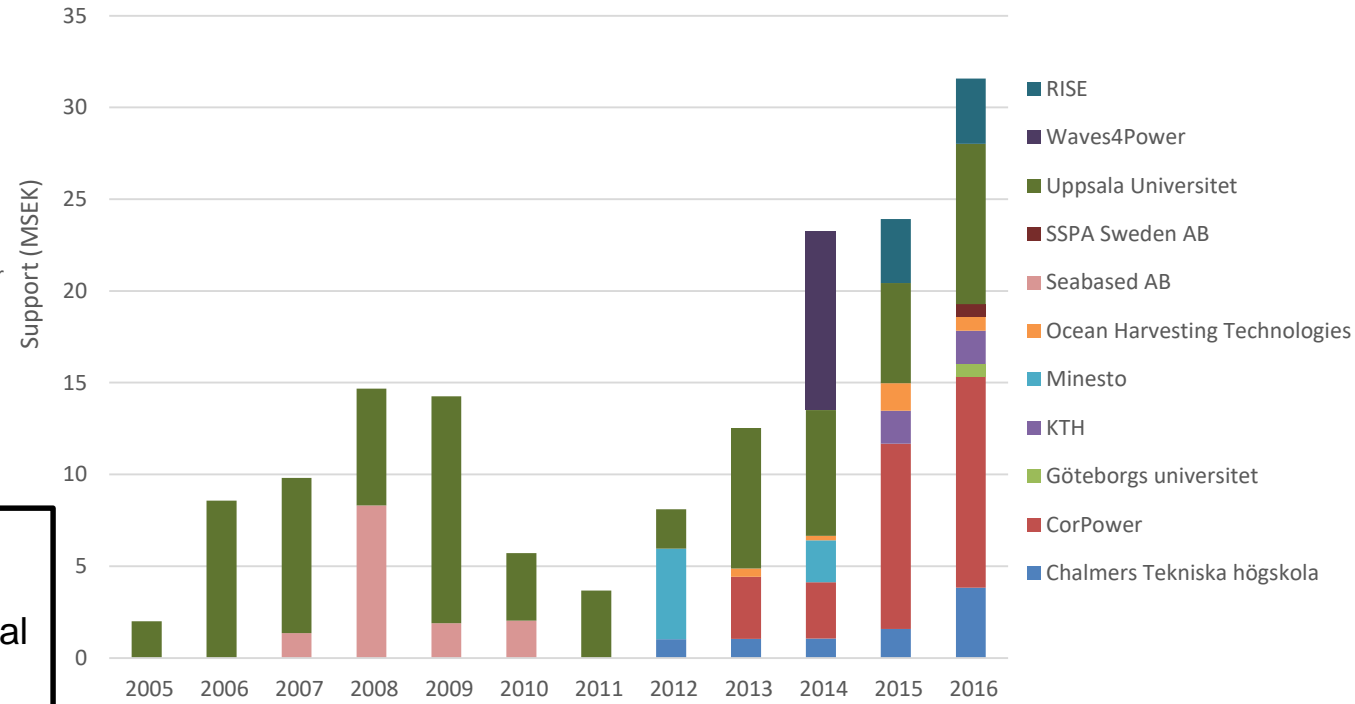
International/national:

2013-2016, approx. 4 % of funding granted went towards international programs, IEA OES och OCEANERA-NET

The government's special support for large installations:

139 MSEK granted in 2010 for pilot installation outside Sotenäs (Sotenäsprojektet) 91 MSEK issued (2016).  
Recipient Seabased AB

SWEA's granted funding for different ocean energy market participants



\*excl. specific demonstration project (Sotenäs)

\*indirect grant recipients have not been considered, i.e. only main applicant represented in the graph

# Effect logic

## SHORT TERM

### Aktiviteter

- Research and innovation program: Marine energy conversion
- International research program: OCEANERA-Net Cofund
- International cooperation: IEA OES
- Other activities: Reserach programme nydanande, affärsutvecklingsstöd

### Results (example)

- Prototypes
- Reports on environmental impacts
- Members of heavy industry participate in projects
- Patents
- Innovative solutions
- International projects
- PHDs
- Publications
- Demonstration projects

## LONG TERM

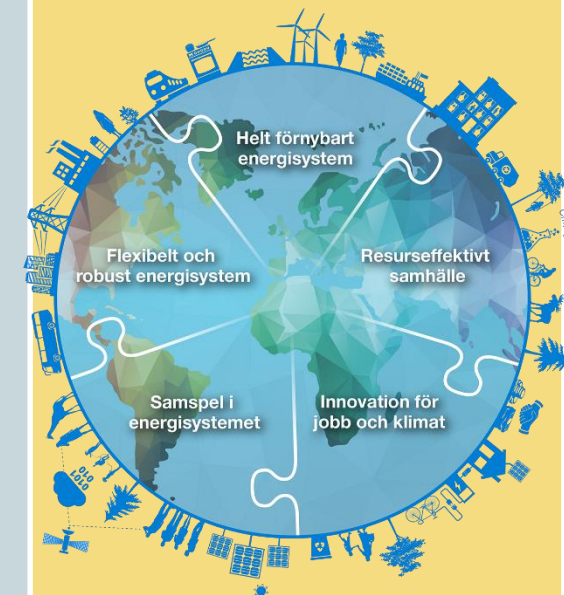
### Outcomes

- Swedish ocean energy industry commercialise their products and services on the global market
- There is access to high competence across the Swedish value chain
- There is a strong value chain in ocean energy with stakeholders brought together
- Additional Swedish industries are active in ocean energy
- There are cost efficient and sustainable ocean energy systems developed in Sweden
- Sharing of experiences and knowledge between market participants
- Strong knowledge about the environmental impact of OE

### Effect

- Larger share of renewable energy globally (EU 2030-target, Paris Agreement)
- Increased Swedish exports and number of exporting companies (Sweden's export strategy)
- Employment and growth in Sweden (Energiforskningspropositionen<sup>1</sup>)

## VISION



A GLOBAL  
SUSTAINABLE  
ENERGY  
SYSTEM

Timeline

Ca 2025

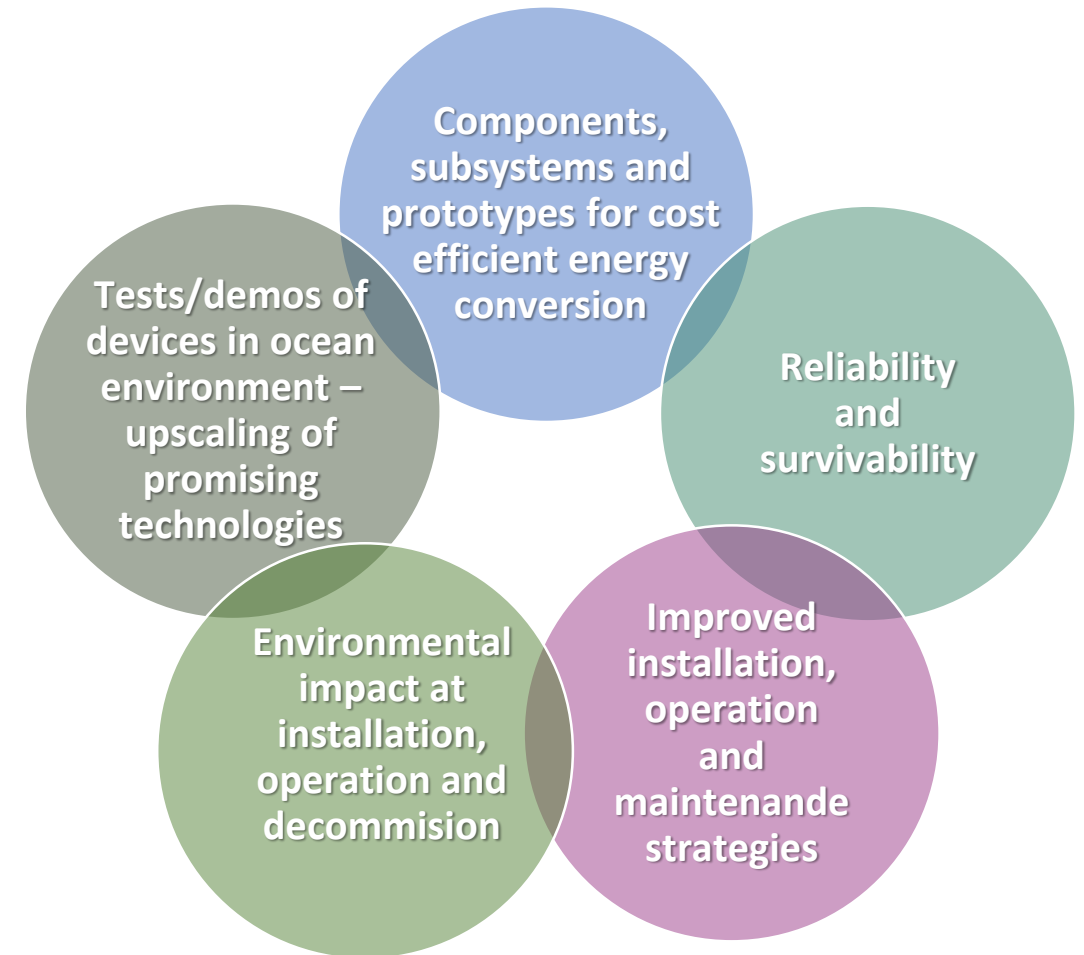
Ca 2050

# Priority areas and strategic direction

## Rationale for the strategic direction

- Commercialisation of Swedish innovations
- Access to highly skilled resources
- Strong value chain with several players
- Cooperation to reach cost-efficient ocean energy
- Increase knowledge of environmental impacts

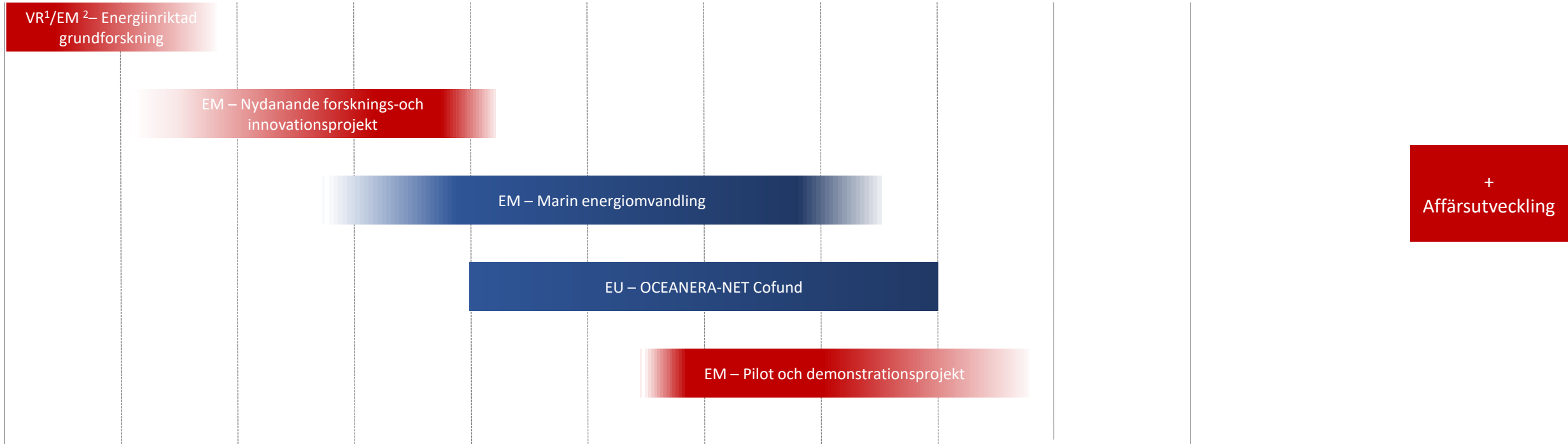
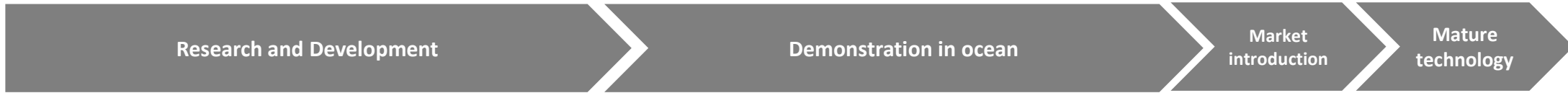
## Prioritised areas of research and innovation



\*Focus on technologies with the potential to be commercialised by 2030



# Avenues for funding from SWEA



**TRL 1**  
Basic principles observed

**TRL 2**  
Technology concept formulated

**TRL 3**  
Experimental proof of concept

**TRL 4**  
Technology validated in lab

**TRL 5**  
Technology validated in industrial relevant environment

**TRL 6**  
Technology demonstrated in industrial relevant environment

**TRL 7**  
System prototype demonstration in operation environment

**TRL 8**  
System complete and qualified

**TRL 9**  
Actual system proven in operational environment / Competitive manufacturing

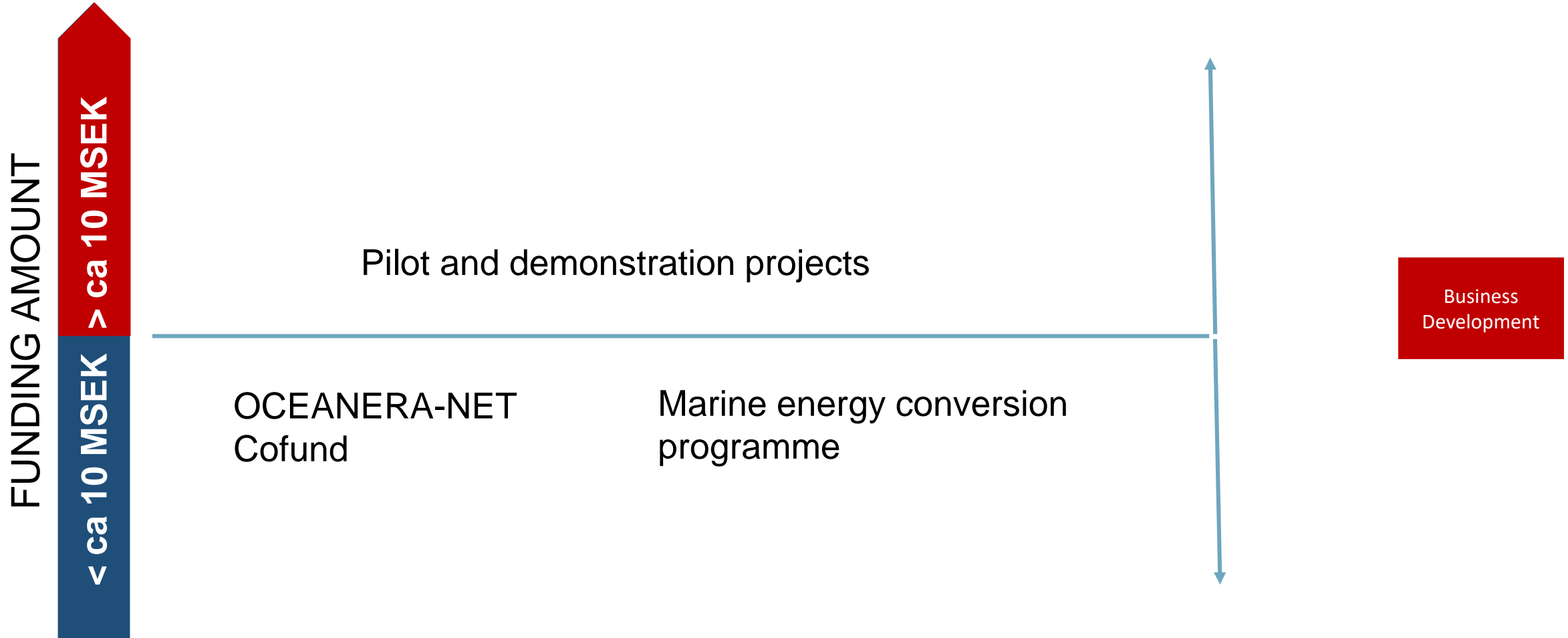
Entire energy system

Ocean energy

- 1) Vetenskapsrådet
- 2) Energimyndigheten

# Demonstration in ocean

## Possible avenues for support from SWEA



Thank you

Lars Karlbom

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