

# New world suited to sustainability trends: Alternative energy outlook

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# The world in 2009: a new world is born

# Old world: 1980-2008

- Main growth tool: credit, consumers
- Main govt motto: laisser-faire, individual enrichment
- Main growth sector: investment banks

## New world: 2009- ...

- Main growth tools: innovation
- Main govt motto: support, focus on competitiveness
- Main growth sector: sustainable development with secular & sustainability trends and innovation like
  - Alternative energy
  - Resource efficiency
  - Nanotechnology







... and in Kondratieff-Cycles key innovations, such as solar- and nano-technology initiate new industrial & social era in development of our society ...





# Sustainability trend: New economic landscape triggers high demand for energy and natural resources...

- 3 main challenges in the future
- (1) <u>rising demand for resources</u> due to increasing population, urbanization, demand for higher life quality, infrastructure building ...
- (2) <u>declining resources reserves</u> due to sustained demand (EM markets particularly)
- (3) <u>climate change</u> due to accelerated GHG emissions

#### **Solutions: Sustainable development and innovation,**

underpinned by expected strong investments: USD 150 bn in 2008, expected to attain USD 600 bn by 2030E





# Greenhouse-gas emissions accelerate globally

- CO<sub>2</sub> emissions expected to increase substantially by 2030
- Links between GHG and temperature increase is complex and difficult to predict
- Measured:
  - + 0.8°C than pre-industrial
  - + 0.2°C last 20 years
- Expected temperature increase of 4-6°C compared to pre-industrial by 2100E



#### Energy-related CO<sub>2</sub> emissions by region (Giga tonnes) Scenario assuming absence of new climate policy





# New economic landscape triggers high energy demand...



Total world energy demand in mn ton oil equivalent

Energy demand is expected to jump by 60% until 2030 in a steady expansion. Oil will still remain the nb 1 energy source by 2030 according to IEA estimates, yet alternative energy will record the steepest growth



## ...should drive Alternative Energies' growing market share





## Solar & Wind to grow fastest ...



#### Worldwide Energy Supplies (toe)

#### Projected Year 2050 Worldwide Energy Supplies



**2005:** 15% supply from renewable energies

**2050:** to rise to 37%

Solar, wind and geothermal energy with strongest growth;

7 - 8% annually by 2020E (total energy supply: 1.8% growth p.a.)

Source: Shell, Credit Suisse



# Renewable energy for electricity production: small fraction but strong growth - part I





# Renewable energy for electricity production: small fraction but strong growth (part II) World electricity generation

BRIC regions energy generation forecast growth (% p.a. 2006-2030)





Source: IEA, Credit Suisse



# Costs of renewable energy are decreasing by 2030E - part I

#### Est. average generating (producing) costs of renewable energy technologies (USD / MWh)



Source: IEA, Credit Suisse



# Costs of renewable energy are decreasing - part II



#### Est. average investment (installation) costs of renewable energy technologies (USD / kW)

Source: IEA, Credit Suisse



# Governmental objectives:

Climate change targets and state incentives support the fast development of alternative energies.



Source: National Renewable Energy Lab (NREL), Suntech



Source: National Offshore Wind Association of Ireland

(1)<u>EU</u>: 20% of all energy from renewables by 2020

(2) <u>China</u>: 15% of all energy by 2020

#### (3)<u>USA</u>: plan; 25% of electricity by 2025

In place; USD 150 bn green investments over 10 years

- Green jobs (2.5m)
- GHG emissions reduction (30% by 2020, 80% by 2050)
- Offset all U.S. oil imports by 2040
- Cut oil consumption in half by 2025
- 0 carbon emission federal buildings by 2030
- Reduce energy consumption by 25% by 2020
- Obtain 25% of electricity from renewables by 2025
- Improve vehicle efficiency 20% by 2020, 50% by 2050

Source: National Renewable Energy Lab



### The solar sector: economies of scale driving down solar costs



 <u>Conversion efficiencies</u> increased from 14% to 17% in the last 5 years.

 $\Rightarrow$  In 2008, leader SunPower reached a new world record of over 23% efficiency for large area panels.

- <u>New technology</u> and <u>production</u> improvements: thin film solar: production costs/Watt < 1 USD. ⇒Grid parity to be reached by 2012 in some areas.
- <u>Raw material</u> costs (Si) are declining due to the current crisis
  ⇒ Selling prices expected to decrease by 15%-20% in 2009E.

Typical EBIT margins: 20% for cell, 8-10% for module



Annual new solar installation (GW)





## Thin-film technologies will growth faster than c-Si

- Thin-film technologies are younger
- Small proportion: 18% in 2009
- Lower conversion efficiency (typ. 8-10%)
- Currently cheaper cost/Watt (typ. USD 1-1.5/W)
- Fast technological improvement potential (via process control)







Source: EPIA, Credit Suisse



#### Annual new solar installation (GW)

## The solar sector: Rapid growth expected by 2012

- Est. total market cap (sector):
- Globally new installed capacity (2009E)
- Growth (2008-2012E CAGR):
- Early stage industry:
- Main short-term risks (2009-10):
- Long term growth drivers:



est. 50 bn USD

- near 6 GW (over 15 GW in total since 2000-2008)
- est. 30% (new capacities [MW], 5-10% in 2009E)
- High fragmentation, consolidation likely, Margins to decline
- Financing difficulties, unfavorable solar economics, low oil price Government incentives and stimulus plan, climate change, grid parity, rising energy needs, declining oil reserves, energy independence

Upstream (Silicon + Wafer providers)	8 major providers (many new Chinese players to enter in 2009)	Hemlock, Wacker, REC, Tokuyama, Mitsubishi, Solarworld,
Solar Cell manufacturers	ca. <b>20 major providers</b>	Q-Cells, Sharp, SunTech, SunPower, Kyocera, BP Solar etc.
Solar Module manufacturers	ca. <b>40 major providers</b>	Solarworld, Sharp, First Solar, Schott Solar, Ersol, SunPower,…
Installers	More than <b>300 worldwide</b>	Many local players

Source: Industry estimates, Credit Suisse



# The affordable wind energy: technology yield further energy costs decline

Largest Wind Turbine delivering 6 Megawatts (rotor 126 meters) power > 5000 homes. Technological advances:

- Larger turbines
- More resistant materials e.g. nano-composites
  - $\Rightarrow$  better efficiency; 20% compared to 2000
  - $\Rightarrow$  longer life span; 15%

#### Typical EBIT margins: 10-15% (Vestas)



Technology	USD/kWH
Existing Pulverized Coal	0.04
Existing Gas	0.06
Wind (medium wind speed of 17 mph)	0.08
Gas – Advanced Combined Cycle	0.09
Geothermal (California)	0.10
Nuclear – Advanced Technology	0.12



Source: GWEC, Credit Suisse



# Off-shore is still more expensive but has strong long term perspectives

- On-shore:
  - 1981: 40 cents/kWh
  - 2006: 3-6 cents/kWh
- Off-shore: source NREL/EERE
  - 2006; 9-11 cents/kWh
  - 2014E: 5 cents/kWh
- Offshore project: turbines account for 1/3 of cost:
  - $\Rightarrow$  larger turbines decrease:
    - the foundation costs/Watt
    - the el. transmission costs/Watt
    - the operational expenses/Watt





Source: NREL



## The wind sector: Higher demand visibility

- Est. total market cap (sector):
- Globally new installed capacity (2009E) over 10 GW
- Growth (2008-2011E CAGR):
- Maturing industry
- Main short-term risks (2009):
- Long term growth drivers:



Source: Industry estimates, Credit Suisse



est 50 bn USD

- ~15% (new capacities [MW], 5-8% in 2009E)
- Incumbents (western) dominate high-end sector, Asian entrants in the low-power business
- Financing difficulties, off-shore projects out, low oil price Government incentives and stimulus plan, rising energy needs, energy independence, climate change, declining oil reserves

Component suppliers (Blades, gear boxes, bearings, towers)	Many local and international providers	LM Glasfiber, Tecsis, Hansen, Winergy, Enercon, ABB, Siemens, Moventas
Turbine manufacturers	10 major providers (whereof 7 European) Chinese players enter low end Mkt	Vestas, Gamesa, Suzlon, REpower, Clipper, Nordex, GE, Siemens, Goldwind
Installers	Usually, turbine manufacturers install their products	

# Biofuels: the 1st generations have drawbacks

- The 1st generation of biofuels
  - Based on food resource (corn, sugar)
  - Easier /cheaper to produce
  - Important CO<sub>2</sub> emission reduction (see chart)
- BUT
  - Negative impact on food price as demand raised





Data pair	Correlation coefficient
Crude-gasoline	0.98
Crude-ethanol	0.88
Ethanol-corn	0.25
Crude-corn	0.16
Crude-soybeans	0.13
Corn-soybean	0.72

Source: US DoE (EERE)



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#### GHG emissions relative to gasoline (100% normalized)

# Biofuels: the 2nd generations have strong potential

- Strong long-term growth potential
- Easy/cheap to implement (use of ex. infrastructure and engines)
- Higher emission reduction potential
- Support from climate change legislations
- Utilize waste resources (no "food for energy" issue)
- BUT: still expensive to produce on large-scale
- Need further technology development/investment
- $\Rightarrow$  expected to come beyond 2012









#### Final consumption of biofuels by region (Mtoe)





### Conclusions for the alternative energy markets

Annual revenues [USD bn] per sector



#### Wind, bioenergy and solar:

revenues are expected to increase 10-12% annually to 2018

from USD 117 bn in 2008 up to USD 340 bn in 2018, according to the Clean Edge Market Authorities

Source: NREL, Enercon, National Offshore Wind Associoation of Ireland



### The Credit Suisse Global Alternative Energy Index: Key advantages

- (1) Global index: Worldwide exposure
- (2) Covers all AE sub-sectors (equally weighted)
  - Natural gas
  - Solar
  - Wind
  - Bio-energy
  - Geothermal, Hydropower, Fuel cells, Batteries







## The Credit Suisse Global Alternative Energy Index: Key advantages, cont.

(3) Semi-annual rebalancing:

- Selecting the largest stock in each sub-sector, 30 stocks in the Index.
- Resetting each sub-sector weighting at 20% of index.
- Resetting stock, whose weight exceeds 10% at rebalancing date, at 10% of index.
- $\Rightarrow$  Keep up with changes (IPOs, M&As, ...)
- $\Rightarrow$  Leave equal potential for each AE source



## The Credit Suisse Global Alternative Energy Index: Key advantages, cont.

Sector allocation<sup>\*</sup> (well-balanced approach) Regional allocation<sup>\*</sup> (worldwide exposure) \* As of the last Rebalancing date (Dec 2008)







# Credit Suisse Global Alternative Energy Index members & weights (2008)

Company's name	ISIN	Country	Sector
ABENGOA INH. EO 0,25 ARCHER-DANIELS-MIDLD BUNGE LTD. DL -,01 COSAN SA INDUST.E.COMERC. CSR LTD NOVOZYMES A/S NAM. B DK10 EDP-ENERGIAS PORTUG. EO 1 FUELCELL ENERGY DL-,0001 HEADWATERS DL-,001 HOKURIKU EL, PWR	ES0105200416 US0394831020 BMG169621056 BRCSANACNOR6 AU000000CSR5 DK0010272129 PTEDP0AM0009 US35952H1068 US42210P1021 JP3845400005	Spain USA USA Brazil Australia Denmark Portugal USA USA Japan	Bioenergy Bioenergy Bioenergy Bioenergy Bioenergy Geothermal & Hydro & Batteries Geothermal & Hydro & Batteries Geothermal & Hydro & Batteries Geothermal & Hydro & Batteries
OESTERR. EL-WIRT.INH. A	AT0000746409	Austria	Geothermal & Hydro & Batteries
ORMAT TECHNOLOG. DL-,001	US6866881021	USA	Geothermal & Hydro & Batteries
ANADARKO PET.CORP. DL-,10	US0325111070	USA	Natural Gas
APACHE CORP. DL -,625	US0374111054	USA	Natural Gas
BG GRP PLC LS-,10	GB0008762899	UK	Natural Gas
ENCANA CORP.	CA2925051047	Canada	Natural Gas
OAO GAZP.ADR REG.S 4/RL 5	US3682872078	Russia	Natural Gas
XTO ENERGY DL-,01	US98385X1063	USA	Natural Gas
FIRST SOLAR INC. D -,001	US3364331070	USA	Solar
Q-CELLS AG	DE0005558662	Germany	Solar
RENEWABLE ENERGY NK 1	NO0010112675	Norway	Solar
SOLARWORLD AG O.N.	DE0005108401	Germany	Solar
SUNPOWER CORP. A DL -,01	US8676521094	USA	Solar
SUNTECH POWER HLDGS ADR	US86800C1045	China	Solar
EDF ENERGIES NOUV. EO 1,6	FR0010400143	France	Wind
FPL GRP INC. DL-,01	US3025711041	USA	Wind
GAMESA CORP.TEC.I.EO-,17	ES0143416115	Spain	Wind
IBERDROLA INH. EO -,75	ES0144580Y14	Spain	Wind
NORDEX AG O.N.	DE000A0D6554	Germany	Wind
VESTAS WIND SYST. NAM.DK1	DK0010268606	Denmark	Wind



#### Major players in the markets for Alternative Energy (AE)

#### <u>SOLAR</u>

- SOLARWORLD AG manufactures solar power systems with an integrated business model: from wafers, cells to finished modules made of poly and monocrystalline silicon.
- Q-CELLS AG is focused on the manufacturing of solar cells. Through their subsidiaries, they have a diversified product portfolio, from classic poly c-Si, mono c-Si to innovative product like upgraded metallurgical silicon, or thin films.
- RENEWABLE ENERGY group is the most integrated solar energy company, providing products in the almost the whole solar energy value-chain, from solar grade silicon production, to silicon wafers and solar cells & modules.

#### <u>WIND</u>

- VESTAS is the largest (23% market share) wind turbine manufacturers. Over 25 years Vestas wind turbines efficiency improve by a factor of 100. It delivers turnkey projects or individual turbine as well as maintenance services.
- GAMESA CORP.TEC Gamesa is one of the main wind turbine manufacturers (21.5% market share). 13 GW installed up to now. Gamesa offers also turnkey solutions and maintenance services
- IBERDROLA The 4th largest energy company, focusing on sustainable development. Total installed capacity is 41.6 GW.

#### **BIOFUELS**

- NOVOZYMES A/S. Novozymes is the world leader in three segments: technical enzyme for industrial use, food enzyme market and animal feed enzyme market. The company produces enzymes, mainly through biotechnology.
- ARCHER-DANIELS-MIDLAND one of the world's largest agricultural processors. Integrated business enables the company to produce bioenergy product from biomass and crop residue such as corn stalks and husks.
- ABENGOA S.A. provides diversified products for sustainable development. The company is active in solar, bioenergy, environmental services, information technology and construction.

#### **GEOTHERMAL**

 ORMAT TECHNOLOGIES develops technologies for geothermal power, recovered energy generation (REG) and remote power.

#### NATURAL GAZ

- OAO GAZPROM is the world's largest gas company involved in many gas related businesses. The company owns about 17% of the world's proven reserved representing around 29 trillion m3
- APACHE CORPORATION is large oil and gas company producing 204.8 MMboe (Million barrel of oil equivalent) in 2007, with estimated proven reserve of 2'500 MMboe.



### Performance since launch date of our indices linked to sustainability:

Performance vs. MSCI World Index per 18.6.2009:

- + 20% for CS Global Alternative Energy Index (CSAEPXUS Index) since 18.1.2007
- + 13% for CS Global Nanotechnology Index (CSGNI Index) since 26.6.2007

0% for CS Global Resource Efficiency Index (CSREPXUS Index) since 29.9.2008



Source: Bloomberg, Credit Suisse



# Conclusions and outlook

#### Alternative energy:

- > Financial and economic crisis impacted significantly the alternative energy industry
- Several government incentives and stimulus plan
- Macro-economic long-term drivers remain strong
- Price/watt decreasing faster thanks to technological progress
- Solar grid parity is expected sooner (2012 in some regions)
  Attractive long-term perspectives
  Strong growth once economy recovers

#### **Credit Suisse thematic indices:**

- Each of our three thematic indices belong to sustainable development for the coming decades, with likely higher growth rates than the rate of a broad market
- Credit Suisse thematic indices belong to the most representative indices for alternative energy and resource efficiency markets worldwide.



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