

Recent Results on Global Warming: Approach to a Low Carbon Society

地球温暖化の最新成果:
低炭素社会に向けたアプローチ

Prof Ogunlade R Davidson

Dean, Post-Graduate Studies, University of Sierra Leone

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–Towards its Realisation with Collaboration of Actors"

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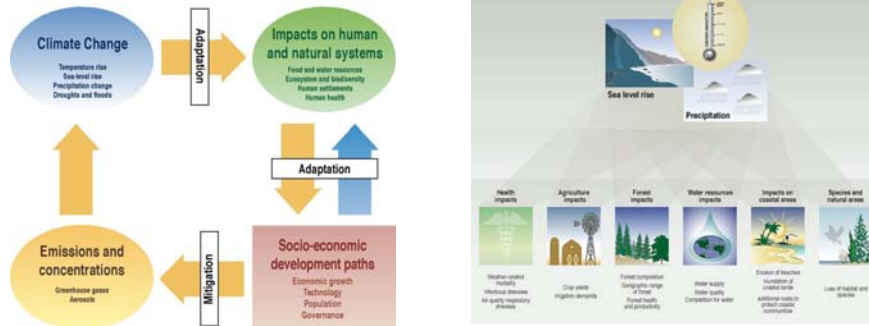
Contents of Lecture

- Climate Change Problem
気候変動問題
- AR4 Findings
IPCC第4次評価報告書の知見
- Need for a Low Carbon Society
低炭素社会の必要性
- Low-Carbon Technology Options
低炭素型技術オプション
- Technology Deployment Mechanism
技術普及メカニズム
- Policy Options for Low Carbon Society
低炭素社会に向けた政策オプション
- Conclusions
結論

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The Climate Change is more a developmental than an environmental Problem

気候変動は、環境問題というよりも、開発の問題である。



Global Commitment: UNFCCC Overall Objective

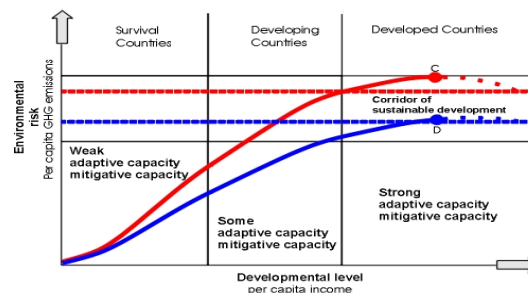
世界のコミットメント: UNFCCCの目的

- Stabilise atmospheric GHG concentration to prevent dangerous levels
危険なレベルを防止するGHG大気中濃度を安定化すること
- Enable economic development to progress in a sustainable manner and ensuring that food production is not threatened
持続可能な方法で、食糧生産が脅かされないことを確保しつつ、経済開発を達成すること

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Climate Change and Low Carbon Society (Sustainable Development)

気候変動と低炭素社会(持続可能な開発)



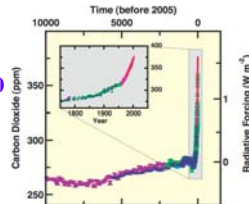
- The world can be categorized as three distinct societies (developed, developing, survival)
- Different societies will need different pathways to achieve low carbon society
- There is a strong synergy between achieving low carbon society and attaining sustainable development

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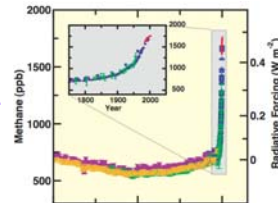
Observation: All GHG concentrations has increased making future warming unequivocal

観測結果:すべてのGHG濃度が上昇し、将来の温暖化が明白となっている

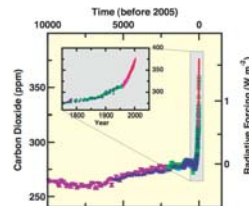
CO₂ grew from 280 ppm in 1750 to 379 ppm in 2005



Methane grew from 715 ppb in 1750 to 1774 ppb 2005



N₂O grew from 270 ppb in 1750 to 319 ppb in 2005



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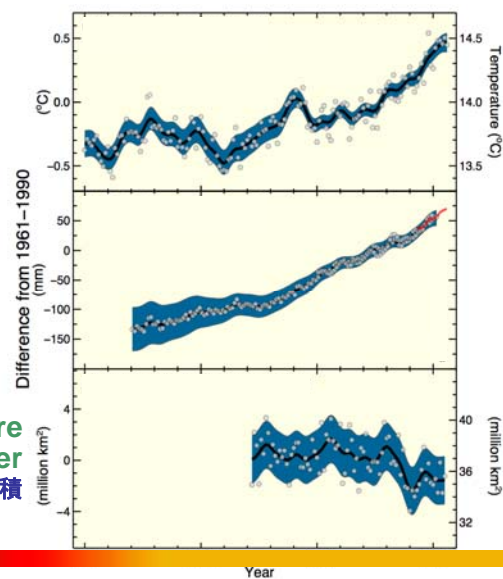
Scientific Observation

科学的観測結果

Global average temperature
世界の平均気温

Global average sea level
世界の平均海水面

Northern hemisphere snow cover
北半球の氷雪被覆面積



Scientific Observation

科学的観測結果

Global average temperature

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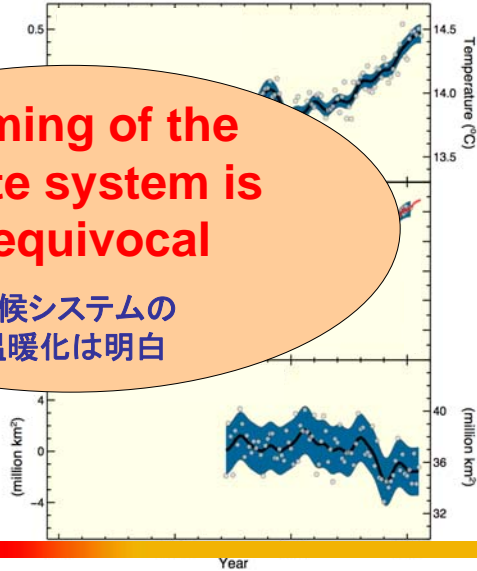
Global average

Warming of the climate system is unequivocal

気候システムの温暖化は明白

Northern hemisphere snow cover

北半球の氷雪被覆面積

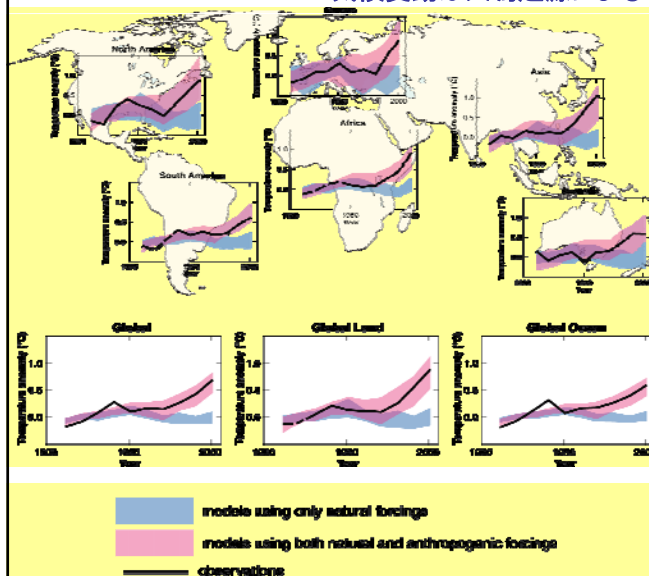


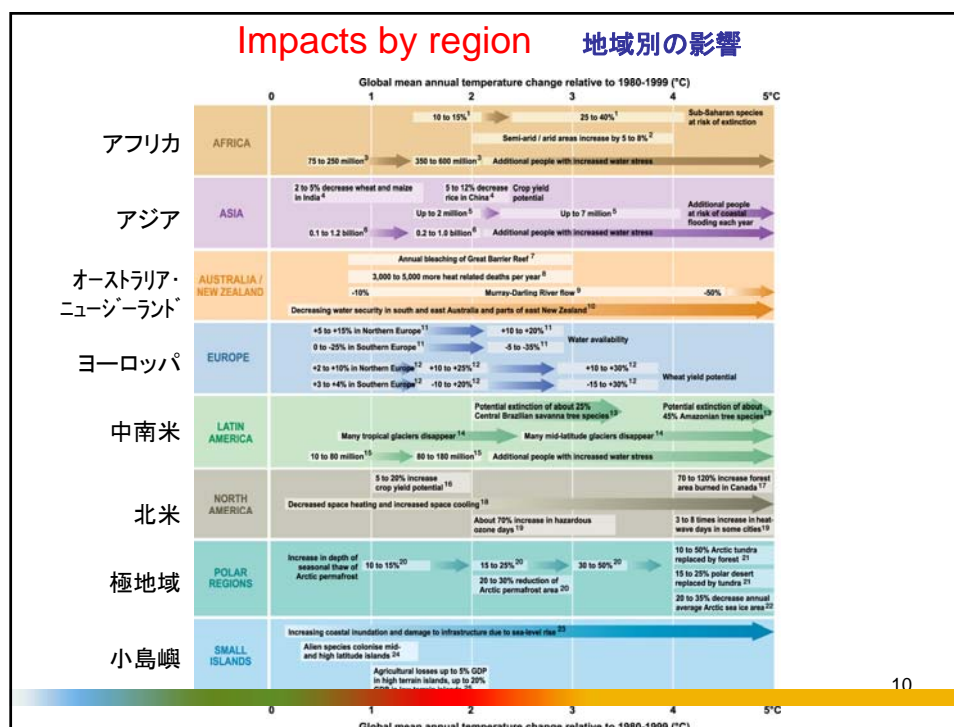
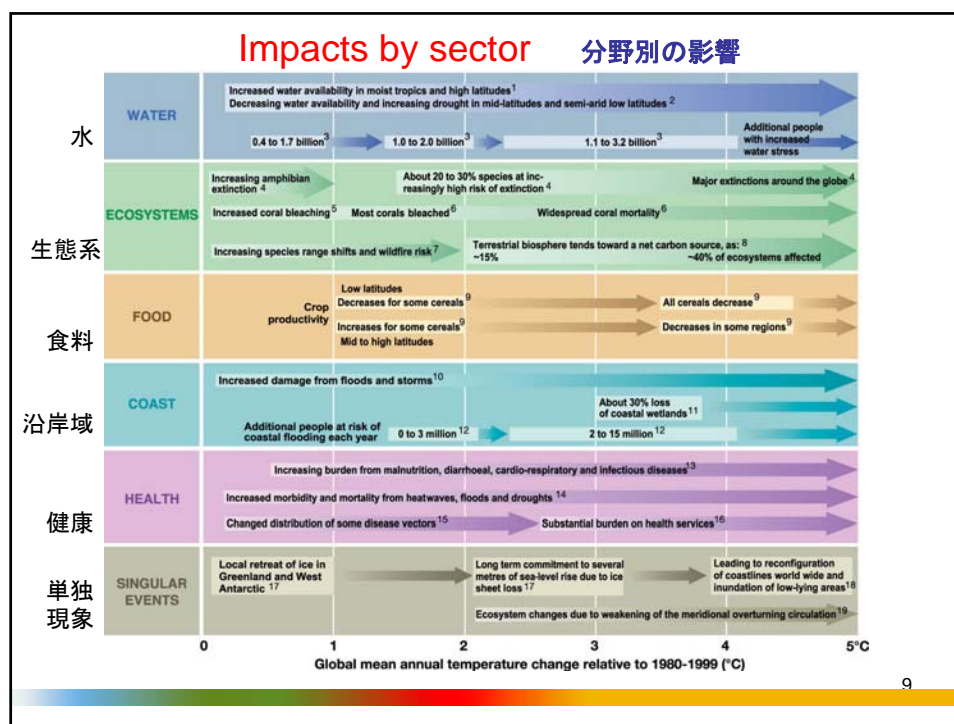
Climate change is human induced

気候変動は人為起源による

Consistent pattern of warming over land, oceans and over each continent (except Antarctica)

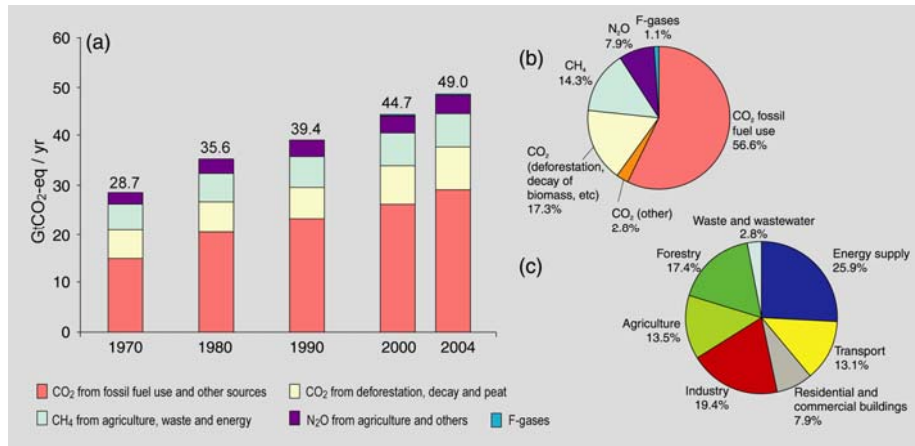
陸地・海洋・各大陸上（南極を除く）の温暖化には、一定のパターンがある。





Between 1970 and 2004 global greenhouse gas emissions have increased by 70 %

1970～2004年の間に世界のGHG排出量は70%増加した。

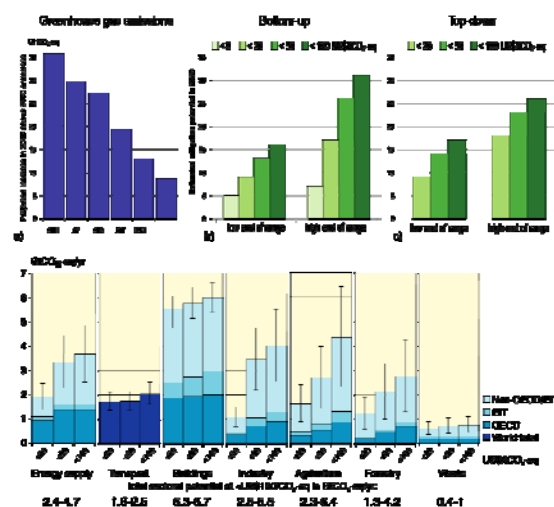


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Projected GHG and Mitigation Potential

GHGの推移予測と緩和のポテンシャル

- Current climate change mitigation policies *and related sustainable development practices (SRES)*, could increase between 25-90% between 2000 and 2030
- Mitigation potential based on both bottom-up and top-down studies could offset the expected GHG emissions growth
- All sectors could contribute though their potential differ in quantity and sectors

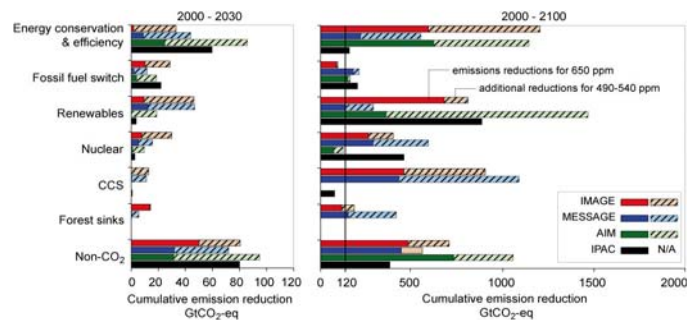


Estimates do not include non-technical options such as lifestyle changes

Technologies are available now and in the future

技術は、今も将来も利用可能である。

- The range of stabilization levels can be achieved by
 - deployment of a portfolio of technologies that are currently available and
現在利用可能な技術のポートフォリオの配置
 - those that are expected to be commercialised in coming decades.
今後数十年の間に実用化されることが期待されている
- This assumes that appropriate and effective incentives are in place for development, acquisition, deployment and diffusion of technologies and for addressing related barriers



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What are the macro-economic costs in 2030?

2030年のマクロ経済的なコストはどのようなになるのか？

- Costs are global average for least cost approaches from top-down models
コストは、トップダウンモデルからの最低費用アプローチの世界平均値
- Costs do not include co-benefits and avoided climate change damages
コストには、コベネフィット及び気候変動損害の回避は含んでいない。

Trajectories towards stabilization levels (ppm CO ₂ -eq)	Median GDP reduction [1] (%)	Range of GDP reduction [2] (%)	Reduction of average annual GDP growth rates [3] (percentage points)
590-710	0.2	-0.6 – 1.2	< 0.06
535-590	0.6	0.2 – 2.5	< 0.1
445-535 [4]	Not available	< 3	< 0.12

[1] This is global GDP based market exchange rates.

[2] The median and the 10th and 90th percentile range of the analyzed data are given.

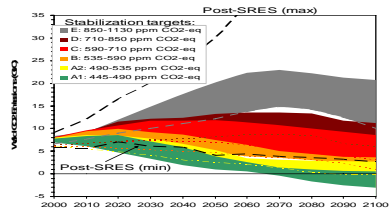
[3] The calculation of the reduction of the annual growth rate is based on the average reduction during the period till 2030 that would result in the indicated GDP decrease in 2030.

[4] The number of studies that report GDP results is relatively small and they generally use low baselines.

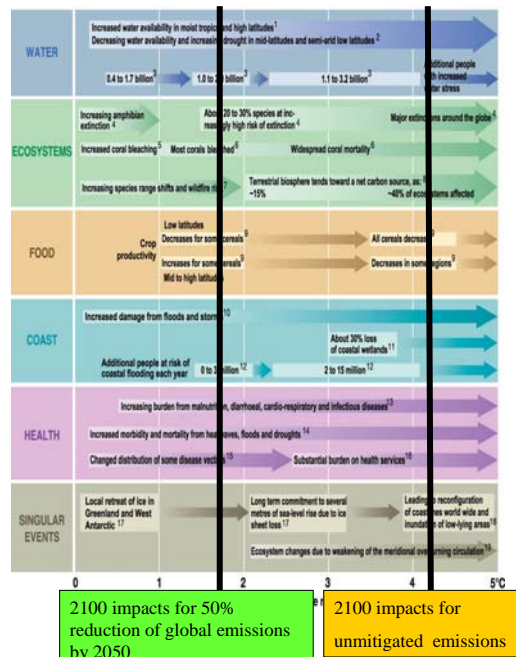
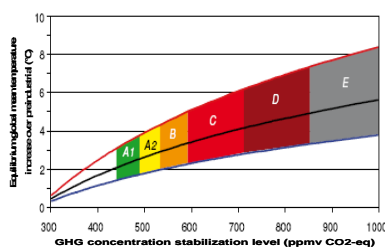
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Climate Change Impacts and Stabilisation

気候変動の影響と安定化



The lower the stabilisation, the earlier global GHG emissions need to go down
 低いレベルで安定化させるには、世界のGHG排出量を早い段階で削減に向かわせなければならない。



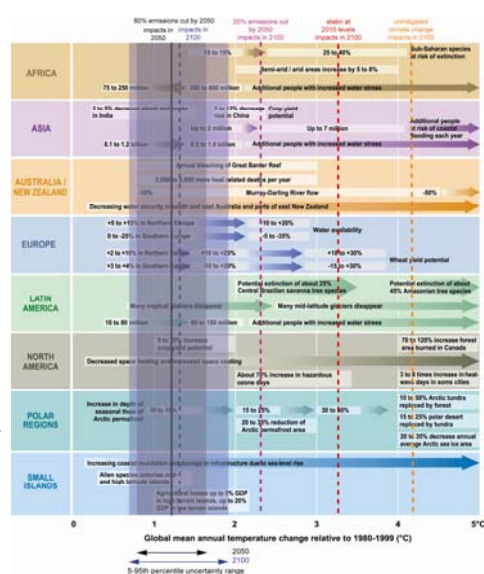
2100 impacts for 50% reduction of global emissions by 2050

2100 impacts for unmitigated emissions

Current committed warming makes adaptation unavoidable, worse for vulnerable countries

現在想定される温暖化には適応策が不可避であり、脆弱な国でより大きな悪影響が出る

- G8 Summit call for 50% GHG reduction by 2050 below 1990
G8サミットは2050年までに1990年レベルから50%削減が必要としている
- EU target of 2 C above 1990
EUは1990年から2℃気温上昇を目標に設定
- Bali road map: Some call for 50% reduction, others 80% below 1990
バリロードマップ: 1990年から50%削減必要とも、80%削減必要とも
- IPCC-AR4:
 - 50% reduction will not avoid major impacts and stabilisation of 450-550 ppm: EU target - 2 C above pre-industrial or 1.6 C above 1990). Serious water stress
50%削減では、主要な影響は不可避、安定化は450~550ppm (産業革命以前から2℃上昇、1990年から1.6℃上昇)。水資源に与える影響大。
 - 80% reduction will lead to 400-470 ppm. Will not exceed 2 C in 2050. Reduce water stress
80%削減で、400~470ppm。2050年の上昇は2℃以下。水資源に与える影響を緩和できる。



Reductions Annex I and non-Annex I countries: Suggested Targets

附属書 I 国・非附属書 I 国の削減：目標値の提案

Scenario category	Region	2020	2050
A-450 ppm CO₂-eq²	Annex I	–25% to –40%	–80% to –95%
	Non-Annex I	Substantial deviation from baseline in Latin America, Middle East, East Asia and Centrally-Planned Asia	Substantial deviation from baseline in all regions
B-550 ppm CO₂-eq	Annex I	–10% to –30%	–40% to –90%
	Non-Annex I	Deviation from baseline in Latin America and Middle East, East Asia	Deviation from baseline in most regions, especially in Latin America and Middle East
C-650 ppm CO₂-eq	Annex I	0% to –25%	–30% to –80%
	Non-Annex I	Baseline	Deviation from baseline in Latin America, Middle East, and East Asia

Strategies to Achieve a Low Carbon Society

低炭素社会を構築するための戦略

- Technological strategies
技術的戦略
- Lifestyles changes
生活様式の変換
- Policy strategies
政策戦略
 - Climate Change Policies
気候変動政策
 - Non-Climate Policies
気候に関連しない政策

Energy Technology Options

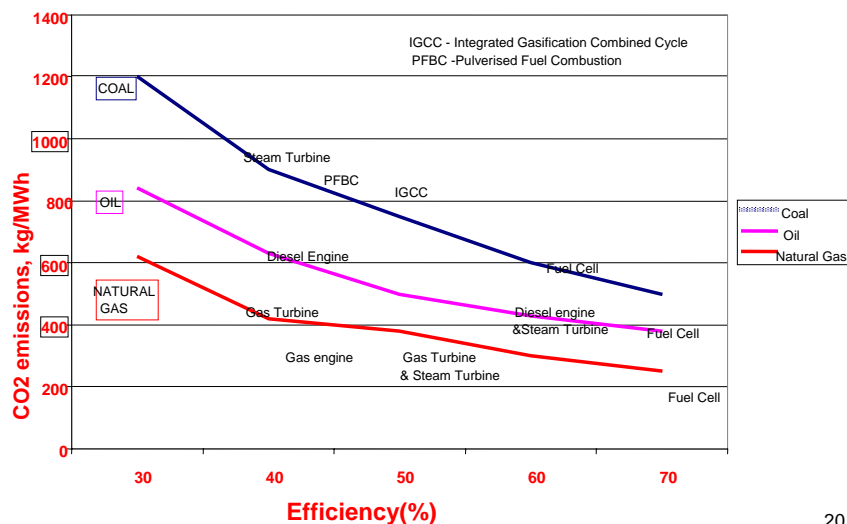
エネルギー技術のオプション

- Energy Technology options are growing and most of them enhanced each other
- Implementing these technologies require treating them as a portfolio not in isolation
- None will solve the climate change problem alone or stabilise the GHG emissions
- All these technologies are in different stages of development and deployment
- These technologies will play different roles in different parts of the world (major player to niche markets)
- Deployment of these technologies to different parts of the world remain a major challenge
- These are:
 - Improved Fossil fuel technologies 化石燃料技術の改良
 - Carbon dioxide capture and storage CO2回収・貯留
 - Bio-Energy バイオエネルギー
 - Renewable energy (Wind, solar, hydro) 風力・太陽光・水力など再生可能エネルギー
 - Hydrogen energy 水素エネルギー
 - End-use technologies 末端利用技術
 - Nuclear energy 原子力エネルギー

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Efficiency and CO2 Emissions in Power Plants are getting better

発電所の効率とCO2排出量は改善しつつある

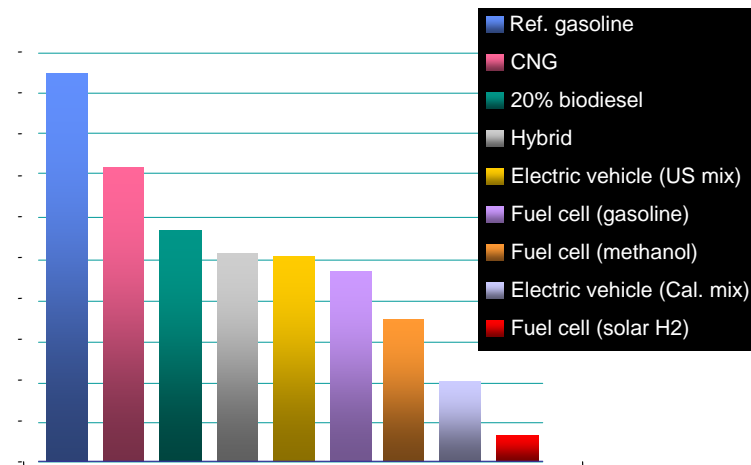


Source: Adapted from VTT, 2002

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GHG emissions per kilometre for different vehicle technologies

自動車技術別の1km走行にかかるGHG排出量



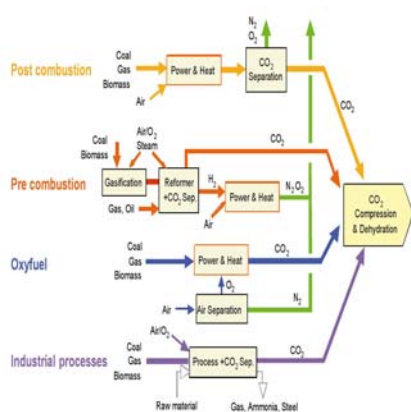
Source: Moomaw et al, IPCC (2001)

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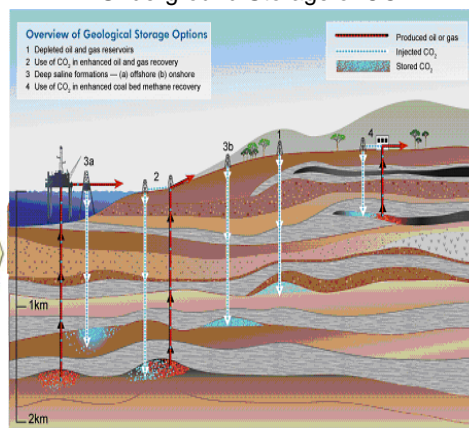
Carbon Dioxide Capture and Storage will be important in the future

CO2回収・貯留は、将来重要となる

Capture of CO2



Underground Storage of CO2



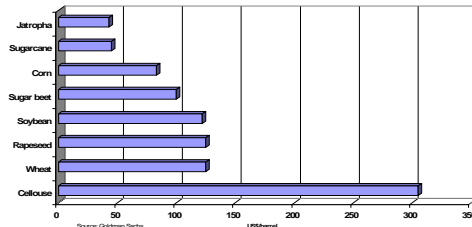
- Large potential geological capacity but not evenly distributed
- Some small-scale pilot plants, not yet for large impacts on CC
- CCS will be most economic if deployed with other systems
- R&D, environmental and legal challenges remain

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Bio- Energy

バイオエネルギー

Cost per Barrel of Fuel by Biofuels feedstock



A major feedstock



- 10-12% of global energy is from Biomass

世界のエネルギーの10~12%はバイオマス由来

- Replicating existing good practices will enhance its use

既存の優良事例を真似ることがその利用を高める

- Future technologies (transport, industrial and power)

将来の技術(交通・産業・電力)

- Constraints are many 制約は多い。

- Conflict with food

食料との競合

- Resources (Land, water, etc)

資源(土地・水など)

- R&D challenges

研究・開発の課題



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Renewable Energy

再生可能エネルギー

- Renewable energy systems can be used as stand alone or mini-grid based on

再生可能エネルギーシステムは、以下に基づいて、単独で、又は小規模グリッドで利用できる。

- Needs assessment
ニーズ調査
- Provision of wide technology choice
技術の広範な選択オプションの提示
- Facilitation of technical back-up
技術的バックアップの確保
- Provision of subsidised financial system
補助金等の資金援助の提供
- Support existing cooperatives or promote new ones
既存の協力関係の支援、又は新たな関係の促進



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Hydrogen as an Energy Source

エネルギー資源としての水素



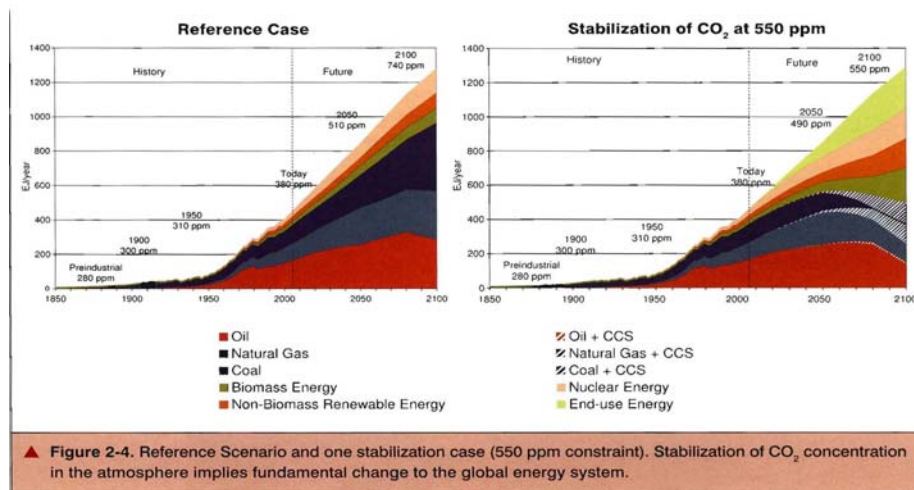
- Attractive for CC concerns
- Can be useful for transport needs
- GHG constraint (full-cycle)
- Major R&D challenges

気候変動に関して、魅力的。
交通ニーズに有用となりうる。
全循環においてGHG抑制する。
研究・開発の課題が大きい。

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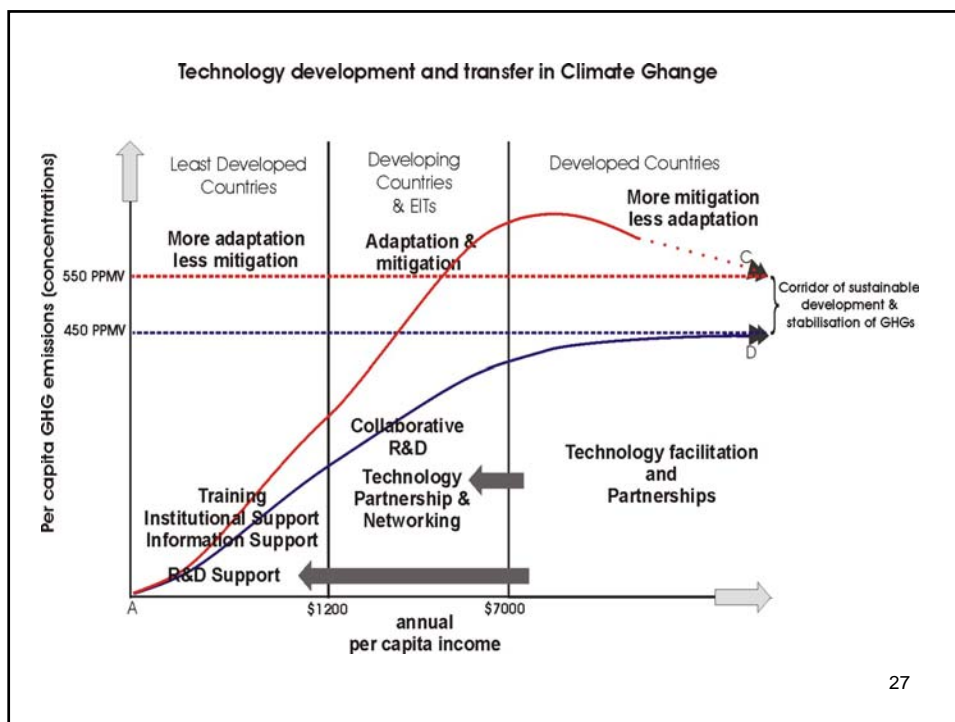
A Perspective of achieving a Low-Carbon World

低炭素型世界の構築に向けた見解



Source: GTSP, 2007

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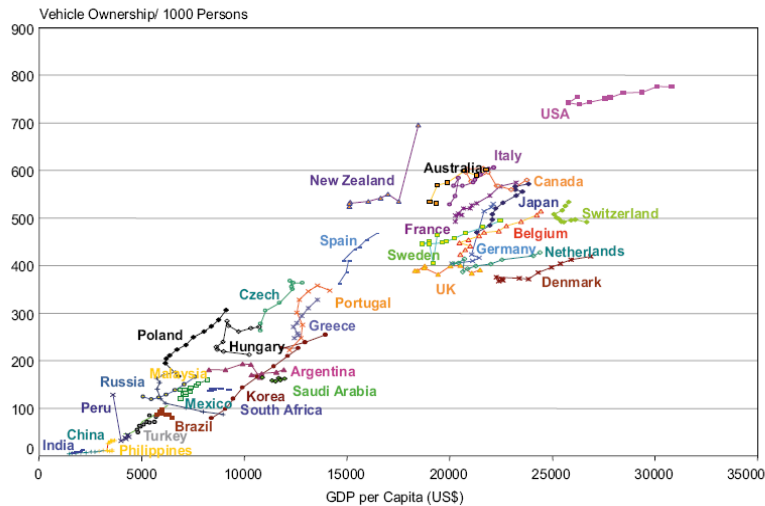
Changes in lifestyle and behaviour patterns can contribute to climate change mitigation, but this has not been quantified

生活様式・行動パターンの変革は、気候変動緩和に貢献するが、
定量化されていない。

- Changes in occupant behaviour, cultural patterns and consumer choice in buildings.
- Reduction of car usage and efficient driving style, in relation to urban planning and availability of public transport
- Behaviour of staff in industrial organizations in light of reward systems

Differences in vehicle ownership

自動車保有率の差



Mitigation Policies are available to governments

緩和政策は、政府のみ利用可能である。

- Effectiveness of policies depends on national circumstances, their design, interaction, stringency and implementation
政策の効率は、国内事情や政策デザイン、相互作用、逼迫性、及び実施による。
- Integrating climate policies in broader development policies
幅広い開発政策への気候政策の統合
 - Regulations and standards 規制・基準化
 - Taxes and charges 課税・課金
 - Financial incentives 財政的インセンティブ
 - Tradable permits 取引可能な許可枠
 - Voluntary agreements 自主的協定
 - Information instruments 情報手段
 - Research and development 研究・開発

An effective carbon-price signal could realise significant mitigation potential in all sectors

効果的な炭素価格のサインを出すことは、
すべての分野における重要な緩和ポテンシャルを実現化しうる。

- Policies that provide a real or implicit price of carbon could create incentives for producers and consumers to significantly invest in low-GHG products, technologies and processes.
現実又は明確な炭素価格を提示する政策は、生産者・消費者が低GHG製品・技術・プロセスに投資するインセンティブを創出することとなりうる。
- Such policies could include economic instruments, government funding and regulation
そのような政策には、経済的措置や政府の資金拠出・規制も含まれうる。
- For stabilisation at around 550 ppm CO₂eq carbon prices should reach 20-80 US\$/tCO₂eq by 2030 (5-65 if “induced technological change” happens)
550ppmでの安定化のためには、CO₂換算1t当たりの炭素価格は、2030年までに20～80米ドル（「誘発的な技術変革」が起これば、5～65米ドルに到達する程度となるであろう。
- At these carbon prices, major shifts in investments is expected to low carbon technologies
この炭素価格においては、投資の大幅なシフトは低炭素技術に向けられることが期待される。

Non-climate policies can influence carbon emissions as much as specific climate policies

Sectors	Non-climate policies -- Candidates for integrating climate concerns	Possible influence (% of global emissions)
Macro-economy	Taxes, subsidies, other fiscal policies	All GHG emissions (100 %)
Forestry	Forest protection, sustainable management	GHGs deforestation (7%)
Electricity	Renewable energy, demand management, decreasing losses transport/distribution	Electricity sector emissions (20 %)
Oil-imports	Diversification energy sources/decrease intensity -> enhance energy security	GHGs from oil product imports (20 %)
Insurance buildings, infrastructure	Differentiated premiums, liability conditions, improved conditions green products	GHG emissions buildings, transport (20 %)
Bank lending	Strategy/policy, lending projects accounting for options emission limitations	Notably development projects (25%)
Rural energy	Policies promoting LPG, kerosene and electricity for cooking	Extra emissions over biomass (<2 %)

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Sustainable development and climate change mitigation

持続可能な開発と気候変動緩和策

- Making development more sustainable by changing development paths can make a major contribution to climate change mitigation
開発方法の変更により開発をより持続的なものとする事は、気候変動緩和策に大きく貢献できる。
- Implementation may require resources to overcome multiple barriers.
実施は、複数の障壁を克服するための資源を必要とするかもしれない。
- Possibilities to choose and implement mitigation options to realise synergies and avoid conflicts with other dimensions of sustainable development.
緩和オプションを選択・実施することは、持続可能な開発との相乗効果をもたらし、他の側面との衝突を回避する可能性を含みうる。

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Conclusion: Fitting it together in the long term

結論: 長期的に調和させること

- Global warming is equivocal and early action by all and governments are needed to reduce serious climate risks
地球の温暖化は明白であり、全人類・政府による早期の行動が深刻な気候リスクの低減に必要である。
- Large number of technologies are available now and in the near future to offset the GHG emissions
GHG排出量を相殺する多数の技術が現在及び近い将来に利用可能である。
- Linking sustainable development with climate policies provide governments the opportunity to avert the possible climate threats
持続可能な開発と気候政策の連結は、政府に気候脅威の可能性を回避するチャンスをもたらす。
- Conventional economic analysis has to consider both social and environmental aspects for optimal decision-making
伝統的な経済分析は、最適な意思決定のための社会的側面と経済的側面の両方を検討しなければならない。
- Climate change could worsen the gap in distributional goods and services between and within generations as the poor and disadvantaged will be the most affected
気候変動は、貧困層や脆弱層にもっとも影響を与えるため、世代間及び同一世代内での財・サービスの分配にかかる格差を広げうる。

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Concluding comments II

結論:コメント(2)

- Non-governmental organisations (International and national) are very important
国際・国内NGOは非常に重要
 - Human and institutional capacity building 人材・組織の能力開発
 - Sensitizing and popularising technological innovations
技術革新の敏感化・大衆化
- Private sector can be involved in development and deployment of technologies 民間分野は、技術開発・普及に関与することができる
 - Regulations are crucial 規制は重要
 - Competition is necessary 競争は必要
- Addressing equity concerns:
衡平性の問題への対処:
 - Establishment of a equitable and participative framework for decision-making and implementation
意思決定及び実施にかかる衡平且つ参加型の枠組の創設
 - Reduction of potential social disruption from climate change impacts
気候変動の影響による社会的混乱の可能性の低減
 - Protection of cultural diversity and threatened cultures needed in the future
文化的多様性と消失危機にある文化の保護が将来的に必要

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Thank you for your attention

Further Information

Contact

University of Sierra Leone

Freetown, Sierra Leone.

Tel. No. 232-22-223340

Fax. No 232-22-223270

Email: ogunladedavidson@hotmail.com

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