MINISTRY OF FOREIGN AFFAIRS
OF DENMARK

GREEN TRANSITION

THE STORY OF DENMARK

2019 Global Wind Day Wind Industry Symposium, Seoul, June 14th 2019

EMBASSY OF DENMARK IN KOREA

DANISH ROYAL VISIT TO SOUTH KOREA

IMPLEMENTING ARRANGEMENT ON COOPERATION IN RENEWABLE ENERGY

Danish Energy Agency

KOREA ENERGY AGENCY

EMBASSY OF DENMARK

KOREA DENMARK
덴마크 한국
1959-2019

DANISH ROYAL VISIT TO SOUTH KOREA

ESBJERG MUNICIPALITY AND ULSAN MUNICIPALITY

Memorandum of Understanding on Cooperation in the field of Offshore Wind Energy

Esbjerg Kommune

ULSAN
THE RISING CITY

EMBASSY OF DENMARK

KOREA DENMARK
덴마크 한국
1959-2019

DENMARK – A BIKING NATION

- NGOs improving public environmental awareness
- Promoting use of bicycle between home and work
- Improve bicycle infrastructure
- Up to 45% commute by bicycle in major cities

CLEAN AIR

Clean air in Denmark

- Denmark has been combatting air pollution since **the 1970s**
- **Regulation** as a key driver for less pollution
- **500** Danish high-tech companies deliver clean air solutions
- Atmospheric pollution in most areas in Denmark has been reduced to less than **one fifth** of the levels during the late 1970s

WIND ENERGY IN DENMARK

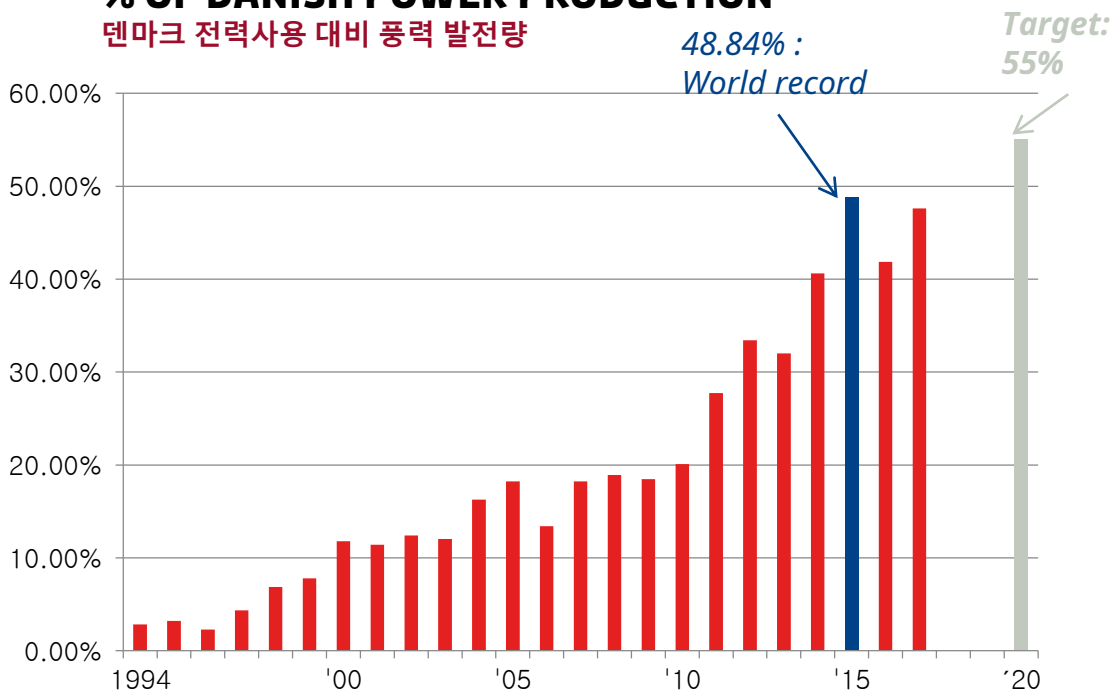
덴마크의 풍력

45 YEARS OF EXPERIENCE - 45년간의 경험

TIMELINE 타임라인

- **1970s:** First Danish onshore wind turbines developed and installed
- **1991**: 393MW onshore capacity 393 MW 육상풍력 설치
  First Danish offshore wind farm Vindeby (5 MW)
  덴마크 첫 해상풍력단지: Vindeby (5MW)
- **2019**: 4,400MW onshore capacity 4,400 MW 육상풍력 설치
  ~ 1,300 MW offshore capacity including 28 MW R&D
  28MW R&D 단지포함 1,300 MW 해상풍력 설치
- **Future:** Additional 1,350 MW offshore capacity currently under construction
  추가 1,350MW 해상풍력 설치 건설 예정
  New tenders for at least 3 x 800 MW
  추가 3x 800MW 입찰 예정

WIND POWER GENERATION
% OF DANISH POWER PRODUCTION
덴마크 전력사용 대비 풍력 발전량



Source: Danish Energy Agency

Source: Danish Energy Agency

THE DANISH EXPERIENCE IN OFFSHORE WIND REGULATION CALLS FOR AN INTEGRATED GOVERNMENT APPROACH

리스크를 최소화한 통합적 덴마크 정부의 접근

- Instrumental factors to secure low bid prices - 최저 입찰단가를 확보하기 위한 중요한 요소 :

1) Maritime Spatial Planning and Prioritisation
   입지계획및 우선순위화
2) Streamlined Consenting
   간소화된 인허가및 입찰 절차
3) De-Risking
   리스크 최소화

➔ Fostering both market creation and green transition

Source: Danish Energy Agency

MARITIME SPATIAL PLANNING & PRIORITISATION 해상풍력 입지계획

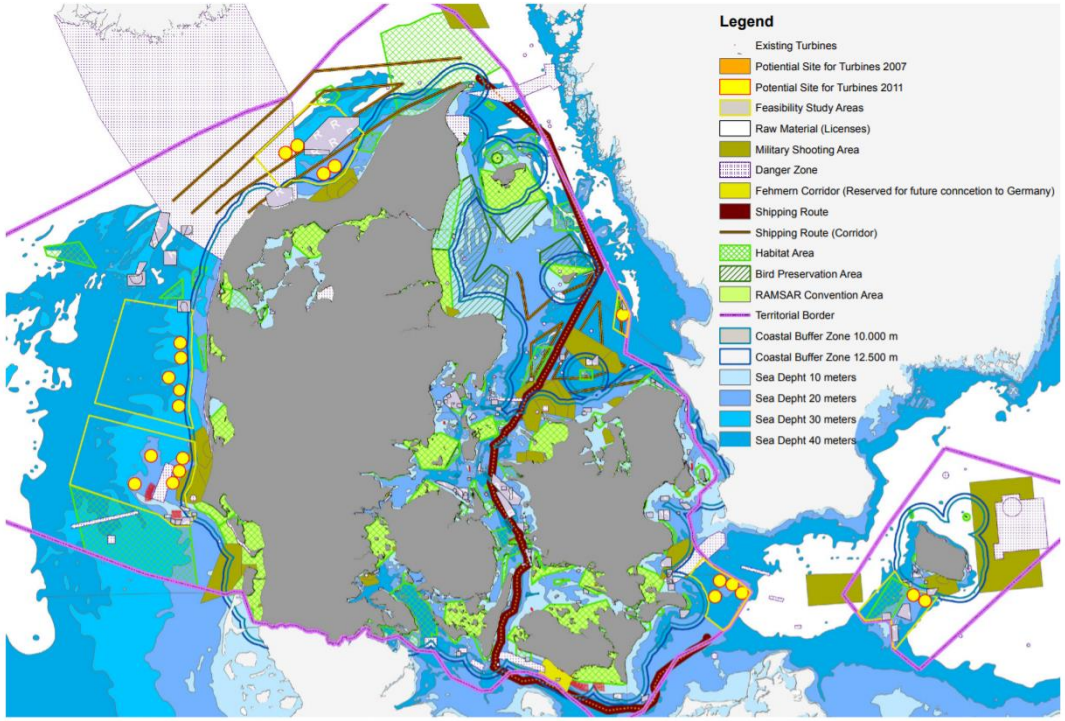
- INITIAL INVOLVEMENT OF ALL RELEVANT STAKEHOLDERS *각 이해당사자의 초기단계 참여*

Planned process since 1995 headed by DEA
1995년 부터 덴마크에너지청이 입지 계획 주도

Stakeholders involved in the Spatial Planning Committee
관련 이해당사자 :

- Ministry of Energy, Utility and Climate (offshore resources)
  에너지 전력 기후 부(해상풍력자원관련)
- TSO and local grid operators
  전력계통운영자 및 지역 전력 오퍼레이터
- Ministry of Environment and Agriculture (natural environment and fishery)
  환경부및 농림부(자연환경및 수산업관련)
- Ministry of Transportation and Buildings (safety at sea)
  교통건설부(해양 안전관련)
- Ministry of Defense (naval issues)
  국방부(군사관련)
- Ministry of Culture (visual interest, etc.)
  문화부(각종문화재관련)
- Wind Industry and R&D institutes
  풍력 산업계및 연구기관

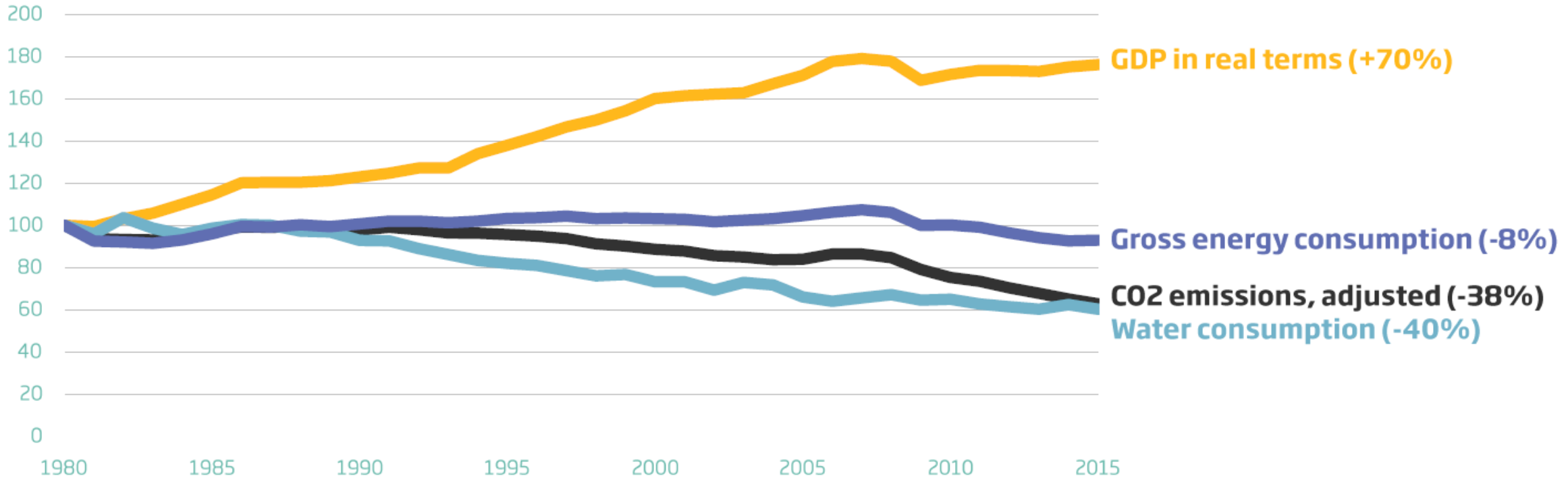
Offshore spatial planning map of Denmark
덴마크 해상풍력 입지계획 지도



Source: Danish Energy Agency

ENERGY DECOUPLING

DENMARK HAS REDUCED WATER CONSUMPTION, CO2 EMISSIONS, AND SAVED ENERGY WHILE INCREASING ECONOMIC GROWTH



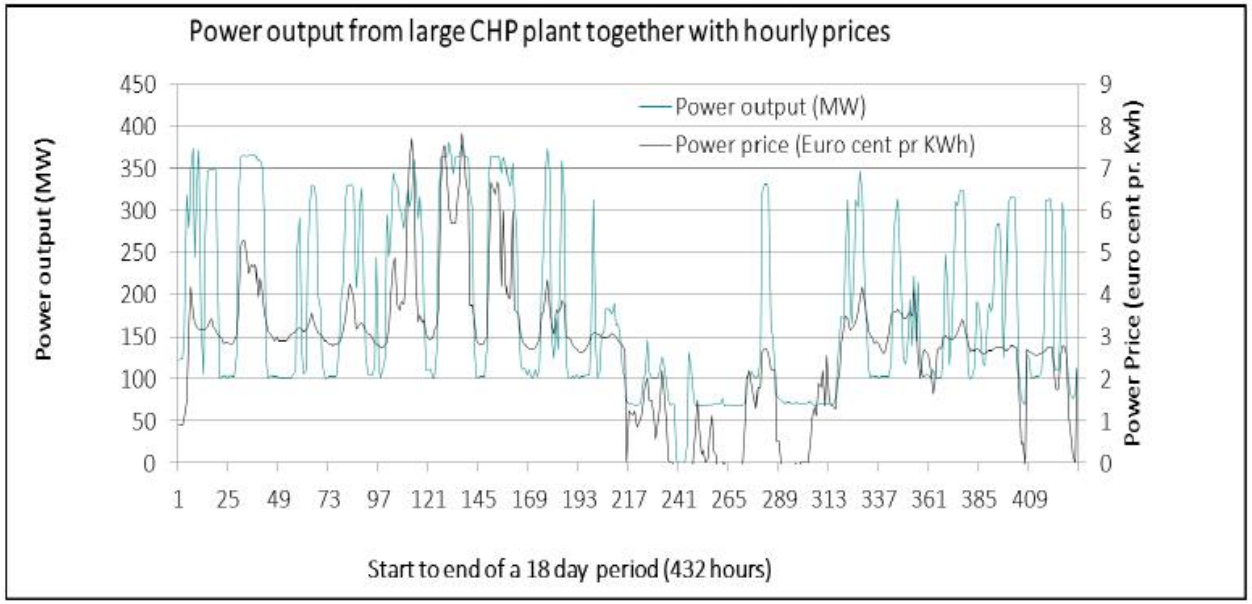
1980=INDEX 100

Source: State of Green

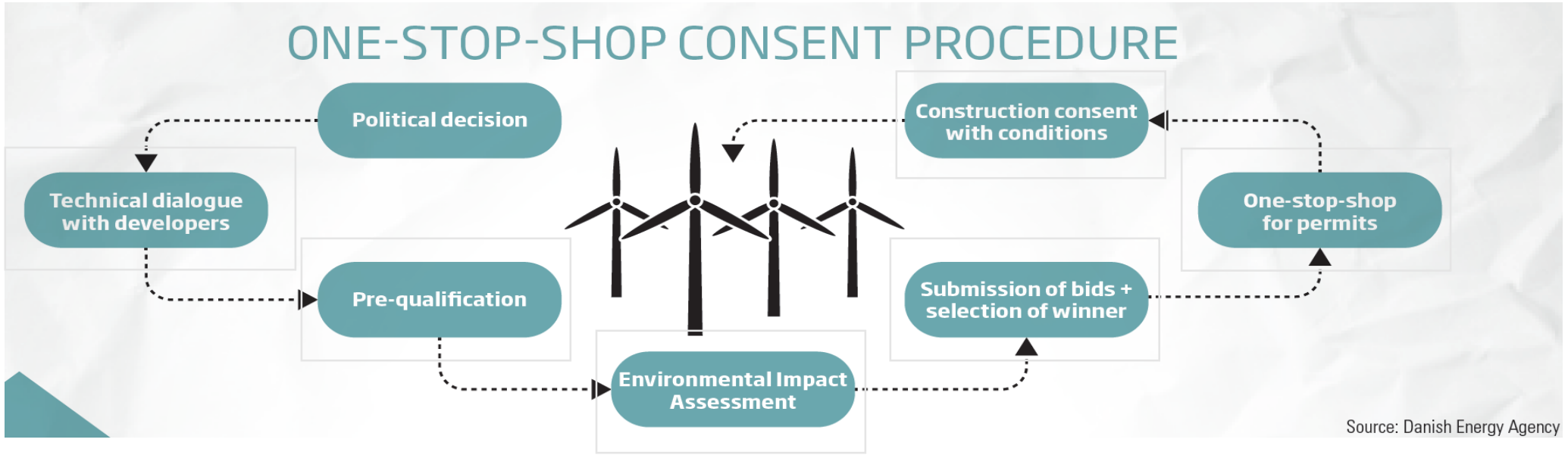
FLEXIBILITY OF POWER PLANTS

Operational range: 10 - 100%
Regulating rate: 3 - 4% per minute

+ Heat accumulators and electric boilers



STREAMLINED CONSENTING - 원 스탑 샵



The Danish Energy Agency is in charge of
덴마크 에너지 청 업무 영역:

- Licensing 면허
- Permitting 허가
- Authorisation 인가
- Dialogue 대화

➔ Reducing development risks for the developers

발전사업자의 개발리스크를 최소화함

Source: Danish Energy Agency

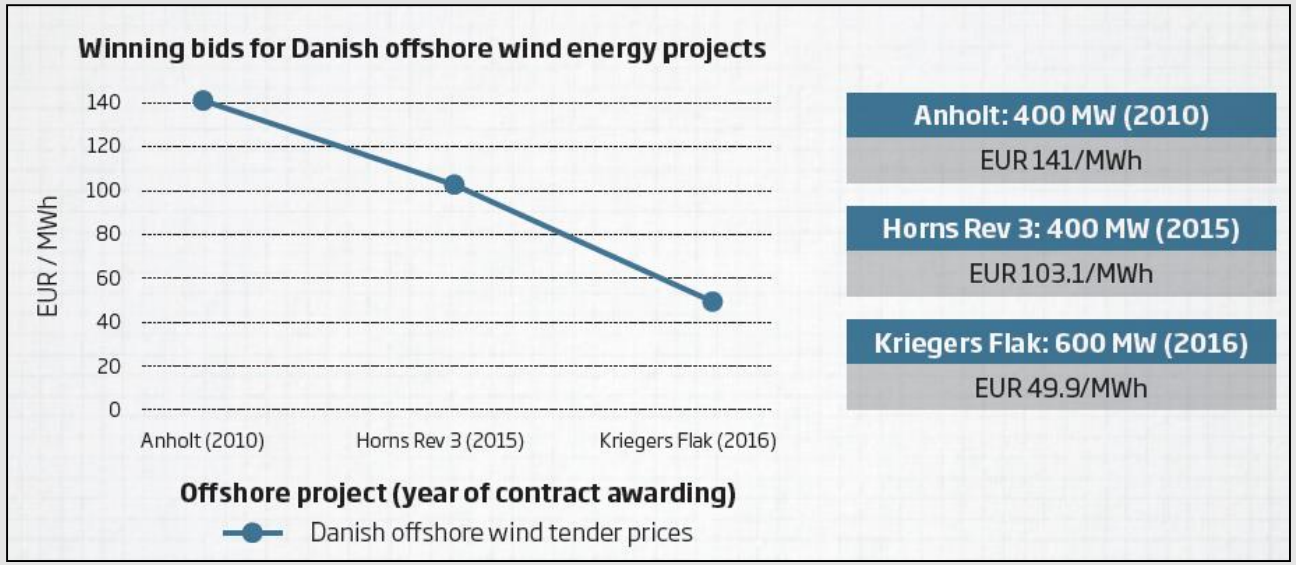
DE-RISKING - *A FRONT-LOADED LOW-RISK APPROACH…*

덴마크 입찰 모델 - 발전 초기 집중된 리스크 절감 방식

TSO undertakes the preliminary studies 전력계통운영자가 사전타당성조사 담당	One Stop Shop 원스톱샵
Fixed feed-in tariff for 50.000 full load hours 50,000시간 운행시간에 따른 고정 FIT	Efficient and transparent electricity market 효율적이고 투명한 전력시장
Priority access to the grid 전력계통 확보	Dialogue & negotiation with potential bidders 입찰자와의 지속적인 대화와 협상
No local content requirements 국산화 사용 요구 사항 없음	Price per kWh is the **only** award criteria kWh 당 단가가 입찰 최종결정의 유일한 조건

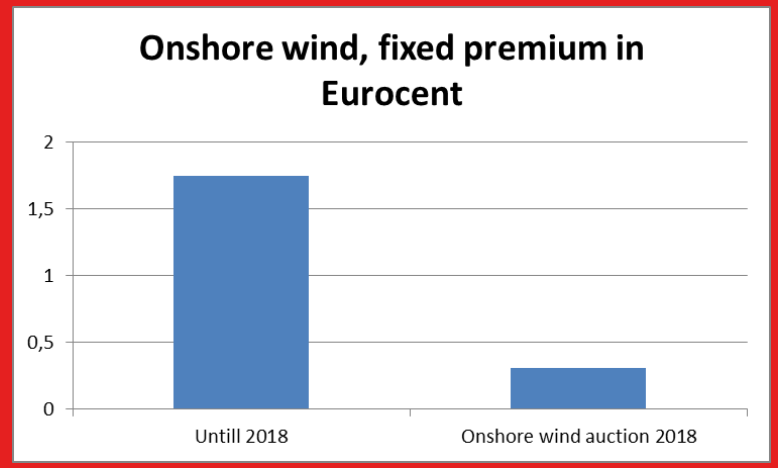
… WHICH HAS BROUGHT THE LCOE DOWN

올바른 정책에 따른 해상풍력 **LCOE**의 빠른 절감 효과



EUR 49.9/MWh ~ KRW 65,600/MWh

The cost of onshore has also significantly reduced through a coordinated approach



EUR 3.1/MWh ~ KRW 4,000/MWh

Source: Danish Energy Agency

RESULT: NEW ENERGY BUSINESS AND JOB CREATION

- More than **70,000 jobs** created in green energy sector
- Danish companies exported energy technology and services for **11.2 Billion Euro** (DKK 83.8 billion) ; makes up **11.8 %** of the total export of Danish commodities in 2016
- **44% export growth in green energy technology** since 2010 (vs EU: 8.3%)

Source: Dansk Industri

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THANK YOU FOR YOUR ATTENTION