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**How to Finance
Climate Change Mitigation and Adaptation**

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Main Messages

1. Financial needs are uncertain but high as scenarios tell us
2. Carbon finance does not get traction in transport
3. A broad reform agenda self-finances much of the transition



Financial needs for low-carbon transport are uncertain

- Sources of uncertainty
 - Climate change: Do we have to insure against catastrophic change?
 - Technological perspectives: Which low-carbon technologies will be available and affordable?
 - Policy uncertainty: What international agreement? Will good examples invite followers?



Financial needs for low-carbon transport are uncertain

- Precaution and technical pessimism lead to high cost estimates
 - More emphasis on changing the modal composition of infrastructure
 - Stronger increase on transport costs and higher negative impact on economic development
- Few scenarios contain a fully developed transport sector and forecast strongly different roles of the transport sector for future emissions



Financial needs for low-carbon transport are uncertain: Forecast differences

Cutting energy-related emissions in half by 2050 requires deep decarbonization of the power sector

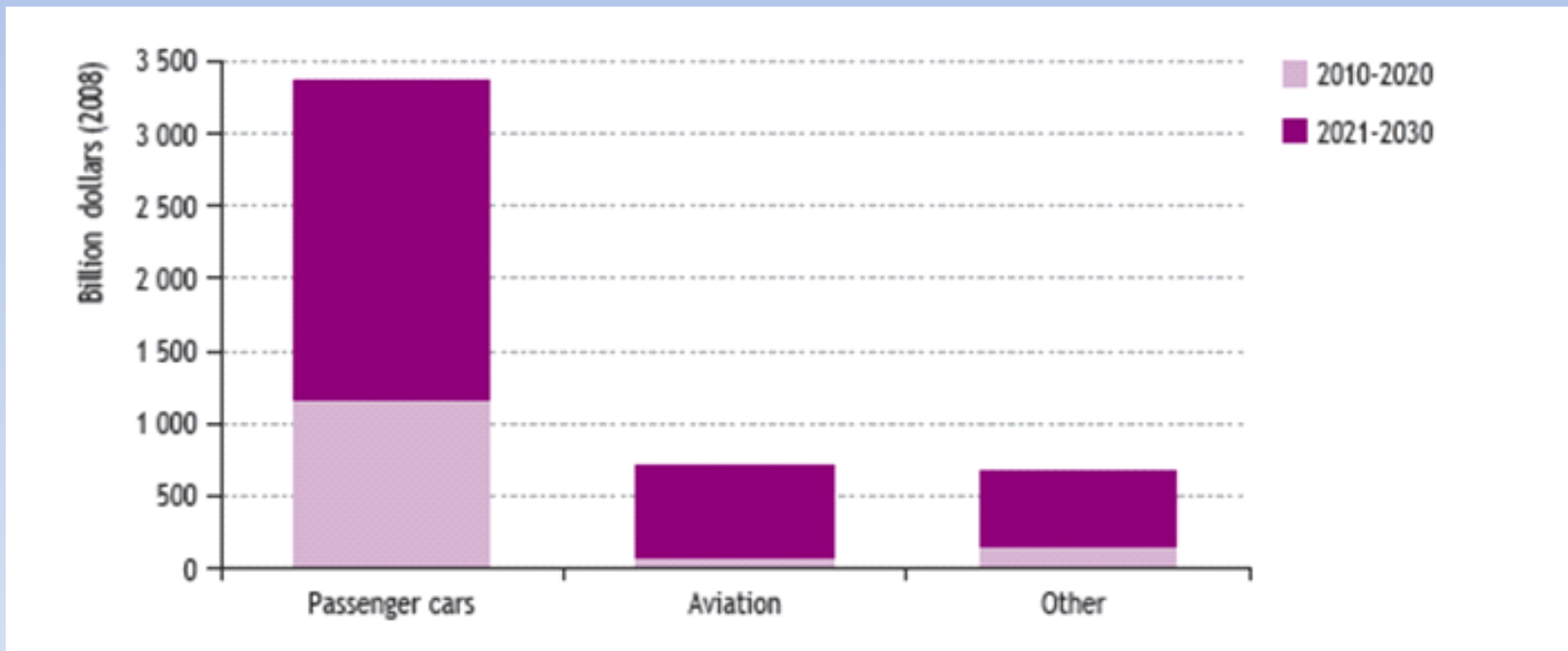
| Estimated % of carbon that must be removed by sector, 2005–2050 | | |
|---|-----|---------|
| Sector | IEA | MiniCAM |
| Power | –71 | –87 |
| Building | –41 | –50 |
| Transport | –30 | +47 |
| Industry | –21 | –71 |
| Total | –50 | –50 |

Sources: WDR team based on data from IEA 2008b; Calvin and others forthcoming.



Financial needs for low-carbon transport are high, mitigation

Cumulative incremental investment in transport by mode relative to the baseline, \$ billions



Source: IEA, World Energy Outlook 2009



Financial needs for low-carbon transport are high, mitigation

Global cumulative incremental investment 2010 – 2030 and CO2 savings in 450 ppm scenario relative to baseline

| | Incremental investment, \$ billion | CO2 savings due to low-carbon technologies (GT) | Indirect CO2 savings (GT) | Total CO2 savings (GT) |
|------------------|------------------------------------|---|---------------------------|------------------------|
| Power generation | 1745 | 5.8 | 3.5 | 9.4 |
| Biofuels supply | 405 | n.a. | n.a. | 0.4 |
| Industry | 1056 | 1.7 | 1.5 | 3.2 |
| Buildings | 2533 | 0.6 | 1.9 | 2.5 |
| Transport | 4730 | 1.2 | 0 | 1.2 |
| Total | 10469 | 9.3 | 6.9 | 16.7 |



Financial needs in transport generate less savings

- Best performing sector:
power generation 5.35 Gt CO₂ savings per trillion invested
- Least performing sector:
transport with 0.25 Gt CO₂ savings per trillion invested
- Result is conditional on narrow policy agenda measuring success exclusively in CO₂ savings



Financial needs for low-carbon transport are high, adaptation

Overall adaptation needs, early studies

| Study | New investment flows (\$ billions) | Percent of new investment sensitive to climate | Additional costs to reduce risk from climate change (percent) | Costs (\$ billions) |
|-------------------|------------------------------------|--|---|---------------------|
| World Bank (2006) | 1760 | 2-40 | 10-20 | 9-41 |
| Stern (2007) | 1760 | 2-20 | 5-20 | 4-37 |
| UNDP (2007) | 3112 | 2-33 | 5-20 | 5-67 |
| UNFCCC (2007) | 5417 ^a | 0.7-2.7 | 5-20 | 2-41 |

No account of infrastructure gaps in developing countries.



Financial needs for low-carbon transport are high, adaptation

- International Institute for Environment and Development (2009) estimates the incremental annual costs for adaptation in all low- and middle-income countries over 20 years to be \$ 15.9 to 63.2 billion
- Estimate includes closing financial gap according to demands associated with Millennium Development Goals.



Before the use of carbon finance cut harmful subsidies

Annual potential diesel subsidy savings, 2007

| <i>Country</i> | <i>Diesel price 2008, \$ cents/liter 1)</i> | <i>Annual potential subsidy savings, \$ mill.</i> |
|----------------------|---|---|
| Algeria | 20 | 1951.49 |
| Argentina | 58 | 1482.45 |
| Bahrain | 13 | 258.84 |
| Brunei | 21 | 89.55 |
| India | 70 | 2055.18 |
| Indonesia | 42 | 2853.79 |
| Iran | 3 | 12464.40 |
| Mexico | 54 | 3276.93 |
| Myanmar | 52 | 235.72 |
| Saudi Arabia | 9 | 10062.54 |
| Sri Lanka | 75 | 42.65 |
| Thailand | 64 | 1756.66 |
| United Arab Emirates | 62 | 730.18 |
| Venezuela | 1 | 1865.80 |
| Yemen | 17 | 218.29 |



Carbon finance does not get traction in transport

1. Carbon markets

- Joint implementation is irrelevant: no transport project
- CDM: > 4200 projects in the pipeline, 2246 registered in June 2010
 - 3 of them in transport
 - Investment share is 0.11 percent of the total



Carbon finance does not get traction in transport

2. Global Environment Facility (GEF)

| Project Type | Number of Projects, Total | Number of Projects, Transport | GEF Grant \$ millions | Co-financing \$ millions | Total, \$ mill. | Transport Share of the Total, in % |
|------------------------------|---------------------------|-------------------------------|-----------------------|--------------------------|-----------------|------------------------------------|
| Enabling Activities | | | | | | |
| <i>Total</i> | 280 | | 172.3 | 25.98 | 198.28 | |
| <i>Transport</i> | | 0 | | | | 0.00 |
| Medium Sized Projects | | | | | | |
| <i>Total</i> | 117 | | 101.66 | 512 | 613.68 | |
| <i>Transport</i> | | 6 | 5.65 | 20.84 | 26.49 | 4.32 |
| Full Sized Projects | | | | | | |
| <i>Total</i> | 423 | | 2563.14 | 17494.66 | 20057.8 | |
| <i>Transport</i> | | 22 | 176.77 | 2165.24 | 2342.01 | 11.68 |



Transport in Clean Technology Fund Country Programs

- In 6 of the 12 country programs of the CTF, transport is included, in Kazakhstan and Ukraine in Phase II.
- Where transport is included it is significant.



Transport in Clean Technology Fund Country Programs

Indicative Country Investment Plans endorsed by the CTF, total in \$ millions and transport share in %

| <i>Country</i> | | <i>Total investment</i> |
|----------------|-----------------|-------------------------|
| Colombia | Total | 3145 |
| | Transport share | 77.1319555 |
| Egypt | Total | 1921 |
| | Transport share | 45.0286309 |
| Mexico | Total | 6197 |
| | Transport share | 38.728417 |
| Philippines | Total | 2780 |
| | Transport share | 12.5899281 |
| Thailand | Total | 4263 |
| | Transport share | 29.7208539 |
| Vietnam | Total | 3445 |
| | Transport share | 33.3817126 |



A broad reform agenda self-finances much of the transition

- Fiscal incentives that maximize welfare effects lead to fiscal revenues to finance the transition
 - Costing carbon: the global dimension
 - A gallon of gasoline contains 0.0024 tons of carbon.
 - Shadow price of \$ 20, \$ 30 or \$ 300 per ton of carbon would translate into 5, 12, and 72 cents per gallon (less than market volatility in recent years).
 - Leads to annual fiscal revenues of about \$ 10, 24 and 145 billion per year for the US, if no significant reduction in vmt occurs.



A broad reform agenda self-finances much of the transition

- Fiscal incentives that maximize welfare effects lead to fiscal revenues to finance the transition, cont.
 - Costing local air pollution
 - Would lead to a mile charge of 1 to 8 cents per mile in Los Angeles area.
 - In 2003 40.84 billion vehicle miles were driven in the Los Angeles area (district 7 of Caltrans).
 - Implies a revenue potential of \$ 400 million to \$ 3.26 billion for the Los Angeles Area.



A broad reform agenda self-finances much of the transition

- Fiscal incentives that maximize welfare effects lead to fiscal revenues to finance the transition, cont.
 - Willingness to pay for the reduction of health effects is lower in poorer countries but not by much.
 - Estimates of the income elasticity of the WTP is between 0.26 and 0.6.



A broad reform agenda self-finances much of the transition

- Fiscal incentives that maximize welfare effects lead to fiscal revenues to finance the transition, cont.
 - Costing congestion
 - Congestion is local, but some estimates average for the national level
 - Averaged congestion costs for the US example are 3.5 cents per mile (Small and Parry) to 5 cents per mile (FHWA).
 - Implies a revenue potential of \$ 58 to 83 billion per year.



A broad reform agenda self-finances much of the transition

- Fiscal incentives that maximize welfare effects lead to fiscal revenues to finance the transition, cont.
 - Costing external accident costs
 - Estimate of 2 to 7 cents per mile for the US.
 - Implies a revenue potential of 33 to 117 billion in 2007.



Conclusions

- Financial needs to achieve a low-carbon transport sector are high if based on a narrow climate change agenda.
- The transport sector has not done well to attract carbon finance. Benefit-cost ratios are small compared to other sectors when benefits are narrowly defined.
- Benefit-cost ratios increase substantially if co-benefits in congestion reduction, accident prevention and local air pollution are included.
- Fiscal revenues could even allow for secondary benefits from reducing dysfunctional taxes.



Thank you!

