

# **Energy Priorities in 2030: Total's Environmental and Technological Challenges**

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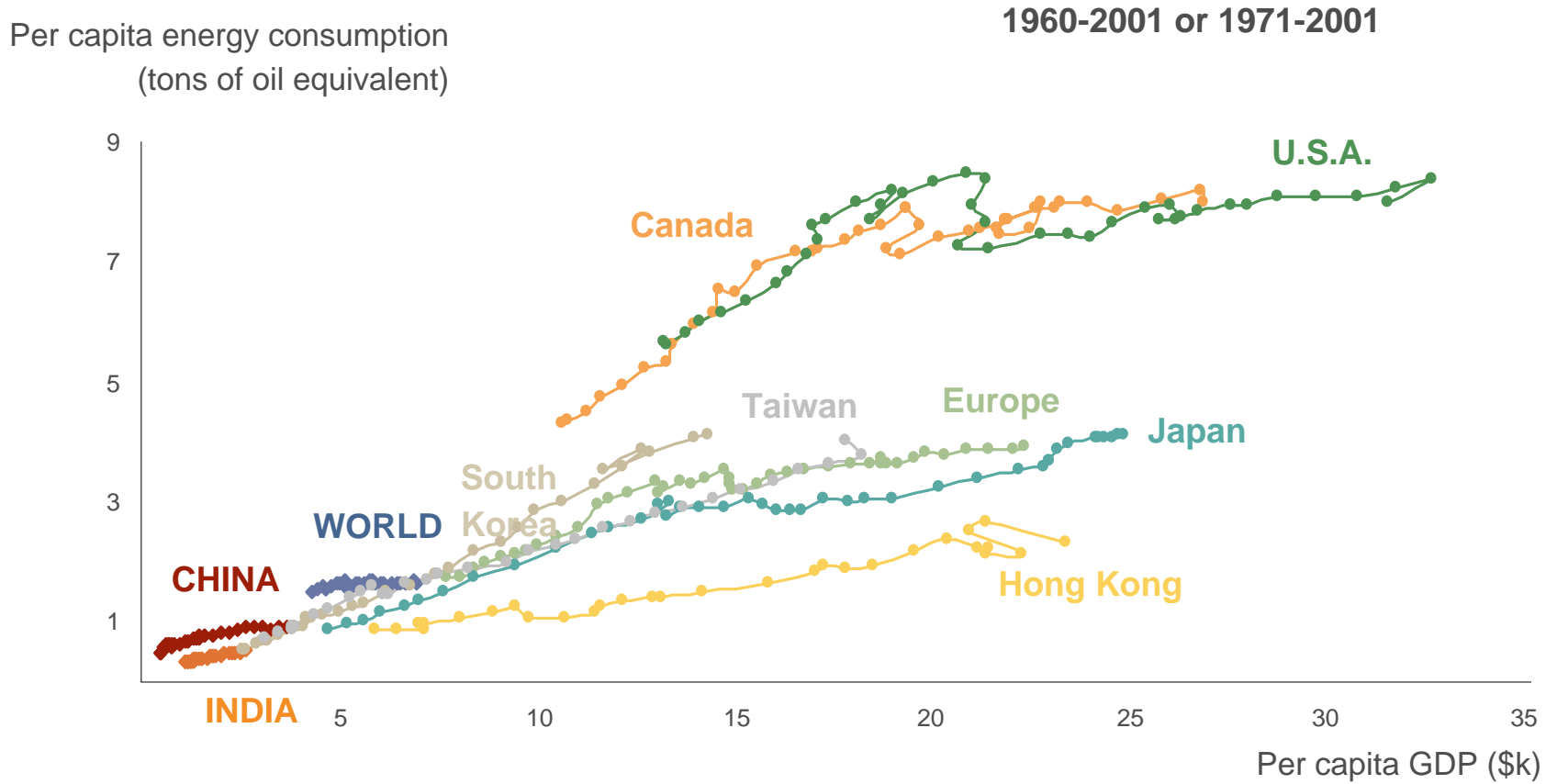


# Sustainable development challenges

- ▶ Solidarity between rich and poor and between generations  
*Meet the current needs of emerging economies*
- ▶ Preserve some of the planet's natural capital for future generations  
*Water, biodiversity, farmland, etc.*

*Interlinked problems  
Manage deadline-driven issues*

# Development is led by growing demand for energy

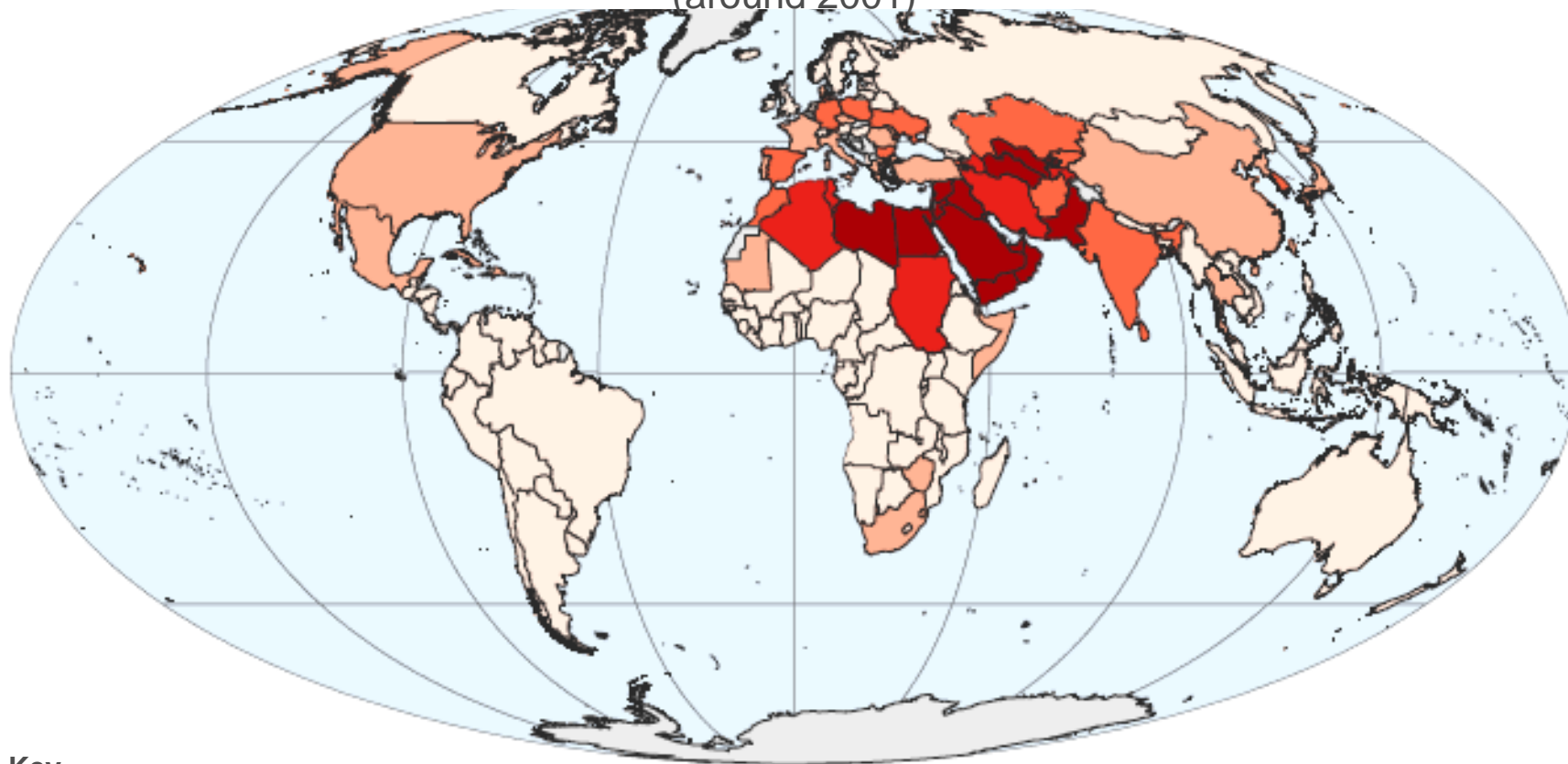


Source: IEA.



# Energy is needed to increase water supply (pumping, desalination, treatment, etc.)

Withdrawals of surface water and groundwater  
as a percentage of existing renewable water resources  
(around 2001)



## Key



FAO - AQUASTAT, 2001  
AQUASTAT  
Projection: Mollweide

# Climate change challenges and impact

## ► Observed and forecast regional changes

- Precipitation
- Extreme phenomena
- Sea level
- Sea ice, polar ice caps
- Migration of species
- Seasonal impact on ecosystems
- Agriculture and forests
- Social and economic
- Other

## ► Recommendations of the IPCC, economists and the French Environment Forum, E.U. policy

- Promote moderate energy use, change the energy mix, encourage CO<sub>2</sub> capture and sequestration
- Take steps as soon as possible:
  - To prevent an increase > 2°C
  - Because investment is less expensive than adaptation
- Prepare for impacts

# Total's challenges (1)

## Meet pressing current energy demand

- ▶ **Through resources that are harder to access and develop**
- ▶ **By reducing environmental impact**

# Technological resource challenges

## Extra-heavy oil



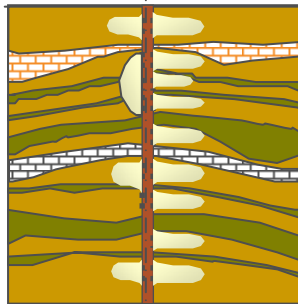
- ▶ Recovery
- ▶ Development
- ▶ Process integration
- ▶ Energy and CO<sub>2</sub>

## Gas solutions



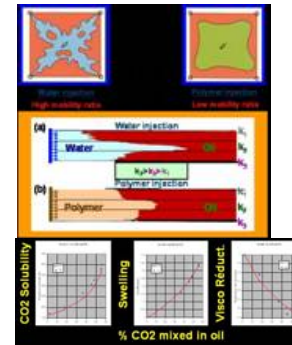
- ▶ Sour gas, CO<sub>2</sub> and H<sub>2</sub>S treatment
- ▶ LNG
- ▶ Chemical conversion: GTL, etc.

## Tight Gas



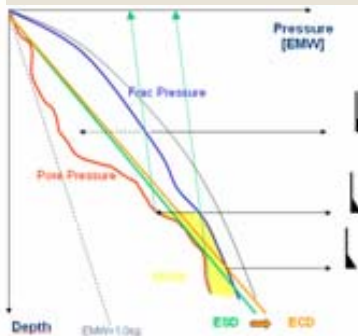
- ▶ Estimating amounts of gas
- ▶ Fracturing
- ▶ Well pattern
- ▶ Reservoir characterisation

## Enhanced recovery

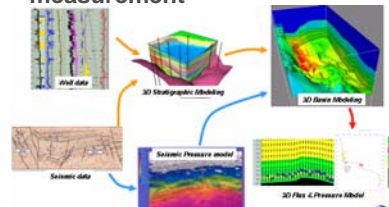


- ▶ Chemicals: solvents, electric heating of oil
- ▶ Laboratory tests
- ▶ Simulation
- ▶ Polymer behaviour at high temperatures, under strain

## Very deep reservoirs



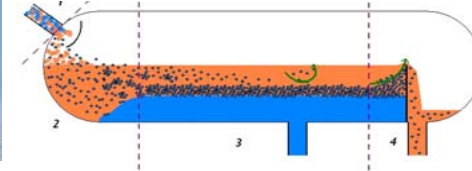
- ▶ Reservoir production
- ▶ High pressure drilling
- ▶ High temperature measurement



## Deepwater

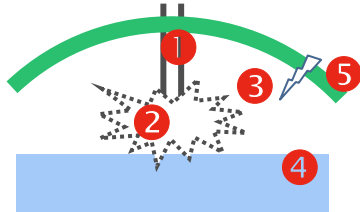


- ▶ Multi-phase subsea installations
- ▶ Flow
- ▶ Qualifications
- ▶ Subsea maintenance



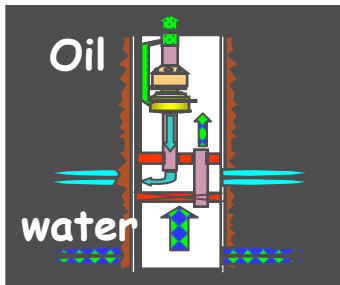
# Enhance safety and reduce environmental footprint

## Treatment of process gases

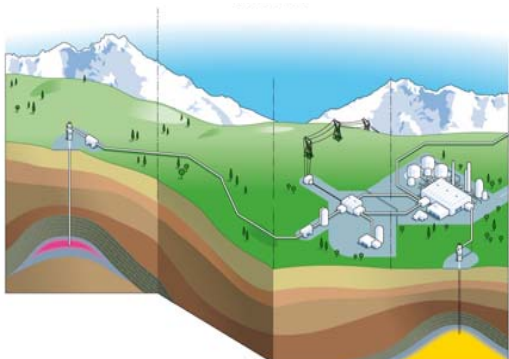


- ▶ Reduce costs
- ▶ Efficiency
- ▶ Reliability

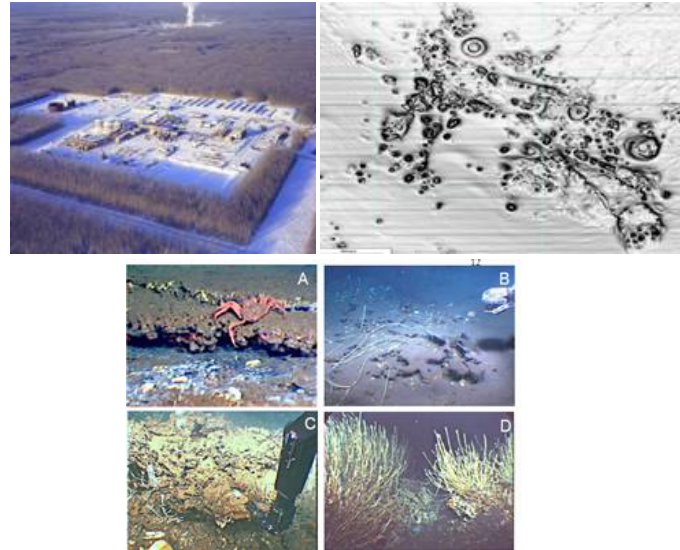
## Water management



- ▶ Separation
- ▶ Corrosion
- ▶ Debottlenecking



## Safety and environment



- ▶ Water treatment
- ▶ Soil remediation
- ▶ Preventing water pollution
- ▶ Biological characterisation of marine environments
- ▶ Knowledge of deep seabeds: Neris

## Lacq project



## Challenges for Total (2)

### Diversify the energy mix fast

- ▶ Strategic choices consistent with Total's businesses
- ▶ Reduce costs through incremental improvements



***Production-driven R&D to reduce costs and improve efficiency by a few percentage points a year in the long-term***

## Total's challenges (3)

# Develop tomorrow's technologies with the help of a Scientific Development Council

- ▶ Take part in upstream R&D

*R&D partnerships*

*600 contracts under way*

- ▶ Bring technologies to the commercial stage

*Industrial processes*

*Cost and reliability*

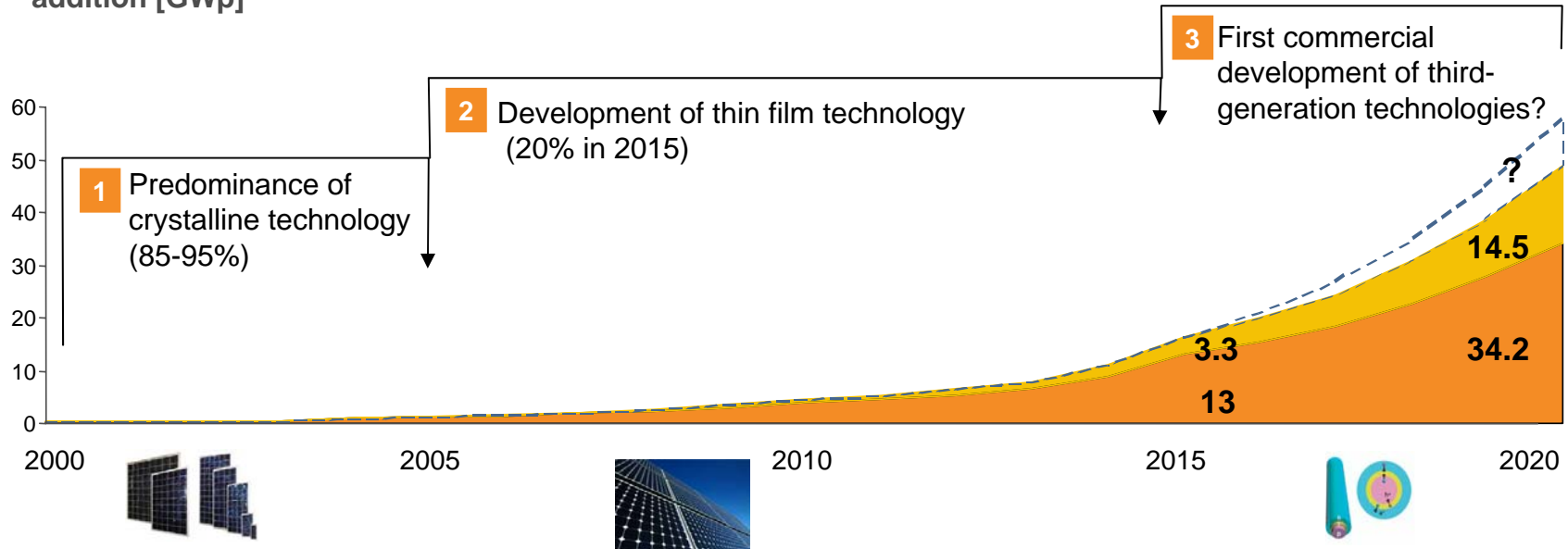
*Demonstration units*

*Development lead times*



# Photovoltaic solar energy: three types of technology will succeed one another

Annual capacity addition [GWp]



## Crystalline technology

- Polycrystalline
- Monocrystalline
- Ribbon

## Thin film technologies

## Third-generation technologies

Nanotubes, etc.

► R&D in all three segments

► A multi-criteria portfolio approach to be present in future technologies well in advance

# Total's challenges (4)

## Manage energy mix challenges

### ► Resource availability

*Examples: Biomass, supply, biodiversity and environment*

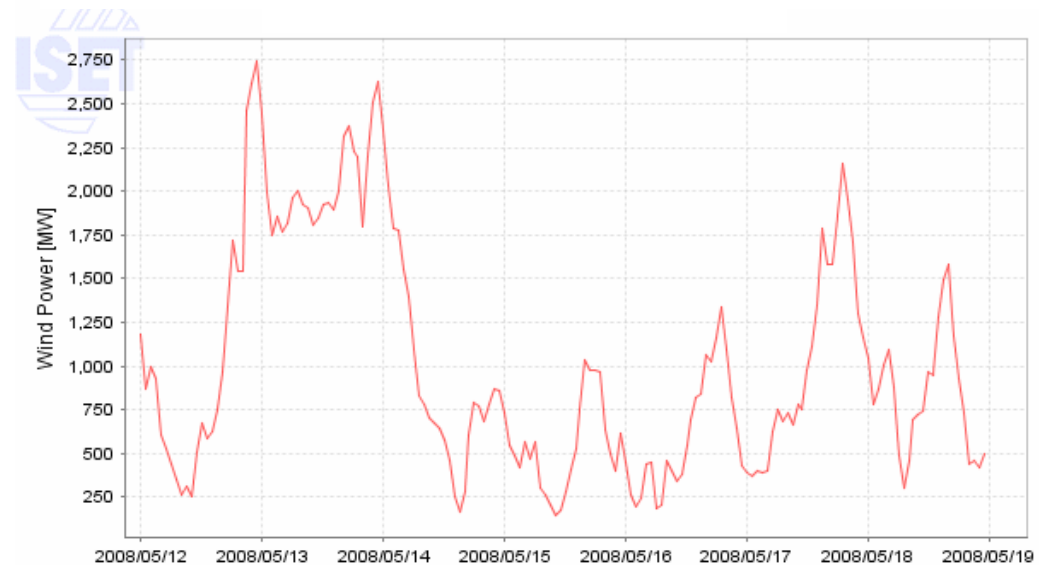
### ► Systemic elements

*Examples: Intermittency, electricity transmission and storage*

### ► Acceptability

*Example: CO<sub>2</sub> capture and sequestration*

Daily wind power production in Germany



Source: ISET - Germany.

# Conclusion: Total's five responses to energy and environmental challenges

## ► Invest long-term

- Current needs and future production

## ► Develop tomorrow's technologies

- New energies, CO<sub>2</sub> capture and sequestration, energy efficiency
- In partnership with host communities

## ► Manage Total's energy consumption

- Efficient processes and utilities
- New development partnership with the French Environment and Energy Management Agency (ADEME) covering the energy efficiency of industrial utilities: investment of \$150 million over five years

## ► Help our customers manage their energy consumption

- Products and services

## ► Prepare for the impact of changes

- Climate, social and economic, etc.
- For the company
- Support actions