WP	Task	Title	Partners involved (leaders in bold)	2020 - Year 1				2021 - Year 2				2022 - Year 3				2023 - Year 4				2024 - Year 5			
				1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
A		**Technical transitions and Energy innovations**	**DIFFER**																				
A.1		**Hybrid Wave-Storage Device and Integration**	**RUG**, Ocean Grazer BV																				
	A1.1	Create mechanical design integrated scale prototype	**RUG**, Ocean Grazer BV	P	P	Mo	t,Mo	Mo	Mo	D,Mo	t												
	A1.2	Design and implement mechatronics and control systems	**RUG**		P	Mo	Mo	D,Mo	C,Pr	L	D,L	T											
	A1.3	Develop predictive OG-Hybrid models and optimize design	**RUG**			P	Mo	Mo	Mo	t,Mo	L	D,L	T										
	A1.4	Build the scale prototype	**RUG**, Ocean Grazer BV						P	Pr	L	D,L											
	A1.5	Design, execute and assess wave tank experiments	**RUG**							P	L	L	L	D,C									
	A1.6	Compare experiments and model results for validation	**RUG**									P	Sy	Sy	T								
	A1.7	Definition and assessment of scenarios	**RUG**, Ocean Grazer BV	P	Mo																		
	A1.8	Critical components and subsystems	**RUG**, Ocean Grazer BV		P	Mo	Mo	Mo	t														
	A1.9	Development of integrated OEP model	**RUG**, Ocean Grazer BV						Mo	Mo	Mo	Mo	Mo	Mo	t								
	A1.10	Case study of OEP performance based on several scenarios	**RUG**, Ocean Grazer BV												Sy	Sy	Sy	t					
	A1.11	Outreach to relevant innovation programmes in offshore energy	**RUG**, Ocean Grazer BV												C	C	C	C	R				
A.2		**Floating Solar Platforms**	**TUD**, Engie, MARIN, OoE, TNO																				
	A2.1	FSP Concept design	**TUD**, Engie		P	t																	
	A2.2	FSP Mooring system	**TUD**, OoE			P	Mo	Mo	t														
	A2.3	FSP model development and verification	**TUD**			P	Mo	Mo	Mo	T	Mo	Mo	Sy	T									
	A2.4	FSP Loading phenomena and failure mechnanisms	**TUD**, TNO					Mo	Mo	Sy	t												
	A2.5	FSP design, execution, and assessment of model tests	**TUD**, MARIN						P	P	L	D	Pr	D	Sy	t							
	A2.6	FSP comparison of results and validation	**TUD**												Sy	Sy	Sy	T					
	A2.7	FSP Design case study	**TUD**, Engie														Sy	Sy	Sy	T			
A.3		**Power to Molecules (P2M)**	**DIFFER**																				
	A3.1	Electrode-electrolyte development	DIFFER	P	P	L	L	L	L														
	A3.2	Electro-chemical CO2 cell development	DIFFER		P	L	L	L	L	L	T,t												
	A3.3	Integration Electrochem Cell with plasma/light stimulus	DIFFER							L	L	L	L,Pr	T,t,L	T,t,L								
A.4		**Recapture of CO2**	**DIFFER**																				
	A4.1	Modelling of new DAC materials using Density Functional Theory	DIFFER					P	P	L	L	L	L	L	T,t								
	A4.2	Material development for Microwave Swing Regeneration	DIFFER							P	P	L	L	L	L	L	L	T,L	T,t				
	A4.3	DAC Process flow analysis and performance optimisation	DIFFER													P	L	L,Pr	L,Pr	Pr,L	T	T	T
A.5		**Liquefied Hydrogen**	**TUD**, GTT, Engie, TNO																				
	A5.1	Literature study & material properties screening	**TUD**, GTT, Engie		P	t																	
	A5.2	Material selection	**TUD**, GTT, Engie			P	Sy	t															
	A5.3	Material-H2 tests at room temperature	**TUD**, TNO				P	L	L	D	T												
	A5.4	Material-(L)H2 tests at cryogenic temperature	**TUD**, TNO								P	L	L	D	T,C								
	A5.5	Advanced material characterization	**TUD**											Sy	Sy	t							
	A5.6	Prediction of material behavior and material selection	**TUD**, GTT, Engie, TNO												Mo	Mo	Mo	Sy	Sy,T	T			
A.6		**Artificial Islands**	**TUD**, MARIN, Deltares, TNO																				
	A6.1	Description of configurations and processes	**TUD**, MARIN, Deltares, TNO			P	P	P	t														
	A6.2	Selection of numerical tools	**TUD**, MARIN, Deltares				P	P	P	P	P										T		
	A6.3	D trial tests	**TUD**							L	L	D	T										
	A6.4	Demonstrator by Marin / Deltares	**TUD**, Deltares											P	Pr	D	T						
	A6.5	Validation of the numerical and empirical models	**TUD**															Sy	Sy		T		
	A6.6	Case study	**TUD**, Deltares, TNO																Sy	Sy	T		
B		**Optimal biodiversity and carrying capacity**	**Deltares**																				
B.1		**Primary production as basis for the Carrying Capacity**	**NIOZ**, UT/ITC, RWS, Deltares																				
	B1.1	Novel high resolution method to measure primary production	**NIOZ**, UT/ITC, Deltares	P,L	F,D	F,D	D	L,t,T		F,D	D	L,t	F,D		D,L	D,t,T	F,D	F,D	D	T		Sy	R
	B1.2	Automated measurements phytoplankton abundance & functional type	**NIOZ**	P,L	F,D	F,D	D	L,t	F,D	F,D	D	L,t	F,D	F,D	D,L	D,t,T	F,D	F,D	D	T	Pr	Sy	R
	B1.3	Effect water column disturbance by wind turbines on primary production	**RWS**, NIOZ	P,L			L	L,t	F,D		D	L,t		F,D	D,L	D,t,T	F,D	F,D	D	T	Pr	Sy	R
	B1.4	Remote sensing based primary production models	**NIOZ**, UT/ITC, Deltares	P,L			L	L,t		Mo	D	Mo, T			D,L	Mo		D	D, Mo	T		Sy	
	B1.5	Spatio-temporal dynamics of potential carrying capacity	**NIOZ**, Deltares	P,L			L				D	L,t			D,L	D,t,T		D	D	T		Sy	
B.2		**Fouling macrofauna biomass on artificial structures**	**WMR**, NIOZ, WUR, Boskalis, Shell, OOE																				
	B2.1	Biomass on man-made structures	**WMR**, WUR, Boskalis, Shell, OOE	L,P	F,L,P	F,L	L,D	L,D	F,L	F,L,T	L,D	L,D	F,L,t	F,L	L,D	L,D	F,L	F,L	L,D	L,D	D		
	B2.2	Species composition	**WMR**	L,P	F,L,P	F,L	L,D	L,D	F,L	F,L	L,D	L,D	F,L	F,L,T	L,D	L,D	F,L	F,L	L,D	L,D	D		
	B2.3	Nutrient cycling	**NIOZ**, WMR, WUR, OOE	P	P	P	P	Pr	Pr, F	F	D	Pr	Pr,F	F	D			T					
	B2.4	Future developments 2030-2050	**WMR**, WUR, NIOZ												P	D	D	D	Sy	Sy	t	T	
B.3		**Restoration in and around windfarms**	**NIOZ**, BuWa, WMR, Boskalis, Shell																				
	B3.1a	Benthic faunal recovery	**NIOZ**, Shell	P	P	F	L		L		L	P	P	F	L	L	L	D	T	R		C	
	B3.1b	Sediment development	**NIOZ**, Shell	P	P	F	L		L		L	P	P	F	L	D	T			R		C	
	B3.2a	Defining suitable water quality for shellfish reefs	**NIOZ**, WMR, BuWa	P		F	L	F	L	F	L	D	T								R	C	
	B3.2b	Quantifying seafloor stability for shellfish reef establishment	**NIOZ**, BuWa, Boskalis	P		F	L	F		F		D	T								R	C	
B.4		**Offshore structures as biotope for seabirds and fish**	**WMR**, NIOZ																				
	B4.1	ESAS data analysis	**WMR**, NIOZ	P	F	D	D,t	D	D	D	T												
	B4.2	Fish Profiler	**WMR**, NIOZ				P	P	F	D	D	D	F	D	t,T								
	B4.3	Seabird foraging	**WMR**, NIOZ				P	P	F	D	D	D	F	Pr	D	D	T						
	B4.4	Modelling food web effects	**WMR**, NIOZ											P	D	D	D	Sy	T				
B.5		**Microbial interactions with the marine built environment**	**NIOZ**, WMR, OoE, SeaRangers																				
	B5.1a	Altered occurrence of harmful algal blooms (HAB)	**NIOZ**, OoE, SeaRangers	P	P	F, O	F, D	F,L	F,L	F,L	F,L,T	F,L	F,L	F,L	F,L	F,L	F,L	F,L	F,L	D	Pr,D	Sy	Sy,R
	B5.1b	Potential enrichment of shellfish pathogens	**NIOZ**, WMR			F	F	L	L	F,L	F,L	L	L	F,L	F,L,T	L	L	F,L	F,L	D	D	Sy	Sy,R
	B5.2a	Links of aquaculture and plastic marine debris	**NIOZ**, Sea Rangers	L	F,L	F,L	F,L,D	L	F,L	F,L	F,L,D	L	F,L	F,L	F,L,D	L	F,L	F,L,T	F,L,D	D	D	Sy	Sy,R
	B5.2b	Impacts of disturbance on microbial communities	**NIOZ**, WMR			F,L	F,L	F,L	F,L	F,L	F,L	F,L	F,L	D	D	Sy	Sy,R	R	R,T				
B.6		**Synthesis for sustainable use and optimal biodiversity**	**Deltares**, NIOZ																				
	B6.1	Formulation of offshore wind scenarios	**Deltares**, NIOZ	P	P	Mo																	
	B6.2	Model runs on hydrodynamic effects of large scale offshore wind farms	**Deltares**, NIOZ		P	Mo	Mo	Mo	Mo	Mo	Mo												
	B6.3	Model scenario studies on effects offshore wind on primary productivity	**Deltares**, NIOZ		P	P	Mo	Mo	Mo	Mo	Mo	Mo	Mo	Mo	T	Mo	Mo	Mo	T				
	B6.4	Model scenario studies on shellfish grazing in wind farms	**Deltares**, NIOZ		P	P	Mo	Mo	Mo	Mo	Mo	Mo	Mo	Mo	t,Mo	Mo	Mo	Mo	t,C				T
	B6.5	Model scenario's offshore wind, natural grazers and aquaculture	**Deltares**, NIOZ								Mo	Mo	Mo	Mo	Mo	Mo	Mo	Mo	R		R,C,Sy		T
C		**Marine food production**	**WMR**																				
C.1		**Farming in the North Sea**	**WMR**, NIOZ, NZB, WPR, MAE																				
	C.1.1	Optimizing management strategies in seaweed and mussel culture	WMR, NZB	P	F,L	F,L	F,L	F,L	t														
	C.1.2	Environmental sustainability	WMR, WPR, NIOZ						P	F,L	F,L	F,L	F,L	t									
	C.1.3	Carrying capacity for culturing seaweed and mussels	WMR, NIOZ, NZB											P	F,L	F,L	D	T,R	T	C	T		
C.2		**Fisheries in transition**	**WU**, WMR, WEcR																				
	C2.1	fish habitat use and migration	WU, WMR	P	F	D	Mo	Mo	Mo	t	D	T											
	C2.2	Fisheries Dynamics Model	WU, WMR, WEcR					Mo	Mo	Mo	Mo	Mo	*S*	Mo	Mo	T							
	C2.3	Benthic impacts	WMR, WU										*S*	Mo	Mo	Mo	Mo	Mo	T				
C.3		**Seaweed proteins**	**NIOZ**, WMR, HZ, HAS																				
	C3.1	Selection most suitable native North Sea seaweed species	**NIOZ**, WMR, HZ, HAS	P	F, L	F, L	F, L	F, L	F, L	F, L	F, L	F, L	F, L	F, L	T	F, L	F, L	F, L	T	F, L	F, L	F, L	T
	C3.2	Variations in abiotic condition affecting proteins	**NIOZ**, WMR, HZ, HAS	P	F, L	F, L	F, L	F, L	F, L	F, L	F, L	F, L	F, L	F, L	T	F, L	F, L	F, L	T	F, L	F, L	F, L	T
	C3.3	Molecular properties of raw and processed protein-rich products	**NIOZ**, WMR, HZ, HAS	P	F, L	F, L	F, L	F, L	F, L	F, L	F, L	F, L	F, L	F, L	T	F, L	F, L	F, L	T	F, L	F, L	F, L	T
C.4		**Carrying Capacity for seaweed and shellfish farming**	**NIOZ**, Deltares																				
	C4.1	Field and laboratory observations	**NIOZ**	P	F,L	F,L	L,D	T,L	F,L,Mo	F,L,Mo	T,D												
	C4.2	Model simulations	**NIOZ**, Deltares				P, Mo	Mo	Mo	Mo	D,Mo	Mo	Mo	Mo	T,D,Mo								
	C4.3	Limiting conditions and advice for sustainable farming	**NIOZ**, Deltares								P, Mo	Mo	Mo	Mo	Mo	Mo	Mo	Mo	T,R				
C.5		**Synthesis marine food production**	**WMR**, NIOZ																				
	C5.1	Ecological feasibility	WMR, NIOZ									P	D	Mo	t,W	D	Mo	T,W					
	C5.2	Scenario's for future marine production	WMR, NIOZ															D	Mo	D	W,Mo	Sy,T	R,Sy
D		**Enabling Change: Socio-Economic and Legal research**	**TiU**																				
D.1		**Role of International Nature Conservation Law**	**TiU**	P	P	W	F	F	F	F	D	D	D	D	D	t	W	C	Pr	Pr	Pr	T	R,Sy
D.2		**Governing Offshore Energy Installations**	**RUG**	P	P	W	F	F	F	F	D	D	D	D	D	t	W	C	Pr	Pr	Pr	T	R,Sy
D.3		**Integrated assessment of the social-ecological system**	**WEcR**, vHL, I&W, LNV, WU-ENP																				
	D3.1	Integrated assessment frame of policy objectives and competing claims	**WEcR**, vHL, I&W, LNV, WU-ENP	P	P	W	F	F	F	Pr	Pr	Pr	Pr	Pr	Pr	Pr	W	C	C	t	T	T	R,Sy
	D3.2	Enhancing assessment model MAGNET with North Sea interactions	**WEcR**, vHL, I&W, LNV, WU-ENP		P	P	F	F	F	D	D	D	Mo	Mo	Mo	Mo	Pr	Pr	Pr	Pr	t	T	R,Sy
	D3.3	Quantification trade-offs social, economic, ecological objectives	**WEcR**,			P	P	F	F	F	D	D	D	Mo	Mo	Mo	Mo	Pr	Pr	Pr	t	T	R,Sy
	D3.4	Comparison Dutch vs. international North Sea management scenarios	**WEcR**				P	P	D	Mo	Mo	Mo	Mo	Mo	Mo	Mo	W	Pr	Pr	Pr	t	T	R,Sy
	D3.5	Quantification of North Sea management scenarios	**WEcR**, vHL, I&W, LNV, WU-ENP				P	P	D	Mo	Mo	Mo	Mo	Mo	Mo	Mo	W	Pr	Pr	Pr	t	T	R,Sy
D.4		**Advancing the Ecosystem Services (ES) application**	**WEcR**, vHL, Ecorys, CBS, I&W, LNV																				
	D4.1	North Sea multi-use scenarios and transition analyses	**WEcR**, vHL, Ecorys, I&W, LNV	P	P	W	F	F	F	Pr	Pr	Pr	Pr	Pr	Pr	Pr	W	C	C	C	T	T	R,Sy
	D4.2	Ecosystem service values in ecological and human systems	**WEcR**, Ecorys, vHL		P	P	F	F	F	F	D	D	Mo	Mo	Mo	Mo	Pr	Pr	Pr	Pr	t	T	R,Sy
	D4.3	Multi-use valuation in ecological and human systems	**WEcR**, Ecorys, CBS			P	P	F	F	F	F	D	D	Mo	Mo	Mo	Mo	Pr	Pr	Pr	t	T	R,Sy
	D4.4	Policy analyses with bow-tie and advice on ES applications for MSFD	**WEcR**, vHL, Ecorys, I&W, LNV				P	P	F	F	F	F	F	D	D	Pr	W	Pr	Pr	Pr	t	T	R,Sy
D.5		**Integrated approach towards sustainable transitions**	**HAME**, NIOZ, WU, Deltares																				
	D5.1	Collating data and information	**HAME**, NIOZ, WU, Deltares	P	D	D,Sy	R,C,t	D	D	D,Sy	C,t	D	D	D,Sy	C,t	D	D	D,Sy	C,t	D	D	D,Sy	C,t
	D5.2	Writing overview publications	**HAME**, NIOZ, WU, Deltares			P	D	Sy,D	Sy,D	Sy	T,R	D	Sy,D	Sy	T,R	D	Sy,D	Sy	T,R	D	Sy,D	Sy	T,R
	D5.3	Determination of missing links in the research	**HAME**, NIOZ, WU, Deltares				P	D	Sy,D	Sy	R	D	Sy,D	Sy	R	D	Sy,D	Sy	R	D	Sy,D	Sy	R
M		**Management, Stakeholder involvement & Outreach**	**NIOZ**																				
	M.1	Management & Coordination	**NIOZ**	M	V	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
	M.2	Stakeholder involvement; networking	**NIOZ**, all partners		*N*	*S*	*G,N*	*S*	*N*	*S*	*G,N*	*S*	*N*	*S*	*G,N*	*S*	*N*	*S*	*G,N*	*S*	*N*	*S*	*G,N*
	M.3	Outreach	**NIOZ, SdN**, all partners	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C

C = Communication (dissemination)
D = Data handling, services
F = Fieldwork, sampling and monitoring
G = General Assembly
L = Laboratory tests and analyses
I = Proteactable Intellectual Property, Patent
M = Management and Coordination
Mo = Model development, validation, runs, scena
N = Networking
O = Operational
P = Plan development
Pr = Prototype, demonstrator, concept
R = Recommendations and Policy options
S = Steering and Stakeholder committee meetings
Sy = Synthesis
T = Thesis, Publications (peer reviewed)
t = Report, conference papers
W = Workshop (and evaluations)