

Section 1 - Bureau of Records Complete

Docket No. 060220-EC Date Docketed: 03/10/2006 Title: Petition for determination of need for Seminole Generating Station Unit 3 electrical power plant in Putnam County, by Seminole Electric Cooperative, Inc.

Company: Seminole Electric Cooperative, Inc.

Official Filing Date: \_\_\_\_\_ Expiration: \_\_\_\_\_  
 Last Day to Suspend: \_\_\_\_\_

Referred to:

CCA	CMP	(ECR)	GCL	PIF	RCA	SCR	SGA
		X	X				

("O" indicates OPR)

Section 2 - OPR Completes and returns to CCA in 10 workdays.

Time Schedule

Program Module B2(a)

WARNING: THIS SCHEDULE IS AN INTERNAL PLANNING DOCUMENT  
 IT IS TENTATIVE AND SUBJECT TO REVISION.  
 FOR UPDATES CONTACT THE RECORDS SECTION: (850) 413-6770

Staff Assignments

OPR Staff

Current CASR revision level

Due Dates  
 Previous Current

Staff Counsel

OCRs

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Recommended assignments for hearing and/or deciding this case:

Full Commission \_\_\_ Commission Panel \_\_\_  
 Hearing \_\_\_ Staff \_\_\_

Date filed with CCA: \_\_\_\_\_

Initials OPR \_\_\_\_\_  
 Staff Counsel \_\_\_\_\_

Section 3 - Chairman Completes

Assignments are as follows:

- Hearing Officer(s)

Commissioners						Hrg Exam	Staff
ALL	ED	DS	AR	CT	TW		

Prehearing Officer

Commissioners					ADM
ED	DS	AR	CT	TW	

Where panels are assigned the senior Commissioner is Panel Chairman: the identical panel decides the case.

Where one Commissioner, a Hearing Examiner or a Staff Member is assigned the full Commission decides the case.

DOCUMENT NUMBER-DATE

Approved: \_\_\_\_\_  
 Date: 09922 OCT 30 8

Section 1 - Bureau of Records Completes

Docket No. 060220-EC Date Docketed: 03/10/2006 Title: Petition for determination of need for Seminole Generating Station Unit 3 electrical power plant in Putnam County, by Seminole Electric Cooperative, Inc.  
 Company: Seminole Electric Cooperative, Inc.

Official Filing Date: \_\_\_\_\_ Expiration: \_\_\_\_\_  
 Last Day to Suspend: \_\_\_\_\_

Referred to: \_\_\_\_\_  
 ("O") indicates OPR

CCA	CMP	(ECR)	GCL	PIF	RCA	SCR	SGA
		X	X				

Section 2 - OPR Completes and returns to CCA in 10 workdays. Time Schedule

Program Module B2(a)

WARNING: THIS SCHEDULE IS AN INTERNAL PLANNING DOCUMENT  
 IT IS TENTATIVE AND SUBJECT TO REVISION.  
 FOR UPDATES CONTACT THE RECORDS SECTION: (850) 413-6770

Staff Assignments

OPR Staff L Colson, B Gardner  
J Lingo, P Stallcup  
B Windham

Current CASR revision level

Due Dates  
 Previous Current

Staff Counsel J Rodan

OCRs

1.	Petition and Testimony Filed	NONE	03/10/2006
2.	Notice of Commencement of Proceeding	NONE	03/21/2006
3.	Order Establishing Procedure	NONE	03/31/2006
4.	Revised CASR Due	NONE	04/03/2006
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Recommended assignments for hearing and/or deciding this case:

Full Commission  Commission Panel \_\_\_\_\_  
 Hearing \_\_\_\_\_ Staff \_\_\_\_\_

Date filed with CCA: 03/15/2006

Initials OPR \_\_\_\_\_  
 Staff Counsel \_\_\_\_\_

Section 3 - Chairman Completes

Assignments are as follows:

- Hearing Officer(s)

Commissioners						Hrg Exam	Staff
ALL	ED	DS	AR	CT	TW		
X							

Prehearing Officer

Commissioners					ADM
ED	DS	AR	CT	TW	
		X			

Where panels are assigned the senior Commissioner is Panel Chairman: the identical panel decides the case.  
 Where one Commissioner, a Hearing Examiner or a Staff Member is assigned the full Commission decides the case.

Approved: ED/RW  
 Date: 03/15/2006

# Case Scheduling/Rescheduling Advice

Last Revised 03/23/2006 at 12:37 p.m.

Page 1 of 1

**To:**  Commissioner Deason       Deputy Executive Director       Economic Regulation  
 Commissioner Arriaga       General Counsel       Court Reporter  
 Commissioner Carter       Strategic Analysis & Gov. Affairs       Staff Contact - Jennifer Rodan  
 Commissioner Tew       Commission Clerk & ADM Services        
 Executive Director       Competitive Markets/Enforcement        
 Public Information Officer       Reg. Compliance/Consumer Asst.     

**From:** Office of Chairman Lisa Edgar

**Docket Number:** 060220-EC -- Petition for determination of need for Seminole Generating Station Unit 3 electrical power plant in Putnam County, by Seminole Electric Cooperative, Inc.

## 1. Schedule Information

Event	Former Date	New Date	Location	Time
Prehearing Conference		05/30/2006	Tallahassee, Room 148	1:30 p. - 3:00 p.
Hearing		06/07/2006	Tallahassee, Room 148	9:30 a. - 5:00 p.

## 2. Hearing/Prehearing Assignment Information

### Former Assignments

**Hearing Officers**

Commissioners						Hearing Exam.	Staff
ALL	ED	DS	AR	CT	TW		

### Current Assignments

Commissioners						Hearing Exam.	Staff
ALL	ED	DS	AR	CT	TW		
X							

**Prehearing Officer**

Commissioners					
ED	DS	AR	CT	TW	ADM

Commissioners					
ED	DS	AR	CT	TW	ADM
		X			

**Remarks:**

Seminole Electric Need Determination -- OEP PSC-06-0247-PCO-EC, 3/23/06.





COMMISSIONERS:  
LISA POLAK EDGAR, CHAIRMAN  
J. TERRY DEASON  
ISILIO ARRIAGA  
MATTHEW M. CARTER II  
KATRINA J. TEW

STATE OF FLORIDA



DIVISION OF THE COMMISSION CLERK &  
ADMINISTRATIVE SERVICES  
BLANCA S. BAYÓ  
DIRECTOR  
(850) 413-6770 (CLERK)  
(850) 413-6330 (ADMIN)

Public Service Commission

March 14, 2006

Charles A. Guyton, Esquire  
Squire, Sanders & Dempsey L.L.P.  
215 South Monroe Street, Suite 601  
Tallahassee, Florida 32301-1804

**Re: Docket No. 060220-EC**

Dear Mr. Guyton:

This will acknowledge receipt of a petition for determination of need for Seminole Generating Station Unit 3 electrical power plant in Putnam County, by Seminole Electric Cooperative, Inc., was filed in this office on March 10, 2006, and assigned the above-referenced docket number. Appropriate staff members will be advised.

Mediation may be available to resolve any dispute in this docket. If mediation is conducted, it does not affect a substantially interested person's right to an administrative hearing. For more information, contact the Office of General Counsel at (850) 413-6248 or FAX (850) 413-7180.

Bureau of Records

I:\Records\acklet-no-app2.doc

DOCUMENT NUMBER - DATE  
09922 OCT 30 06  
EPSC - COMMISSION CLERK

Matilda Sanders

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From: Patti Zellner  
Sent: Thursday, March 16, 2006 1:08 PM  
To: CCA - Orders / Notices  
Subject: Order / Notice Submitted

Date and Time: 3/16/2006 1:04:00 PM  
Docket Number: 060220-EC  
Filename / Path: 060220-notice.comm.proceedings.jar.doc  
Notice Type: Memo for Issuance

2

**NOTICE OF COMMENCEMENT OF PROCEEDING FOR DETERMINATION  
OF NEED FOR PROPOSED ELECTRICAL POWER PLANT**

95/7 + 6 clerks.

DOCUMENT NO.  
09922-06

Matilda Sanders

*PSC-06-0247-PCO-EC*

**From:** Patti Zellner  
**Sent:** Thursday, March 23, 2006 10:43 AM  
**To:** CCA - Orders / Notices  
**Subject:** Order / Notice Submitted

RECEIVED: TPSC  
MAR 23 AM 11:37

**Date and Time:** 3/23/2006 10:41:00 AM  
**Docket Number:** 060220-EC  
**Filename / Path:** 060220-oep.jar.doc  
**Order Type:** Signed / Hand Deliver

*attach online*

COMMISSION  
CLERK

ORDER ESTABLISHING PROCEDURE

(Original will be sent soon)

This e-mail is to replace the one that was just sent because the docket number was wrong (060220-EI).

*2/10*

Matilda Sanders

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**From:** Patti Zellner  
**Sent:** Wednesday, March 29, 2006 10:39 AM  
**To:** CCA - Orders / Notices  
**Subject:** Order / Notice Submitted

*4 pgs.*

**Date and Time:** 3/29/2006 10:34:00 AM  
**Docket Number:** 060220-EI  
**Filename / Path:** 060220-Agency Notice of PH and Hearing.jar.doc  
**Notice Type:** Prehearing

*CCS ✓*

NOTICE OF COMMISSION HEARING AND PREHEARING

*MCD Hearings (Elec)  
49/7 + 6 Public Off.  
for Putnam County*

DK.06-0220

060220-EM

JOHN HEDRICK, CHAIR  
PAN HANDLE CITIZENS COALITION  
P.O. BOX 6683  
TALLAHASSEE, FLA. 32314-6683  
850-339-5462(C)  
JOHN HEDRICK13@YAHOO.COM

PLEASE ADD TO MAILING LIST  
AND HAVE STAFF ATTY.  
CONTACT MS: RE: PROCEEDING  
FOR INTERVIEWING IN THIS  
DOCKET.

OK  
Done  
04/03/06  
KMP

**\*\*CCA OFFICIAL DOCUMENT...\*\*b>**

**Kimberley Pena**

---

**From:** Martha Brown  
**Sent:** Monday, April 03, 2006 3:13 PM  
**To:** Kimberley Pena  
**Subject:** RE: Dkt. 060220

**Ok. :-)**

**-----Original Message-----**

**From:** Kimberley Pena  
**Sent:** Monday, April 03, 2006 2:46 PM  
**To:** Martha Brown  
**Cc:** Kay Flynn  
**Subject:** Dkt. 060220  
**Importance:** High

**Martha, Mr. Hedrick has left a request with us asking to be included in the docket mailing list as an interested person. He further requested that you contact him with the correct procedure to intervene in this docket. I have entered his information in CMS.**

*Done  
at 10:30  
KMP ✓*

Matilda Sanders

060220-EC

**From:** john hedrick [johnhedrick13@yahoo.com]  
**Sent:** Friday, April 21, 2006 5:07 PM  
**To:** Filings@psc.state.fl.us  
**Cc:** Ed Deaton; Ruth Nettles  
**Subject:** Fwd: Petition to Intervene from Edward Deaton, Ratepayer FYI-testimony to follow

john hedrick <johnhedrick13@yahoo.com> wrote:

Date: Fri, 21 Apr 2006 13:59:41 -0700 (PDT)  
From: john hedrick <johnhedrick13@yahoo.com>  
Subject: Petition to Intervene from Edward Deaton, Ratepayer FYI-testimony to follow  
To: Ruth Nettles <RNettles@PSC.STATE.FL.US>  
CC: Ed Deaton <edde@nettally.com>

BEFORE THE PUBLIC SERVICE COMMISSION

In re: Petition for  
Determination Docket  
No.: 060220-EC  
of Need for Seminole  
Generating Filed: April  
21, 2006

Station Unit 3 electrical power plant in  
Putnam County, by Seminole Electric  
Cooperative, Inc.

PETITION TO INTERVENE OF EDWARD DEATON, RATEPAYER

Pursuant to Chapter 120, Florida Statutes, Sections 403.519 and 366.07, Florida Statutes,  
and Rules 25-22.039, 25-22.082, and 28.106.205, Florida Administrative Code ("F.A.C."),  
Edward Deaton hereby files this Petition to Intervene into this proceeding, and in support, states the following:

1. The name and address of the affected agency are as follows:

Florida Public Service Commission ("Commission")  
2540 Shumard Oak Drive  
Tallahassee, FL 32399-0850

- The name and address of Petitioner Edward Deaton are as follows:

Edward Deaton  
9601 Miccosukee Road, #25  
Tallahassee, FL 32309  
Telephone: 850-877-6628  
Email: [edde@nettally.com](mailto:edde@nettally.com)

Copies of all pleadings, notices and orders in this docket should be provided to:

Edward Deaton (information as shown in #2 above)  
 John Hedrick  
 Panhandle Citizens Coalition  
 P.O. Box 6683  
 Tallahassee, Fl 32314-6683  
 Email: [johnhedrick13@yahoo.com](mailto:johnhedrick13@yahoo.com)

4. Statement of Edward Deaton's substantial interests. I am substantially affected by

this proceeding. I am a ratepayer of Talquin Electric Cooperative ("Talquin"), which is part of Seminole Electric Cooperative, Inc. ("Seminole") who supplies at least in part Talquin's electricity. My participation will assist the Commission in ensuring that the most cost-effective option is secured for not only my but the benefit of all of Seminole's customers and the ultimate ratepayers. To the extent that the decision in this docket may have precedential effect in future proceedings, my participation in this proceeding has that value through intervention. This proceeding involves Seminole's petition filed with the Commission requesting the Commission to issue a determination of need regarding Seminole's proposal to construct Seminole Generating Station Unit 3 electrical power plant on Seminole's current site in Putnam County, Florida. My substantial interests are affected by the necessity to provide cost-effective alternatives to Seminole's build option for providing new electric generation capacity. Inasmuch as a key purpose of this proceeding is to ascertain whether Seminole has proposed the most cost-effective electric generating capacity alternative or addition, my interest is the type of interest that this proceeding is designed to protect and is actually one of the chief purposes of this proceeding. My involvement will help determine whether Seminole has met its burden of proof to demonstrate the cost-effectiveness of its proposal and that the most cost-effective option is secured for the benefit of the ratepayers.

5. Disputed Issues of Material Fact. I anticipate that the disputed issues of material fact in this proceeding will include, but not necessarily be limited to:

- Did Seminole take into account all risks to ratepayers associated with their proposed new electric power generation capacity?
  - Has Seminole met its burden regarding need for the proposed Seminole Generating Station Unit 3, taking into account the need for electric system reliability and integrity, as this criterion is used in Section 403.519, Florida Statutes?
  - Has Seminole met its burden regarding need for the proposed Seminole Generating Station Unit 3, taking into account the need for adequate electricity at a reasonable cost, as this criterion is used in Section 403.519, Florida Statutes?
  - Has Seminole met its burden to demonstrate that its proposed build option for its new electric generating capacity is the most cost-effective alternative, from the ratepayers' perspective?
  - If Seminole has not met its burdens, what action(s) should the Commission take?
  - Has Seminole met its burden regarding any and all conservation measures taken by or reasonably available to Seminole which would mitigate the need for the proposed power plant?
  - Has Seminole adequately ensured the availability of fuel commodity and transportation to serve their proposed power plant?
  - Should the Commission grant Seminole's petition to determine the need for the proposed Seminole plant?
  - Should this docket be closed?
6. Statement of Ultimate Facts Alleged. I allege that Seminole failed to properly

recognize all risks to ratepayers associated with its build proposal (which is buttressed by the attached testimony), so that, ultimately, Seminole has not met its burden to demonstrate that the proposed Seminole Generating Station Unit 3 electrical power plant is the most cost-effective alternative available to provide new generating capacity. Accordingly, it would be in the



ratepayers' best interests to deny Sem...le's petition for determination of need, and instead to place into effect protocols that will ensure the selection of the most cost-effective choices.

WHEREFORE, EDWARD DEATON respectfully requests the Commission to enter an Order granting me permission and participate as a party to this proceeding.

Respectfully submitted this 21<sup>st</sup> day of April, 2006

---

EDWARD DEATON  
9601 Miccosukee Road, #25  
Tallahassee, FL 32309  
Telephone: 850-877-6628  
Email: [edde@nettally.com](mailto:edde@nettally.com)

Matilda Sanders

060220-EC

**From:** john hedrick [johnhedrick13@yahoo.com]  
**Sent:** Friday, April 21, 2006 5:05 PM  
**To:** Filings@psc.state.fl.us  
**Cc:** Ed Deaton; Ruth Nettles  
**Subject:** Fwd: RE: Petition to Intervene from Edward Deaton, Ratepayer FYI-testimony to follow

Ruth Nettles <RNettles@PSC.STATE.FL.US> wrote:

Subject: RE: Petition to Intervene from Edward Deaton, Ratepayer FYI-testimony to follow  
Date: Fri, 21 Apr 2006 17:01:28 -0400  
From: "Ruth Nettles" <RNettles@PSC.STATE.FL.US>  
To: "john hedrick" <johnhedrick13@yahoo.com>

Mr. Hedrick, Your motion needs to be filed officially in our website. Please follow those links.

[www.floridapsc.com](http://www.floridapsc.com)

go to how to file electronically.

---

**From:** john hedrick [mailto:johnhedrick13@yahoo.com]  
**Sent:** Friday, April 21, 2006 5:00 PM  
**To:** Ruth Nettles  
**Cc:** Ed Deaton  
**Subject:** Petition to Intervene from Edward Deaton, Ratepayer FYI-testimony to follow

BEFORE THE PUBLIC SERVICE COMMISSION

In re: Petition for  
Determination Docket  
No.: 060220-EC  
of Need for Seminole  
Generating Filed: April  
21, 2006

Station Unit 3 electrical power plant in  
Putnam County, by Seminole Electric  
Cooperative, Inc.

PETITION TO INTERVENE OF EDWARD DEATON, RATEPAYER

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and Rules 25-22.039, 25-22.082, and 28.106.205, Florida Administrative Code ("F.A.C."),  
Edward Deaton hereby files this Petition to Intervene into this proceeding, and in support, states the following:

1. The name and address of the affected agency are as follows:

Florida Public Service Commission ("Commission")  
2540 Shumard Oak Drive  
Tallahassee, FL 32399-0850

The name and address of Petitioner Edward Deaton are as follows:

Edward Deaton  
 9601 Miccosukee Road, #25  
 Tallahassee, FL 32309  
 Telephone: 850-877-6628  
 Email: [edde@nettally.com](mailto:edde@nettally.com)

Copies of all pleadings, notices and orders in this docket should be provided to:

Edward Deaton (information as shown in #2 above)  
 John Hedrick  
 Panhandle Citizens Coalition  
 P.O. Box 6683  
 Tallahassee, FL 32314-6683  
 Email: [johnhedrick13@yahoo.com](mailto:johnhedrick13@yahoo.com)

4. Statement of Edward Deaton's substantial interests. I am substantially affected by

this proceeding. I am a ratepayer of Talquin Electric Cooperative ("Talquin"), which is part of Seminole Electric Cooperative, Inc. ("Seminole") who supplies at least in part Talquin's electricity. My participation will assist the Commission in ensuring that the most cost-effective option is secured for not only my but the benefit of all of Seminole's customers and the ultimate ratepayers. To the extent that the decision in this docket may have precedential effect in future proceedings, my participation in this proceeding has that value through intervention. This proceeding involves Seminole's petition filed with the Commission requesting the Commission to issue a determination of need regarding Seminole's proposal to construct Seminole Generating Station Unit 3 electrical power plant on Seminole's current site in Putnam County, Florida. My substantial interests are affected by the necessity to provide cost-effective alternatives to Seminole's build option for providing new electric generation capacity. Inasmuch as a key purpose of this proceeding is to ascertain whether Seminole has proposed the most cost-effective electric generating capacity alternative or addition, my interest is the type of interest that this proceeding is designed to protect and is actually one of the chief purposes of this proceeding. My involvement will help determine whether Seminole has met its burden of proof to demonstrate the cost-effectiveness of its proposal and that the most cost-effective option is secured for the benefit of the ratepayers.

5. Disputed Issues of Material Fact. I anticipate that the disputed issues of material fact in this proceeding will include, but not necessarily be limited to:

Did Seminole take into account all risks to ratepayers associated with their proposed new electric power generation capacity?  
 Has Seminole met its burden regarding need for the proposed Seminole Generating Station Unit 3, taking into account the need for electric system reliability and integrity, as this criterion is used in Section 403.519, Florida Statutes?  
 Has Seminole met its burden regarding need for the proposed Seminole Generating Station Unit 3, taking into account the need for adequate electricity at a reasonable cost, as this criterion is used in Section 403.519, Florida Statutes?  
 Has Seminole met its burden to demonstrate that its proposed build option for its new electric generating capacity is the most cost-effective alternative, from the ratepayers' perspective?  
 If Seminole has not met its burdens, what action(s) should the Commission take?  
 Has Seminole met its burden regarding any and all conservation measures taken by or reasonably available to Seminole which would mitigate the need for the proposed power plant?  
 Has Seminole adequately ensured the availability of fuel commodity and

transportation to serve their proposed power plant?

Should the Commission grant Seminole's petition to determine the need for the proposed Seminole plant?

Should this docket be closed?

6. Statement of Ultimate Facts Alleged. I allege that Seminole failed to properly

recognize all risks to ratepayers associated with its build proposal (which is buttressed by the attached testimony), so that, ultimately, Seminole has not met its burden to demonstrate that the proposed Seminole Generating Station Unit 3 electrical power plant is the most cost-effective alternative available to provide new generating capacity. Accordingly, it would be in the ratepayers' best interests to deny Seminole's petition for determination of need, and instead to place into effect protocols that will ensure the selection of the most cost-effective choices.

WHEREFORE, EDWARD DEATON respectfully requests the Commission to enter an Order granting me permission and participate as a party to this proceeding.

Respectfully submitted this 21<sup>st</sup> day of April, 2006

---

EDWARD DEATON  
9601 Miccosukee Road, #25  
Tallahassee, FL 32309  
Telephone: 850-877-6628  
Email: [edde@nettally.com](mailto:edde@nettally.com)

Kay Flynn

060220-EC

**From:** Filings@psc.state.fl.us  
**Sent:** Monday, April 24, 2006 8:34 AM  
**To:** 'john hedrick'; Filings@psc.state.fl.us  
**Cc:** Ed Deaton; Ruth Nettles; Martha Brown; Matilda Sanders  
**Subject:** RE: Petition to Intervene from Edward Deaton, Ratepayer FYI-testimony to follow

Mr. Hedrick, please see "E-Filings How To" on the Commission's Website for instructions on filing electronically. Filings must be submitted as attachments to electronic mail. We will print and process your filing once it is submitted in accordance with e-filing requirements.

Your 4/21/06 e-mail will be placed on the correspondence side of the docket file.

Please let me know if any questions.

Kay Flynn  
 FPSC  
 CCA - Records  
 413-6744  
[kflynn@psc.state.fl.us](mailto:kflynn@psc.state.fl.us)

---

**From:** john hedrick [mailto:johnhedrick13@yahoo.com]  
**Sent:** Friday, April 21, 2006 5:07 PM  
**To:** Filings@psc.state.fl.us  
**Cc:** Ed Deaton; Ruth Nettles  
**Subject:** Fwd: Petition to Intervene from Edward Deaton, Ratepayer FYI-testimony to follow

*john hedrick <johnhedrick13@yahoo.com> wrote:*

Date: Fri, 21 Apr 2006 13:59:41 -0700 (PDT)  
 From: john hedrick <johnhedrick13@yahoo.com>  
 Subject: Petition to Intervene from Edward Deaton, Ratepayer FYI-testimony to follow  
 To: Ruth Nettles <RNettles@PSC.STATE.FL.US>  
 CC: Ed Deaton <edde@nettally.com>

BEFORE THE PUBLIC SERVICE COMMISSION

In re: Petition for  
 Determination Docket  
 No.: 060220-EC  
 of Need for Seminole  
 Generating Filed: April  
 21, 2006

Station Unit 3 electrical power plant in  
 Putnam County, by Seminole Electric  
 Cooperative, Inc.  
PETITION TO INTERVENE OF EDWARD DEATON, RATEPAYER

4/24/2006

Pursuant to Chapter 120, Florida Statutes, Sections 403.519 and 366.07, Florida Statutes, and Rules 25-22.039, 25-22.082, and 28.106.205, Florida Administrative Code ("F.A.C."), Edward Deaton hereby files this Petition to Intervene into this proceeding, and in support, states the following:

1. The name and address of the affected agency are as follows:

Florida Public Service Commission ("Commission")  
2540 Shumard Oak Drive  
Tallahassee, FL 32399-0850

The name and address of Petitioner Edward Deaton are as follows:

Edward Deaton  
9601 Miccosukee Road, #25  
Tallahassee, FL 32309  
Telephone: 850-877-6628  
Email: [edde@nettally.com](mailto:edde@nettally.com)

Copies of all pleadings, notices and orders in this docket should be provided to:

Edward Deaton (information as shown in #2 above)  
John Hedrick  
Panhandle Citizens Coalition  
P.O. Box 6683  
Tallahassee, Fl 32314-6683  
Email: [johnhedrick13@yahoo.com](mailto:johnhedrick13@yahoo.com)

4. Statement of Edward Deaton's substantial interests. I am substantially affected by

this proceeding. I am a ratepayer of Talquin Electric Cooperative ("Talquin"), which is part of Seminole Electric Cooperative, Inc. ("Seminole") who supplies at least in part Talquin's electricity. My participation will assist the Commission in ensuring that the most cost-effective option is secured for not only my but the benefit of all of Seminole's customers and the ultimate ratepayers. To the extent that the decision in this docket may have precedential effect in future proceedings, my participation in this proceeding has that value through intervention. This proceeding involves Seminole's petition filed with the Commission requesting the Commission to issue a determination of need regarding Seminole's proposal to construct Seminole Generating Station Unit 3 electrical power plant on Seminole's current site in Putnam County, Florida. My substantial interests are affected by the necessity to provide cost-effective alternatives to Seminole's build option for providing new electric generation capacity. Inasmuch as a key purpose of this proceeding is to ascertain whether Seminole has proposed the most cost-effective electric generating capacity alternative or addition, my interest is the type of interest that this proceeding is designed to protect and is actually one of the chief purposes of this proceeding. My involvement will help determine whether Seminole has met its burden of proof to demonstrate the cost-effectiveness of its proposal and that the most cost-effective option is secured for the benefit of the ratepayers.

5. Disputed Issues of Material Fact. I anticipate that the disputed issues of material fact in this proceeding will include, but not necessarily be limited to:

Did Seminole take into account all risks to ratepayers associated with their proposed new electric power generation capacity?  
Has Seminole met its burden regarding need for the proposed Seminole Generating Station Unit 3, taking into account the need for electric system reliability and integrity, as this criterion is used in Section 403.519, Florida Statutes?  
Has Seminole met its burden regarding need for the proposed Seminole Generating

Station Unit taking into account the need for adequate electricity at a reasonable cost, as this criterion is used in Section 403.519, Florida Statutes?

Has Seminole met its burden to demonstrate that its proposed build option for its new electric generating capacity is the most cost-effective alternative, from the ratepayers' perspective?

If Seminole has not met its burdens, what action(s) should the Commission take?

Has Seminole met its burden regarding any and all conservation measures taken by or reasonably available to Seminole which would mitigate the need for the proposed power plant?

Has Seminole adequately ensured the availability of fuel commodity and transportation to serve their proposed power plant?

Should the Commission grant Seminole's petition to determine the need for the proposed Seminole plant?

Should this docket be closed?

6. Statement of Ultimate Facts Alleged. I allege that Seminole failed to properly

recognize all risks to ratepayers associated with its build proposal (which is buttressed by the attached testimony), so that, ultimately, Seminole has not met its burden to demonstrate that the proposed Seminole Generating Station Unit 3 electrical power plant is the most cost-effective alternative available to provide new generating capacity. Accordingly, it would be in the ratepayers' best interests to deny Seminole's petition for determination of need, and instead to place into effect protocols that will ensure the selection of the most cost-effective choices.

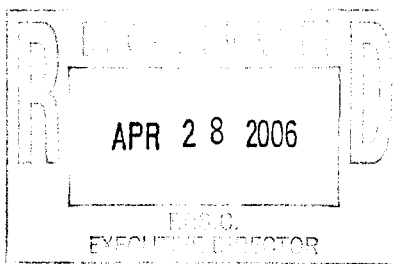
WHEREFORE, EDWARD DEATON respectfully requests the Commission to enter an Order granting me permission and participate as a party to this proceeding.

Respectfully submitted this 21<sup>st</sup> day of April, 2006

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EDWARD DEATON  
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Florida Public Service Commission  
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060220  
April 28, 2006

Re: ~~Docket~~ 060220

RECEIVED - FPSC  
APR 28 PM 1:11  
COMMISSION CLERK

Dear Commissioners,

Studies heard at a number of Public Utility Commissions across the country have shown that the **economic costs** of health and environmental effects of coal plants, not including the cost of global warming, are as high as the generation cost.

Recent studies by insurance companies, analysts, government agencies, and economists have demonstrated that the economic costs of global warming are already comparable to the generation cost - and are increasing exponentially. The costs of stronger storms and sea level rise alone are projected to be of similar magnitude over the next 30 years on an annual basis as the full annual generation cost. Attached is one of many studies documenting the huge social and economic costs of global warming / climate change.

Since credible evidence now places the externality cost of power generation for some fuels as more than the generation cost, it is no longer reasonable or prudent to take only generation cost into account when decisions on power production are made. Economists agree that decisions should be made based on the best estimates of total societal and economic cost for the future period being considered - not on historical data for a **portion** of the total cost under conditions unlikely to be similar to future conditions. The Sierra Club believes that it is time for the Florida Public Service Commission to include externality cost in the decision-making process, and Docket 060220 (Seminole Unit 3) is a good place to start.

Thank you for your consideration.

Sincerely,

Brian Lupiani  
Vice Chair, Florida Sierra Club Energy Committee  
607 McDaniel Street  
Tallahassee FL 32303  
brianlupiani@yahoo.com

cc: Mary Andrews Bane  
Charles Hill  
Tim Devlin

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- COM \_\_\_\_\_
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- SEC \_\_\_\_\_
- OTH Ken P



# Environmental, Social, and Economic Effects of global warming – rising exponentially

## From Wikipedia, the free encyclopedia

[http://en.wikipedia.org/wiki/Effects\\_of\\_global\\_warming#Cost of more extreme weather](http://en.wikipedia.org/wiki/Effects_of_global_warming#Cost_of_more_extreme_weather)

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    - 1.1.1 More extreme weather
    - 1.1.2 Increased evaporation
    - 1.1.3 Cost of more extreme weather
    - 1.1.4 Destabilization of local climates
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  - 1.5 Further global warming (positive feedback)
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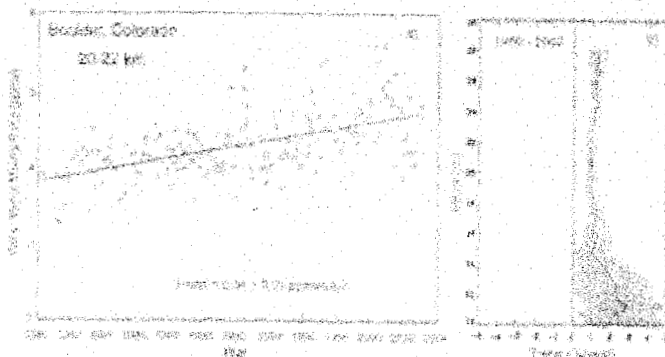
## More extreme weather

The Intergovernmental Panel on Climate Change (IPCC) third annual assessment report "Climate Change 2001" stated "there is no compelling evidence to indicate that the characteristics of tropical and extratropical storms have changed." [6] There is, however, limited evidence from a relatively short time period that storm strength is increasing, such as the Emanuel (2005) "power dissipation index" of hurricane intensity [7]. Worldwide, the proportion of hurricanes reaching categories 4 or 5 – with wind speeds above 56 metres per second – has risen from 20% in the 1970s to 35% in the 1990s.[8] Precipitation hitting the US from hurricanes increased by 7% over the twentieth century [9]. See also Time Magazine's "Global Warming: The Culprit?".

The World Meteorological Organization [10] has suggested a possible link between global warming and increasing extreme weather events, as have Hoyos *et al.* (2006), writing, "the increasing ... number of category 4 and 5 hurricanes ... is directly linked to" increasing temperatures. [11] Hurricane modeling has produced similar results, e.g., "hurricanes, simulated under warmer, high-CO<sub>2</sub> conditions, are more intense ... than under present-day conditions.... greenhouse gas-induced warming may lead to ... increasing ... occurrence of highly destructive category-5 storms." [12] A paper by 14 scientists [13] notes that "research shows very little evidence to support the claim that the rising costs associated with weather ... are associated with changes in [their] frequency or intensity." The IPCC TAR, in 2001, made no strong statements on the issue.

A substantially higher risk of extreme weather does not necessarily mean a noticeably greater risk of slightly-above-average weather [14]. However, the evidence is clear that severe weather and moderate rainfall are also increasing.

Stephen Mwakifwamba, national co-ordinator of the Centre for Energy, Environment, Science and Technology - which prepared the Tanzanian government's climate change report to the UN - says that change is happening in Tanzania right now. "In the past, we had a drought about every 10 years", he says. "Now we just don't know when they will come. They are more frequent, but then so are floods. The climate is far less predictable. We might have floods in May or droughts every three years. Upland areas, which were never affected by mosquitoes, now are. Water levels are decreasing every day. The rains come at the wrong time for farmers and it is leading to many problems" [15].



Increasing water vapor .

### **Increased evaporation**

As the climate grows warmer, evaporation will increase. This may cause heavier rainfall and more erosion, and in more vulnerable tropical areas (especially in Africa), desertification due to deforestation. Many scientists think that it could result in more extreme weather as global warming progresses. The IPCC Third Annual Report says: "...global average water vapour concentration and precipitation are projected to increase during the 21st century. By the second half of the 21st century, it is likely that precipitation will have increased over northern mid- to high latitudes and Antarctica in winter. At low latitudes there are both regional increases and decreases over land areas. Larger year to year variations in precipitation are very likely over most areas where an increase in mean precipitation is projected" [16] [17].

### **Cost of more extreme weather**

The economic impact of extreme weather is rising rapidly both because of increases in the frequency and intensity of extreme weather and because of changes in human behavior. An example of how human behavior has increased exposure to extreme weather is the movement towards greater development along vulnerable seacoasts. The economic impact of hurricanes has increased because there is more development along seacoasts vulnerable to hurricanes. Similarly, the economic impact of floods has increased because there is more development in floodplains.

Choi and Fisher, writing in *Climate Change*, vol. 58 (2003) pp. 149, predict that each 1% increase in annual precipitation would enlarge the cost of catastrophic storms by 2.8%.

The Association of British Insurers has stated that limiting carbon emissions would avoid 80% of the projected additional annual cost of tropical cyclones by the 2080s. The cost is also increasing partly because of building in exposed areas such as coasts and floodplains. The ABI claims that reduction of the vulnerability to some inevitable impacts of climate change, for example through more resilient buildings and improved flood defences, could also result in considerable cost-savings in the longterm. [18]

### **Destabilization of local climates**

The first ever recorded South Atlantic hurricane, "Catarina", hit Brazil in 2004. Although there has been speculation based on satellite intensity estimates that the lowest pressure in Monica (a tropical cyclone which has since made its second Australia landfall) was lower than Wilma's Atlantic basin record of 882 millibars in 2005 and perhaps even Typhoon Tip's world record lowest measured pressure of 870 mb in 1979, with no aircraft reconnaissance in Monica we'll never know for sure. Nor will we know exactly what its winds were and whether some of the official figures that have been cited were overestimations -- I'm always a little skeptical of tropical cyclone winds estimated to be in excess of 200 mph, even in gusts -- but Monica sure was one mighty impressive tropical cyclone at its peak! And unprecedented in the Southern hemisphere.

In the northern hemisphere, the southern part of the Arctic region (home to 4,000,000 people) has experienced a temperature rise 1° to 3° Celsius over the last 50 years. Canada, Alaska and Russia are experiencing initial melting of permafrost. This may disrupt ecosystems and by increasing bacterial activity in the soil lead to these areas becoming carbon sources instead of carbon sinks [19]. A study (published in *Science*) of changes to eastern Siberia's permafrost suggests that it is gradually disappearing in the southern regions, leading to the loss of nearly 11% of Siberia's nearly 11,000 lakes since 1971 [20]. At the same time, western Siberia is at the initial stage where melting permafrost is creating new lakes, which will eventually start disappearing as in the east. Western Siberia is the world's largest peat bog, and the melting of its permafrost is likely to lead to the release, over decades, of large quantities of methane—creating an additional source of greenhouse gas emissions [21].

Hurricanes were thought to be an entirely north Atlantic phenomenon. In April 2004, the first Atlantic hurricane to form south of the Equator hit Brazil with 40 m/s (144 km/h) winds; monitoring systems may have to be extended 1,600 km (1000 miles) further south [22].

## **Oceans**

### **Sea level rise**

*Main article: sea level rise.*

With increasing average global temperature, the water in the oceans expands in volume, and additional water enters them which had previously been locked up on land in glaciers and the polar ice caps. An increase of 1.5 to 4.5 °C is estimated to lead to an increase of 15 to 95 cm (IPCC 2001).

The sea level has risen more than 120 metres since the peak of the last ice age about 18,000 years ago. The bulk of that occurred before 6000 years ago. From 3000 years ago to the start of the 19th century, sea level was almost constant, rising at 0.1 to 0.2 mm/yr; since 1900, the level has risen at 1–2 mm/yr [23]; since 1992, satellite altimetry from TOPEX/Poseidon indicates a rate of about 3 mm/yr [24].

## Temperature rise

The temperature of the Antarctic Southern Ocean rose by 0.17 °C (0.31 °F) between the 1950s and the 1980s, nearly twice the rate for the world's oceans as a whole [25]. As well as effects on ecosystems (eg by melting sea ice, affecting algae that grow on its underside), warming could reduce the ocean's ability to absorb CO<sub>2</sub>.

More important for the United States may be the temperature rise in the Gulf of Mexico. As hurricanes cross the warm Loop Current coming up from South America, they can gain great strength in under a day (as did Hurricane Katrina and Hurricane Rita in 2005), with water above 85 degrees F seemingly promoting Category 5 storms.

## Acidification

*Main article: ocean acidification.*

The world's oceans soak up much of the carbon dioxide produced by living organisms, either as dissolved gas, or in the skeletons of tiny marine creatures that fall to the bottom to become chalk or limestone. Oceans currently absorb about one metric tonne of CO<sub>2</sub> per person per year. It is estimated that the oceans have absorbed around half of all CO<sub>2</sub> generated by human activities since 1800 (120,000,000,000 tonnes or 120 petagrams of carbon) [26].

But in water, carbon dioxide becomes a weak carbonic acid, and the increase in the greenhouse gas since the industrial revolution has already lowered the average pH (the laboratory measure of acidity) of seawater by 0.1 units on the 14-point scale, to 8.2. Predicted emissions could lower it by a further 0.5 by 2100, to a level not seen for millions of years. [27]

There are concerns that increasing acidification could have a particularly detrimental effect on corals [28] (16% of the world's coral reefs have died from bleaching since 1998 [29]) and other marine organisms with calcium carbonate shells. Increased acidity may also directly affect the growth and reproduction of fish as well as the plankton on which they rely on for food [30].

## Shutdown of thermohaline circulation

*Main article: Shutdown of thermohaline circulation.*

There is some speculation that global warming could, via a shutdown or slowdown of the thermohaline circulation, trigger localised cooling in the North Atlantic and lead to cooling, or lesser warming, in that region. This would affect in particular areas like Scandinavia and Britain that are warmed by the North Atlantic drift. The chances of this occurring are unclear; there is some evidence for the stability of the Gulf Stream and possible weakening of the North Atlantic drift. There is, however, no evidence for cooling in northern Europe or nearby seas; quite the reverse.

## Ecosystems

Rising temperatures are beginning to impact on ecosystems. Butterflies have shifted their ranges northward by 200 km in Europe and North America. Plants lag behind, and larger animals' migration is slowed down by cities and highways. In Britain, spring butterflies are appearing an average of 6 days earlier than two decades ago [31]. In the Arctic, the waters of Hudson Bay are ice-free for three weeks longer than they were thirty years ago, affecting polar bears, which do not hunt on land [32].

Two 2002 studies in *Nature* (vol 421) [33] surveyed the scientific literature to find recent changes in range or seasonal behaviour by plant and animal species. Of species showing recent change, 4 out of 5 shifted their ranges towards the poles or higher altitudes, creating "refugee species". Frogs were breeding, flowers blossoming and birds migrating an average 2.3 days earlier each decade; butterflies, birds and plants moving towards the poles by 6.1 km per decade [34]. A 2005 study concludes human activity is the cause of the temperature rise and resultant changing species behaviour, and links these effects with the predictions of climate models to provide validation for them [35]. Grass has become established in Antarctica for the first time. [36]

Forests in some regions potentially face an increased risk of forest fires. The 10-year average of boreal forest burned in North America, after several decades of around 10,000 km<sup>2</sup> (2.5 million acres), has increased steadily since 1970 to more than 28,000 km<sup>2</sup> (7 million acres) annually. [37]. This change may be due in part to changes in forest management practices.

## Ecological productivity

Increasing average temperature and carbon dioxide may have the effect, up to a point, of improving ecosystems' productivity. Atmospheric carbon dioxide is rare in comparison to oxygen (less than 1% of air compared to 21% of air). This carbon dioxide starvation becomes apparent in photorespiration, where there is so little carbon dioxide, that oxygen can enter a plant's chloroplasts and takes the place where carbon dioxide normally would be in the Calvin Cycle. This causes the sugars being made to be destroyed, badly suppressing growth. Satellite data shows that the productivity of the northern hemisphere has increased since 1982 (although attribution of this increase to a specific cause is difficult).

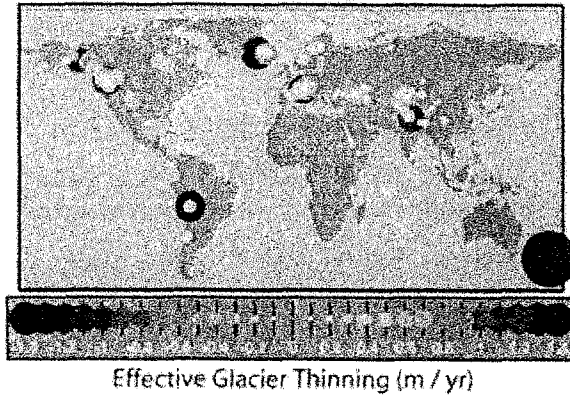
IPCC models predict that higher CO<sub>2</sub> concentrations would only spur growth of flora up to a point, because in many regions the limiting factors are water or nutrients, not temperature or CO<sub>2</sub>; after that, greenhouse effects and warming would continue but there would be no compensatory increase in growth.

Research done by the Swiss Canopy Crane Project suggests that slow-growing trees only are stimulated in growth for a short period under higher CO<sub>2</sub> levels, while faster growing

plants like liana benefit in the long term. In general, but especially in rain forests, this means that liana become the prevalent species; and because they decompose much faster than trees their carbon content is more quickly returned to the atmosphere. Slow growing trees incorporate atmospheric carbon for decades.

## Glacier Retreat

Mountain Glacier Changes Since 1970



A map of the change in thickness of mountain glaciers since 1970. Thinning in orange and red, thickening in blue.



Lewis Glacier, North Cascades, WA USA is one of five glaciers in the area that melted away

In historic times, glaciers grew during the Little Ice Age, a cool period from about 1550 to 1850. Subsequently, until about 1940, glaciers around the world retreated as climate warmed. Glacier retreat declined and reversed, in many cases, from 1950 to 1980 as a slight global cooling occurred. Since 1980, glacier retreat has become increasingly rapid and ubiquitous, so much so that it has threatened the existence of many of the glaciers of the world. This process has increased markedly since 1995. [38]

The total surface area of glaciers worldwide has decreased by 50% since the end of the 19th century [39]. Currently glacier retreat rates and mass balance losses have been increasing in the Andes, Alps, Himalaya's, Rocky Mountains and North Cascades. As of

March 2005, the snow cap that has covered the top of Mount Kilimanjaro for the past 11,000 years since the last ice age has almost disappeared [40].

The loss of glaciers not only directly causes landslides, flash floods and glacial lake overflow[41], but also increases annual variation in water flows in rivers. Glacier runoff declines in the summer as glaciers decrease in size, this decline is already observable in several regions [42]. Glaciers retain water on mountains in high precipitation years, since the snow cover accumulating on glaciers protects the ice from melting. In warmer and drier years, glaciers offset the lower precipitation amounts with a higher meltwater input [43].

The recession of mountain glaciers, notably in Western North America, Franz-Josef Land, Asia, the Alps, Indonesia and Africa, and tropical and sub-tropical regions of South America, has been used to provide qualitative support to the rise in global temperatures since the late 19th century. Many glaciers are being lost to melting further raising concerns about future local water resources in these glacierized areas. The Lewis Glacier, North Cascades pictured at right after melting away in 1990 is one of the 47 North Cascade glaciers observed and all are retreating [44].

Despite their proximity and importance to human populations, the mountain and valley glaciers of temperate latitudes amount to a small fraction of glacial ice on the earth. About 99% is in the great ice sheets of polar and subpolar Antarctica and Greenland. These continuous continental-scale ice sheets, 3 km (1.8 miles) or more in thickness, cap the polar and subpolar land masses. Like rivers flowing from an enormous lake, numerous outlet glaciers transport ice from the margins of the ice sheet to the ocean.

Glacier retreat has been observed in these outlet glaciers, resulting in an increase of the ice flow rate. In Greenland the period since the year 2000 has brought retreat to several very large glaciers that had long been stable. Three glaciers that have been researched, Helheim, Jakobshavns and Kangerdlugssuaq Glaciers, jointly drain more than 16% of the Greenland Ice Sheet. Satellite images and aerial photographs from the 1950s and 1970s show that the front of the glacier had remained in the same place for decades. But in 2001 it began retreating rapidly, retreating 7.2 km (4.5 miles) between 2001 and 2005. It has also accelerated from 20 m (65 ft)/day to 32 m (104 ft)/day.[45] Jakobshavn Isbræ in west Greenland is generally considered the fastest moving glacier in the world. It had been moving continuously at speeds of over 24 m (78 ft)/day with a stable terminus since at least 1950. In 2002, the 12 km (7.5 mile) long floating terminus entered a phase of rapid retreat. The ice front started to break up and the floating terminus disintegrated accelerating to a retreat rate of over 30 m (98 ft)/day. The acceleration rate of retreat of Kangerdlugssuaq Glacier is even larger. Portions of the main trunk that were flowing at 15 m (49 ft)/day in 1988-2001 were flowing at 40 m (131 ft)/day in summer 2005. The front of the glacier has also retreated and has rapidly thinned by more than 100 m (328 ft).[46]

Glacier retreat and acceleration is also apparent on two important outlet glaciers of the West Antarctic Ice Sheet. Pine Island Glacier, which flows into the Amundsen Sea



thinned  $3.5 \pm 0.9$  m ( $11.5 \pm 3$  ft) per year and retreated five kilometers (3.1 miles) in 3.8 years. The terminus of the glacier is a floating ice shelf and the point at which it is afloat is retreating 1.2 km/year. This glacier drains a substantial portion of the West Antarctic Ice Sheet and has been referred to as the weak underbelly of this ice sheet. [47] This same pattern of thinning is evident on the neighboring Thwaites Glacier.

### **Further global warming (positive feedback)**

Some effects of global warming themselves contribute directly to further global warming.

#### **Methane release from melting permafrost peat bogs**

Wikinews has news related to:

#### **Scientists warn thawing Siberia may trigger global meltdown**

Climate scientists reported in August 2005 that a one million square kilometer region of permafrost peat bogs in western Siberia is starting to melt for the first time since it was formed 11,000 years ago at the end of the last ice age. This will release methane, an extremely effective greenhouse gas, possibly as much as 70,000 million tonnes, over the next few decades. An earlier report in May 2005 reported similar melting in eastern Siberia [48].

This positive feedback was not known about in 2001 when the IPCC issued its last major report on climate change. The discovery of permafrost peat bogs melting in 2005 implies that warming is likely to happen faster than was predicted in 2001.

#### **Carbon cycle feedbacks**

There have been predictions, and some evidence, that global warming might cause loss of carbon from terrestrial ecosystems, leading to an increase of atmospheric CO<sub>2</sub> levels. Several climate models indicate that global warming through the 21st could be accelerated by the response of the terrestrial carbon cycle to such warming [49]. The strongest feedbacks in these cases are due to increased respiration of carbon from soils throughout the high latitude boreal forests of the Northern Hemisphere. One model in particular (HadCM3) indicates a secondary carbon cycle feedback due to the loss of much of the Amazon rainforest in response to significantly reduced precipitation over tropical South America [50]. While models disagree on the strength of any terrestrial carbon cycle feedback, they each suggest any such feedback would accelerate global warming.

Observations show that soils in England have been losing carbon at the rate of four million tonnes a year for the past 25 years [51] according to a paper in Nature by Bellamy et al. in September 2005, who note that these results are unlikely to be explained by land use changes. Results such as this rely on a dense sampling network and thus are not available on a global scale. Extrapolating to all of the United Kingdom, they estimate

annual losses of 13 million tons per year. This is as much as the annual reductions in carbon dioxide emissions achieved by the UK under the Kyoto Treaty (12.7 million tons of carbon per year).<sup>[52]</sup>

## Forest Fires

Rising Global temperature might cause forest fires to occur on larger scale, and more regularly. This releases more stored carbon into the atmosphere than the carbon cycle can naturally re-absorb, as well as reducing the overall forest area on the planet, creating a positive feedback loop. Part of that feedback loop is more rapid growth of replacement forests and a northward migration of forests as northern latitudes become more suitable climates for sustaining forests. There is a question of whether the burning of renewable fuels such as forests should be counted as contributing to global warming.

(Climate Change and Fire)

(Climate Roulette: Loss of Carbon Sinks & Positive Feedbacks)

(EPA: Global Warming: Impacts: Forests)

(Feedback Cycles linking forests, climate and landuse activities)

## Consequences

See also *Mitigation of global warming*

### Economic

In addition to direct damages from extreme weather, there are other economic effects of global warming.

### Decline of agriculture

*Main article: Global warming and agriculture.*

For some time it was hoped that a positive effect of global warming would be increased agricultural yields, because of the role of carbon dioxide in photosynthesis, especially in preventing photorespiration, which is responsible for significant destruction of several crops. In Iceland, rising temperatures have made possible the widespread sowing of barley, which was untenable twenty years ago. Some of the warming is due to a local (possibly temporary) effect via ocean currents from the Caribbean, which have also affected fish stocks <sup>[53]</sup>.

Whilst local benefits may be felt in some regions (such as Siberia), recent evidence is that global yields will be negatively affected. "Rising atmospheric temperatures, longer droughts and side-effects of both, such as higher levels of ground-level ozone gas, are likely to bring about a substantial reduction in crop yields in the coming decades, large-scale experiments have shown" (*The Independent*, April 27, 2005, "Climate change poses threat to food supply, scientists say" - report on this event).

Moreover, the region likely to be worst affected is Africa, both because its geography makes it particularly vulnerable, and because seventy per cent of the population rely on rain-fed agriculture for their livelihoods. Tanzania's official report on climate change suggests that the areas that usually get two rainfalls in the year will probably get more, and those that get only one rainy season will get far less. The net result is expected to be that 33% less maize—the country's staple crop—will be grown [54].

## **Insurance**

An industry very directly affected by the risks is the insurance industry; the number of major natural disasters has trebled since the 1960s, and insured losses increased fifteen-fold in real terms (adjusted for inflation) [55]. According to one study, 35–40% of the worst catastrophes have been climate change related (ERM, 2002). Over the past three decades, the proportion of the global population affected by weather-related disasters has doubled in linear trend, rising from roughly 2% in 1975 to 4% in 2001 (ERM, 2002).

A June 2004 report by the Association of British Insurers declared "Climate change is not a remote issue for future generations to deal with. It is, in various forms, here already, impacting on insurers' businesses now". It noted that weather risks for households and property were already increasing by 2-4 % per year due to changing weather, and that claims for storm and flood damages in the UK had doubled to over £6 billion over the period 1998–2003, compared to the previous five years. The results are rising insurance premiums, and the risk that in some areas flood risk insurance will become unaffordable for some.

In the United States, insurance losses have also greatly increased, but according to one study those increases are attributed to increased population and property values in vulnerable coastal areas. (*Science*, 284, 1943-1947).

## **Transport**

Roads, airport runways, railway lines and pipelines, (including oil pipelines, sewers, water mains etc) may require increased maintenance and renewal as they become subject to greater temperature variation, and, in areas with permafrost, subject to subsidence [56].

## **Flood defense**

For historical reasons to do with trade, many of the world's largest and most prosperous cities are on the coast, and the cost of building better coastal defenses (due to the rising sea level) is likely to be considerable. Some countries will be more affected than others - low-lying countries such as Bangladesh and the Netherlands would be worst hit by any sea level rise, in terms of floods or the cost of preventing them.

In developing countries, the poorest often live on flood plains, because it is the only available space, or fertile agricultural land. These settlements often lack infrastructure

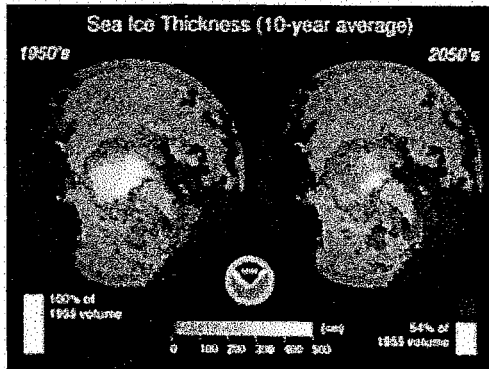
such as dykes and early warning systems. Poorer communities also tend to lack the insurance, savings or access to credit needed to recover from disasters [57].

## Migration

Some Pacific Ocean island nations, such as Tuvalu, are concerned about the possibility of an eventual evacuation, as flood defense may become economically inviable for them. Tuvalu already has an ad hoc agreement with New Zealand to allow phased relocation [58].

In the 1990s a variety of estimates placed the number of environmental refugees at around 25 million. (Environmental refugees are not included in the official definition of refugees, which only includes migrants fleeing persecution.) The Intergovernmental Panel on Climate Change (IPCC), which advises the world's governments under the auspices of the UN, estimated that 150 million environmental refugees will exist in the year 2050, due mainly to the effects of coastal flooding, shoreline erosion and agricultural disruption. (150 million means 1.5 percent of 2050's predicted 10 billion world population.)[59]

## Northwest Passage



Melting Arctic ice may open the Northwest Passage in summer, which would cut 5,000 nautical miles (9,000 km) from shipping routes between Europe and Asia. This would be of particular relevance for supertankers which are too big to fit through the Panama Canal and currently have to go around the tip of South America. According the Canadian Ice Service, the amount of ice in Canada's eastern Arctic Archipelago decreased by 15 percent between 1969 and 2004 [60].

While the reduction of summer ice in the Arctic may be a boon to shipping, this same phenomenon threatens the Arctic ecosystem, most notably polar bears which depend on ice floes. Subsistence hunters such as the Inuit peoples will find their livelihoods and cultures increasingly threatened as the ecosystem changes due to global warming.

## Development

The combined effects of global warming may impact particularly harshly on people and countries without the resources to mitigate those effects. This may slow economic development and poverty reduction, and make it harder to achieve the Millennium Development Goals [61], [62].

In October 2004 the Working Group on Climate Change and Development, a coalition of development and environment NGOs, issued a report Up in Smoke on the effects of climate change on development. This report, and the July 2005 report Africa - Up in Smoke? predicted increased hunger and disease due to decreased rainfall and severe weather events, particularly in Africa. These are likely to have severe impacts on development for those affected.

## **Environmental**

Secondary evidence of global warming — reduced snow cover, rising sea levels, weather changes — provides examples of consequences of global warming that may influence not only human activities but also ecosystems. Increasing global temperature means that ecosystems may change; some species may be forced out of their habitats (possibly to extinction) because of changing conditions, while others may flourish. Few of the terrestrial ecoregions on Earth could expect to be unaffected.

Increasing carbon dioxide may (up to a point) increase ecosystems' productivity; but the interaction with other aspects of climate change, means the environmental impact of this is unclear. An increase in the total amount of biomass produced is not necessarily all good, since biodiversity can still decrease even though a smaller number of species are flourishing.

## **Water scarcity**

Eustatic sea level rises threaten to contaminate groundwater, affecting drinking water and agriculture in coastal zones. Increased evaporation will reduce the effectiveness of reservoirs. Increased extreme weather means more water falls on hardened ground unable to absorb it - leading to flash floods instead of a replenishment of soil moisture or groundwater levels. In some areas, shrinking glaciers threaten the water supply [63].

Higher temperatures will also increase the demand for water for cooling purposes.

In the Sahel, there has been on average a 25 per cent decrease in annual rainfall over the past 30 years.

## **Health**

### **Direct effects of temperature rise**

Rising temperatures have two opposing direct effects on mortality: higher temperatures in winter reduce deaths from cold; higher temperatures in summer increase heat-related

deaths. The distribution of these changes obviously differs. Palutikof et al calculate that in England and Wales for a 1 °C temperature rise the reduced deaths from cold outweigh the increased deaths from heat, resulting in a reduction in annual average mortality of 7000.

The European heat wave of 2003 killed 22,000–35,000 people, based on normal mortality rates (Schär and Jendritzky, 2004). It can be said with 90% confidence that past human influence on climate was responsible for at least half the risk of the 2003 European summer heat-wave (Stott et al 2004).

If average temperatures increase by 1 degree Celsius, there will be an estimated 24,000 additional murders in the U.S. each year (as the additional heat stress leads to more frequent rage). (New Scientist 11/5/02, review of *Body Heat* by Mark Blumberg.)

### **Spread of disease**

Global warming is expected to extend the favourable zones for vectors conveying infectious disease such as malaria [64]. In poorer countries, this may simply lead to higher incidence of such diseases. In richer countries, where such diseases have been eliminated or kept in check by vaccination, draining swamps and using pesticides, the consequences may be felt more in economic than health terms, if greater spending on preventative measures is required [65].

### **Impacts of glacier retreat**

The continued retreat of glaciers will have a number of different quantitative impacts. In areas that are heavily dependent on water runoff from glaciers that melt during the warmer summer months, a continuation of the current retreat will eventually deplete the glacial ice and substantially reduce or eliminate runoff. A reduction in runoff will affect the ability to irrigate crops and will reduce summer stream flows necessary to keep dams and reservoirs replenished. This situation is particularly acute for irrigation in South America, where numerous artificial lakes are filled almost exclusively by glacial melt. <sup>(BBC)</sup> Central Asian countries have also been historically dependent on the seasonal glacier melt water for irrigation and drinking supplies. In Norway, the Alps, and the Pacific Northwest of North America, glacier runoff is important for hydropower.

Many species of freshwater and saltwater plants and animals are dependent on glacier-fed waters to ensure a cold water habitat that they have adapted to. Some species of freshwater fish need cold water to survive and to reproduce, and this is especially true with Salmon and Cutthroat trout. Reduced glacier runoff can lead to insufficient stream flow to allow these species to thrive. Ocean krill, a cornerstone species, prefer cold water and are the primary food source for aquatic mammals such as the Sperm whale. <sup>(CBS)</sup> Alterations to the ocean currents, due to increased freshwater inputs from glacier melt, and the potential alterations to thermohaline circulation of the world's oceans, may impact existing fisheries upon which humans depend as well.

The potential for major sea level rise is mostly dependent on a significant melting of the polar ice caps of Greenland and Antarctica, as this is where the vast majority of glacial ice is located. The British Antarctic Survey has determined from climate modeling that for at least the next 50 years, snowfall on the continent of Antarctica should continue to exceed glacial losses from global warming. The amount of glacial loss on the continent of Antarctica is not increasing significantly, and it is not known if the continent will experience a warming or a cooling trend, although the Antarctic Peninsula has warmed in recent years, causing glacier retreat in that region.<sup>(BAS)</sup> If all the ice on the polar ice caps were to melt away, the oceans of the world would rise an estimated 70 m (229 ft). However, with little major melt expected in Antarctica, sea level rise of not more than 0.5 m (1.6 ft) is expected through the 21st century, with an average annual rise of 0.0004 m (0.0013 ft) per year. Thermal expansion of the world's oceans will contribute, independent of glacial melt, enough to double those figures.<sup>(NSIDC2)</sup>

## See also

- Climate change
- Global warming
- Mitigation of global warming
- Adaptation to global warming
- National Assessment on Climate Change for the United States
- Arctic Climate Impact Assessment
- Loop Current of the Gulf of Mexico

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## External links

- "Anthropogenic Effects on Tropical Cyclone Activity" (Kerry Emanuel)
- "The Climate of Man", *The New Yorker* (2005): [Part 1](#), [Part 2](#), [Part 3](#)
- Pezza, Alexandre Bernardes and Ian Simmonds (Aug 2005). "The first South Atlantic hurricane: Unprecedented blocking, low shear and climate change". *Geophysical Research Letters* 32 (L15712).
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- American Meteorological Society's Environmental Science Seminar Series (Oct 2005): "Hurricanes: Are They Changing and Are We Adequately Prepared for the Future?"
  - "How are hurricanes changing with global warming?" (Kevin Trenberth)
  - "Changes in hurricane intensity in a warming environment" (Judith Curry)
  - "Hurricanes and Climate" (Kerry Emanuel)
- Munich Re: World Map of Natural Hazards
- Oliver James, *The Guardian*, June 30, 2005 [Face the facts: For many people climate change is too depressing to think about, and some prefer to simply pretend it doesn't exist](#)
- Mark Lynas, *The Guardian*, March 31, 2004, ["Vanishing worlds"](#)
- Peter Schwartz and Doug Randall, Global Business Network, "An Abrupt Climate Change Scenario and Its Implications for United States National Security", A report commissioned by the U.S. Defense Department, October 2003 ([executive summary](#))
- Effects of global warming on skiing
- Stabilisation 2005 conference: survey of scientific papers
- Elevated levels of atmospheric CO<sub>2</sub> decrease the nutritional value of plants
- Royal Society, 30 June 2005, ["Ocean acidification due to increasing atmospheric carbon dioxide"](#)
- Time Magazine's "Global Warming: The Culprit?" (Time Magazine, October 3, 2005, pages 42-46)
- The Evidence Linking Hurricanes and Climate Change: Interview with Judith Curry
- Hurricanes and Global Warming Review of most recent *Nature* and *Science* data.
- Recent ice sheet growth in the interior of Greenland
- Increased temperature and salinity in the Nordic Seas



# Insurance Industry

<http://yosemite.epa.gov/OAR/globalwarming.nsf/content/ActionsIndustryInsurance.html>

While the effects of climate change will impact every segment of the business community, the insurance industry is especially at risk. Extreme weather events of the past several years have – in addition to their human toll – caused tens of billions of dollars in losses for insurers. Given development and population trends in high-risk areas, potential future impacts of global warming – such as sea level rise and increased storm activity and severity – could prove far more costly.

- There were *four times as many natural catastrophes* in the 1990s as there were three decades ago.
- Insured *losses from natural disasters* are 15 times higher today than they were in the 1960s, even after adjusting for inflation.
- The total dollars paid out in *natural disaster-related claims* since 1990 is 50 percent greater than the losses incurred over the past 40 years combined.
- People are moving to places like Florida at the rate of 1,000 per day, substantially increasing the *value of the property* in these high-risk areas.

Lawrence Berkley National Laboratory— this DOE sponsored site describes how increasing energy efficiency has the dual benefit of reducing insurance losses and mitigating global warming. <http://eetd.lbl.gov/insurance/>

Surviving Disaster with Renewable Energy— this National Renewable Energy Laboratory sponsored site focuses on the role of renewables in emergency preparedness and response, disaster mitigation and relief, and sustainable development. [http://www.nrel.gov/surviving\\_disaster/](http://www.nrel.gov/surviving_disaster/)

General Re— Provides a search engine dedicated to the insurance industry that returns links to information relevant to the insurance industry including natural catastrophes and other disasters. <http://www.genre.com/sharedfile/pdf/NAArticleIndex200602-en.pdf>

Swiss Re Group— Swiss Re Research and Publications - Climate Change Roundtable, - Explains Swiss Re's philosophy and provides links to environmental information, organizations and business initiatives and in-depth focus reports. <http://www.swissre.com/>

U.S. Insurance Companies Staggering Under Global Warming Increasing Damages <http://www.ens-newswire.com/ens/sep2005/2005-09-13-04.asp>

***Global warming called insurance peril: State regulators and scientists warn of huge losses from climate shifts.***

<http://www.sacbee.com/content/business/story/13538388p-14378761c.html>

# State Insurance Commissioners Calculate Global Warming Pricetag

WASHINGTON - The decision to set up a task force to assess global warming effects on the insurance industry, taken by the National Association of Insurance Commissioners (NAIC), came during the same week that the world's biggest insurance broker, Marsh & McLennan, briefed its corporate clients, which include roughly 75 percent of the "Fortune 500" biggest companies, on the potential impact of global warming on their businesses.

According to a December 2005 study, U.S. insurers have seen a 15-fold increase in insured losses from catastrophic weather events in the past three decades, increases that have far outstripped the growth in premiums, population and inflation over the same time period.

"It's becoming clearer that we are experiencing more frequent and more powerful weather events that pose huge challenges for the insurance industry," according to Tim Wager, director of Nebraska's Department of Insurance and co-chairman of the new task force set up by NAIC, which originally scheduled the initiative for approval at a meeting in New Orleans that was then cancelled due to Hurricane Katrina.

"The impacts are being felt on our coasts and in the interior U.S.," he added. "We're seeing all kinds of extreme weather in the Great Plains states, including drought, tornadoes, brushfires and severe hailstorms." The task force will review whether U.S. insurers have adequately considered the consequences on their industry, including its solvency, if current trends that are believed to be related to global warming continue or intensify, according to Washington State insurance commissioner Mike Kreidler. "We had a statewide drought emergency in Washington last year," he said, noting its impact on the state's agriculture and ski industries. "As scientists predict this trend to continue, I'm concerned with the impact these changes will have on insurance availability and costs." In the U.S. system, individual states, rather than the federal government, regulate the insurance industry.

## **SCARY STATISTICS** Dr. Greg Forbes, Severe Weather Expert

Not only have there been many more tornadoes than average in 2006, but many have been strong tornadoes. That goes a long way toward explaining why there have been so many fatalities from tornadoes this year. **There have been 49 deaths directly caused by tornadoes**, plus one more person who had a heart attack in an area not directly hit by a tornado. **Last year at this time there had only been 5 deaths**, and there were only 39 for the whole year.

**There have been 22 F3 tornadoes thus far this year and one F4. Last year at this time there had only been 3 F3 tornadoes. The first (and only) F4 of the year in 2005 did not occur until November 15.**

Over the years, there has been a very strong relationship between tornado strength and the number of tornado deaths. **Only 6% of all tornadoes in a decade rate F3 or stronger in intensity.** They have winds estimated above about 158 mph. However, **these tornadoes have caused 87% of the tornado deaths.**

Homes are not built to withstand those excessive wind speeds. Building codes are not higher than 90 mph in most parts of the country, so contractors are not required to build homes to resist winds stronger than that. As a standard safety rule, we tell you to go to the lowest, innermost portion (preferably the basement) of a well-built home. But the rest of the story, as one radio personality says, is that even there you are not absolutely safe if you get hit by one of those top-strength tornadoes.

Cover story

# Off the grid or on, solar and wind power gain

## Incentives, savings push more families to renewable energy

By Paul Davidson  
USA TODAY

WILMINGTON, Vt.— The wind whips up in Dale Doucette's expansive backyard, furiously spinning the blades on his 80-foot-tall silver wind turbine and leaving a broad smile on his square-jawed face.

The gusts nudge the voltage on his battery bank and help power Doucette's wood-carving saw, as well as the PC, printer and recessed lights in his wife Michele's home-based chiropractic office.

But overcast skies mean the Doucettes' 10 solar panels won't be as productive as usual. So his two teenage sons can use the computer but not the TV or GameCube.

"I'm the power Nazi," Doucette, 47, says as the turbine blades emit a shrill hum on a late March afternoon.

The Doucettes live off the power grid, but they're far from granola-crunching hippies eking out a bare-bones existence in the hinterlands. They live in a sleek \$500,000 plaster-and-tile house a quarter mile from electric lines and could have hooked in for \$10,000. Instead, they opted to pay about \$41,000 for their own solar and wind energy systems.

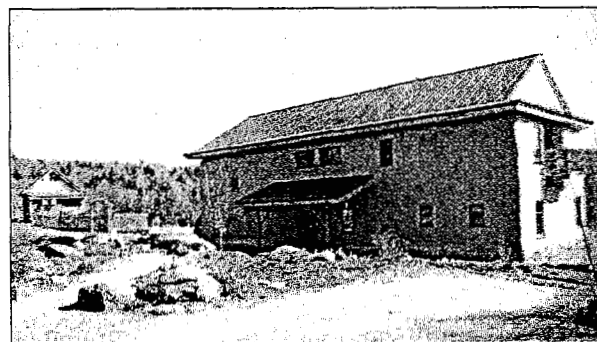
"We want to be as self-sustaining as possible and get out from under Big Brother," Doucette says. "I enjoy not getting an electric bill."

Amid soaring electricity prices, the renewable energy industry is increasingly being driven by families such as the Doucettes who choose to be off the grid for environmental or political reasons and by a



Photos by Nancy Palmieri for USA TODAY

**"Power" station:** Dale Doucette, with cat Nitro, stands near the windmill on his property that supplements solar panels that provide power for his home.



**Elbow room:** Dale and Michele Doucette's home is powered by a solar power system in the shed, left.

Please see COVER STORY next page ▶

# 17 states offer rebates on solar or wind systems

Continued from 1B

much faster-rising number of Americans adding solar and wind systems to grid-connected houses. Such equipment used to be bought almost exclusively by off-the-grid-dwellers in remote rural reaches who couldn't afford fees of \$30,000 or more to tie in to electric lines.

Now, in 27 states, homeowners on the grid can get state rebates or tax breaks that subsidize up to 50% or more of the cost of clean energy systems. They then sell the electricity they generate, but don't use themselves, to utilities, offsetting the cost of the power they draw from the grid as they spin their meters backward and drive their electric bills toward zero.

Seventeen states, and some power companies themselves, now offer utility customers rebates on the purchase and installation of solar or wind systems, up from three in 2000. Florida and Pennsylvania are among those considering rebates. Meanwhile, the number of states with "net metering" laws — which permit customers to sell the power they produce to the electric utility at retail rates — has nearly doubled to 36 in the past six years.

Despite a hodgepodge of state laws, the trend points up a budding

**"I love living off the grid and being independent. I wanted to live on a large piece of property out in the country."**

— Sunny Tappan

grass-roots movement to displace at least some of the nation's power generation from pollution-belching plants to small, clean neighborhood nodes. That eases strains on transmission lines. Some 180,000 families live off-grid, a figure that has jumped 33% a year for a decade, says Richard Perez, publisher of *Home Power* magazine.

Yet, thanks to the incentives, another 27,000 grid-connected houses supplement the utility's power with their own energy systems, most of which are solar, says the Interstate Renewable Energy Council and the American Wind Energy Association. Perez expects the number of utility customers using clean energy to overtake off-the-grid households in a decade.

"It's accelerating very quickly," says Michael Eckhart, of the American Council on Renewable Energy.

The movement got an added jolt in January when utility customers could start taking advantage of a new \$2,000 federal tax credit for solar power system purchases as part of the Energy Policy Act of 2005.

After soaring 30% a year the past five years, sales of solar, or photovoltaic, systems could ratchet even higher this year. Bob-O Schultze, owner of Electron Connection in Northern California, says solar sales have risen 50% annually since 2002. About 75% of his business is from on-grid customers, vs. just 1% four years ago.

## Off the grid

For decades, dealers in small solar and wind systems depended on the small band of mavericks who moved off the grid to live in the countryside, where land is plentiful and inexpensive. California, Washington, Oregon, Colorado, Vermont and Maine have long been havens, though people live off the grid in almost every state.

"These are people who want a big garden, have no close neighbors and the only land they can afford is beyond the reaches of the grid," Perez, an off-gridder himself, says. Property without utility hook-ups, he adds, can cost about a third less than a standard lot. These days, a growing number of off-grid-dwellers could link up fairly cheaply but prefer to be untethered for myriad reasons, including rising electricity rates, a desire to cut power plant pollution and concerns about blackouts or terrorism.

The Wilmington area, in rural southern Vermont, nestled at the foothills of the Green Mountains is speckled with off-grid homes on back roads where the area's criss-

crossing power lines don't reach.

Doucette, a wood carver, and some friends built his 3,200-square-foot house four years ago on a 22-acre, tree-rimmed property, moving from a smaller grid-tied house a few miles away. Considering his old electric bill ran to \$1,700 a year and was certain to go higher, Doucette figures his green energy system will pay for itself in 20 years. But money was not at the heart of their decision.

"We made a conscious choice not to get on the grid," Doucette says, noting he has long been rankled by the electricity price increases of the local resort town during ski season and by periodic winter blackouts.

Like other off-grid-dwellers, Doucette uses his gleaming blue solar panels on the roof of a small shed about 150 feet from his house, as his main energy source. The turbine, another 300 feet away, provides added juice on cloudy days when the wind is swirling.

The power generated by both solar and wind systems is stored in 24 batteries in a bin in the shed. An inverter converts the DC current produced by the systems to the AC current used in homes. The batteries could last several days in the unlikely event there is neither sun nor wind. A backup propane generator kicks in if the batteries get low.

Like other clean-energy homes, Doucette's two-story, earth-toned house is built for conservation, with energy-efficient refrigerator and dishwasher, low-voltage light bulbs and straw-bale insulation.

In nearby Marlboro, Sunny and Nat Tappan live in an older-style off-grid home, about 2½ miles up a hill off a dirt road on an isolated 90-acre tract. The rustic, timber-frame house, which sits next to a pasture with sheep and chickens, has a composting toilet and no running water (they have a well). Sunny and her former husband bought the property 18 years ago and spent a few thousand dollars on a solar power system. Connecting to the power grid would have cost \$80,000, but Sunny, 53, had no interest anyway.

"I love living off the grid and being independent," she says. "I wanted to live on a large piece of property out in the country."

## Cover story

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Four small solar panels angled on brackets in a garden few feet from the back door supply 680 watts of power. But noting she has no TV, dishwasher or washing machine, Sunny says that's more than enough. "We use very little electricity." And if it's persistently cloudy? "So I don't vacuum one week," she says.

For others, living off the grid is a matter of principle. Maynard Kaufman, 77, who lives in a saltbox house on a farm near Bangor, Mich., could have connected to the grid for \$10,000. Instead, he spent \$30,000 on a solar power system and \$12,700 on two wind turbines. Noting he had demonstrated in front of the local nuclear plant, he said, "It was totally a matter of conscience."

### On the grid

For many utility customers, installing an alternative energy system largely boils down to the dollars and cents that state incentives help them save.

California was the first state to offer a generous package of renewable-energy incentives for homes and businesses in the late 1990s as power companies were deregulated. It's blessed with abundant sunshine and plagued by high electric rates and an overtaxed grid that led to rolling blackouts.

By 2002, California was offering households 60% rebates on solar power systems, as well as tax credits, letting homeowners pay less than 30% of retail cost. Residents send much of their solar energy into the grid during the day when they're not home, easing peak demands, and draw from it at night when the sun isn't shining.

Demand for solar power has surged, with about 15,000 utility customers installing systems, and last year the state cut the rebate to 35%. The goal is to use rebates to drive so much demand that solar prices plunge, and the rebates can be phased out. But a worldwide shortage of solar panels, spurred by even-more-generous incentives in Japan and Germany, is keeping prices high until more factories are built in 18 months.

New Jersey is the only other state with a solar incentive program to match California's. Rebates cover more than 50% of a solar power system's cost. Plus, households can sell credits for the energy they produce to utilities to meet state clean energy quotas. The program "helps reduce peak demands, and that helps dramatically," says Jeanne Fox, president of the New Jersey Board of Public Utilities. "Our goal is to drive energy generation and a lot of that is to be distributed" in neighborhoods to improve power-plant reliability and security.

# Energy laws vary from state to state

## Renewable energy incentives

States with tax breaks or rebates for residents who buy clean-energy systems and those with net metering laws permitting consumers to sell power they generate to electric companies at retail rates.

State	State rebates	Net metering	State income tax incentives
Alabama			■
Arizona			■
Arkansas		■	
California	■	■	■
Colorado		■	
Connecticut	■	■	
Delaware	■	■	
District of Columbia		■	
Florida			
Georgia		■	
Hawaii		■	■
Idaho			■
Illinois	■		
Indiana		■	
Iowa		■	■
Kentucky		■	
Louisiana		■	
Maine	■		
Maryland	■	■	■
Massachusetts	■	■	■
Michigan		■	
Minnesota	■	■	
Montana		■	■
Nevada	■	■	
New Hampshire		■	
New Jersey	■	■	
New Mexico		■	■
New York	■	■	■
North Carolina		■	■
North Dakota		■	■
Ohio		■	
Oklahoma		■	
Oregon	■	■	■
Pennsylvania		■	
Puerto Rico			
Rhode Island	■	■	■
South Carolina	■		
Texas		■	
Utah		■	■
Vermont	■	■	
Virginia		■	
Washington		■	
Wisconsin	■	■	
Wyoming	■	■	

Sources: North Carolina Solar Center, Interstate Renewable Energy Council

By Paul Davidson  
USA TODAY

The USA is a patchwork of alternative energy laws in which some states offer much more generous incentives than others for homeowners and businesses to install solar or wind systems.

Renewable energy representatives say the inconsistency hampers mass adoption, keeping prices high.

Thirty-five states and Washington, D.C., allow homeowners who generate their own electricity to sell their surplus to utilities at retail rates. They can offset the power they draw from the grid with what they send in, driving their bills toward zero.

But some states have more consumer-friendly rules than others. California and New Jersey, for instance, let homeowners roll over electricity credits into the next month's bill for a year. In others, such as Massachusetts and Arkansas, a customer who generates a surplus in a given month is paid a much lower, wholesale rate. Just 17 states offer rebates on solar or wind systems. Solar industry officials blame big utilities that don't want to relinquish market share and wield huge influence with state legislatures.

"It's frustrating that you don't have consistency across all 50 states," says Rhone Resch, head of the Solar Energy Industries Association.

Tom Dyer of Kyocera Solar, the No. 3 maker, says, "What I would really like to see is a federal (rebate) program" modeled after those in Japan and Germany.

But the Energy Department's Craig Stevens says, "A lot of this is handled regionally by state law. There wouldn't really be a role for the federal government."

Instead, he says, the White House wants to lower costs with improved technology. President Bush has proposed a 78% jump in solar research funding.

Meanwhile, some utilities say current laws are unfair to them and to other ratepayers. In Northern California, Pacific Gas and Electric says it should not be forced to pay customers retail rates for their surplus electricity. Customers are simply providing raw energy that doesn't account for transmission-line costs.

"We should pay you the wholesale rate for ... your electricity," says Bruce Bowen, PG&E director of regulatory policy. Other ratepayers, he says, subsidize the gap between the two rates. The subsidy, now negligible, could total about 50 cents monthly in eight to 10 years when more people use clean energy systems.

Bowen's argument doesn't account for the fact that energy produced by homes and businesses eases strains on power lines during peak midday periods, says V. John White, who heads the Center for Energy Efficiency and Renewable Technologies in California. "It's quality power that strengthens the grid," he says.

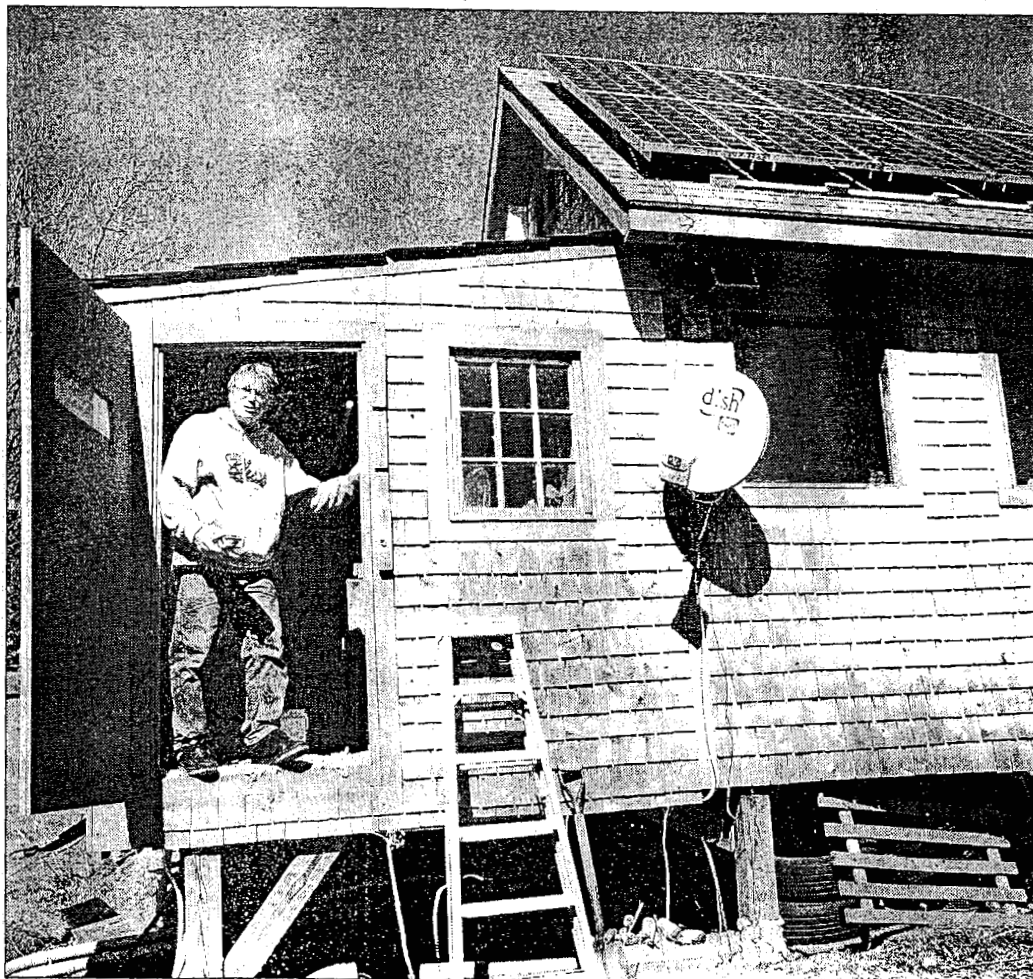
Other states with rebate programs include New York, Massachusetts, Illinois and Rhode Island, where electricity prices are high.

Clark Beebe, 57, of Springfield, N.J., bought a \$50,000 solar power system two years ago for \$15,000 after rebates, installing it on the roof of his four-bedroom house. Because he offsets what he uses with what he pumps into the grid, his annual power bill has dropped from \$1,270 to \$170, though he also installed energy-saving appliances. His \$1,100 yearly savings is supplemented by \$500 in clean energy credits, cutting the payback period for his system to nine years.

After that, he'll effectively net at least a \$200-a-year profit. "I am now an electricity company," says Beebe 57. "Plus, I'm generating electricity without any pollutants."

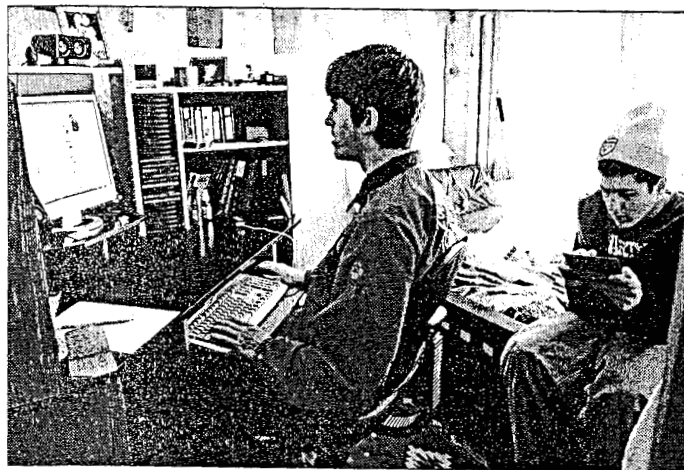
Carrie Buczeke, 42, of Livermore, Calif., rolled the cost of her \$54,000 solar panels — \$25,000 after rebates and tax credits — into a home-equity loan. She has wiped out her \$400 monthly electric bill and pays \$300 a month for the loan. After seven years, the loan will be paid off. "It was such a no-brainer," she says.





Photos by Nancy Palmieri for USA TODAY

**Doing double duty:** Dale Doucette climbs down from a small shed that contains the solar panels that provide all the power needs for his home. The shed also houses his chickens.



**On the Net, but not on the grid:** Justin Doucette, 17, left, works at his computer, while his friend, Stephan Ruiz, 16, uses a handheld device.

FLORIDA PUBLIC SERVICE COMMISSION

Chief Advisor to Chairman Edgar

*Roberta S. Bass*

2540 Shumard Oak Boulevard ♦ Tallahassee, Florida 32399-0854

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E-mail: rbass@psc.state.fl.us

Kay,

Please place the enclosed in the correspondence side of Docket No. 060220, if it hasn't already been done.

Thank you,

*Roberta*

060220

Florida Public Service Commission  
2540 Shumard Oak Blvd  
Tallahassee, FL 32399

April 28, 2006  
RECEIVED-PPSC

06 MAY -2 AM 11:18

Re: Docket 060220

COMMISSION  
CLERK

Dear Commissioners,

Studies heard at a number of Public Utility Commissions across the country have shown that the **economic** costs of health and environmental effects of coal plants, not including the cost of global warming, are as high as the generation cost.

Recent studies by insurance companies, analysts, government agencies, and economists have demonstrated that the economic costs of global warming are already comparable to the generation cost - and are increasing exponentially. The costs of stronger storms and sea level rise alone are projected to be of similar magnitude over the next 30 years on an annual basis as the full annual generation cost. Attached is one of many studies documenting the huge social and economic costs of global warming / climate change.

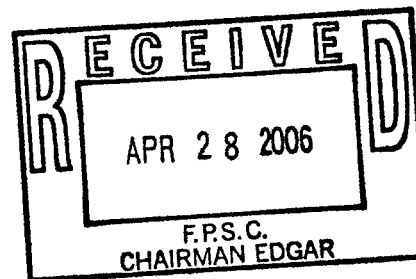
Since credible evidence now places the externality cost of power generation for some fuels as more than the generation cost, it is no longer reasonable or prudent to take only generation cost into account when decisions on power production are made. Economists agree that decisions should be made based on the best estimates of total societal and economic cost for the future period being considered - not on historical data for a **portion** of the total cost under conditions unlikely to be similar to future conditions. The Sierra Club believes that it is time for the Florida Public Service Commission to include externality cost in the decision-making process, and Docket 060220 (Seminole Unit 3) is a good place to start.

Thank you for your consideration.

Sincerely,



Brian Lupiani  
Vice Chair, Florida Sierra Club Energy Committee  
607 McDaniel Street  
Tallahassee FL 32303  
brianlupiani@yahoo.com



cc: Mary Andrews Bane  
Charles Hill  
Tim Devlin



Cover story

# Off the grid or on, solar and wind power gain

## Incentives, savings push more families to renewable energy

By Paul Davidson  
USA TODAY

WILMINGTON, Vt.— The wind whips up in Dale Doucette's expansive backyard, furiously spinning the blades on his 80-foot-tall silver wind turbine and leaving a broad smile on his square-jawed face.

The gusts nudge the voltage on his battery bank and help power Doucette's wood-carving saw, as well as the PC, printer and recessed lights in his wife Michele's home-based chiropractic office.

But overcast skies mean the Doucettes' 10 solar panels won't be as productive as usual. So his two teenage sons can use the computer but not the TV or GameCube.

"I'm the power Nazi," Doucette, 47, says as the turbine blades emit a shrill hum on a late March afternoon.

The Doucettes live off the power grid, but they're far from granola-crunching hippies eking out a bare-bones existence in the hinterlands. They live in a sleek \$500,000 plaster-and-tile house a quarter mile from electric lines and could have hooked in for \$10,000. Instead, they opted to pay about \$41,000 for their own solar and wind energy systems.

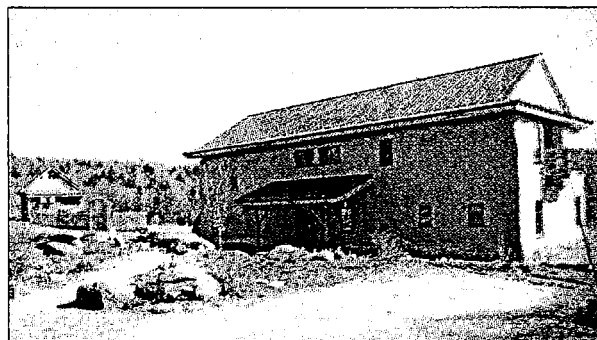
"We want to be as self-sustaining as possible and get out from under Big Brother," Doucette says. "I enjoy not getting an electric bill."

Amid soaring electricity prices, the renewable energy industry is increasingly being driven by families such as the Doucettes who choose to be off the grid for environmental or political reasons and by a



Photos by Nancy Palmieri for USA TODAY

**"Power" station:** Dale Doucette, with cat Nitro, stands near the windmill on his property that supplements solar panels that provide power for his home.



**Elbow room:** Dale and Michele Doucette's home is powered by a solar power system in the shed, left.

Please see COVER STORY next page ▶

# 17 states offer rebates on solar or wind systems

Continued from 1B

much faster-rising number of Americans adding solar and wind systems to grid-connected houses. Such equipment used to be bought almost exclusively by off-the-grid-dwellers in remote rural reaches who couldn't afford fees of \$30,000 or more to tie in to electric lines.

Now, in 27 states, homeowners on the grid can get state rebates or tax breaks that subsidize up to 50% or more of the cost of clean energy systems. They then sell the electricity they generate, but don't use themselves, to utilities, offsetting the cost of the power they draw from the grid as they spin their meters backward and drive their electric bills toward zero.

Seventeen states, and some power companies themselves, now offer utility customers rebates on the purchase and installation of solar or wind systems, up from three in 2000. Florida and Pennsylvania are among those considering rebates. Meanwhile, the number of states with "net metering" laws — which permit customers to sell the power they produce to the electric utility at retail rates — has nearly doubled to 36 in the past six years.

Despite a hodgepodge of state laws, the trend points up a budding

**"I love living off the grid and being independent. I wanted to live on a large piece of property out in the country."**

— Sunny Tappan

grass-roots movement to displace at least some of the nation's power generation from pollution-belching plants to small, clean neighborhood nodes. That eases strains on transmission lines. Some 180,000 families live off-grid, a figure that has jumped 33% a year for a decade, says Richard Perez, publisher of *Home Power* magazine.

Yet, thanks to the incentives, another 27,000 grid-connected houses supplement the utility's power with their own energy systems, most of which are solar, says the Interstate Renewable Energy Council and the American Wind Energy Association. Perez expects the number of utility customers using clean energy to overtake off-the-grid households in a decade.

"It's accelerating very quickly," says Michael Eckhart, of the American Council on Renewable Energy.

The movement got an added jolt in January when utility customers could start taking advantage of a new \$2,000 federal tax credit for solar power system purchases as part of the Energy Policy Act of 2005.

After soaring 30% a year the past five years, sales of solar, or photovoltaic, systems could ratchet even higher this year. Bob-O Schultze, owner of Electron Connection in Northern California, says solar sales have risen 50% annually since 2002. About 75% of his business is from on-grid customers, vs. just 1% four years ago.

## Off the grid

For decades, dealers in small solar and wind systems depended on the small band of mavericks who moved off the grid to live in the countryside, where land is plentiful and inexpensive. California, Washington, Oregon, Colorado, Vermont and Maine have long been havens, though people live off the grid in almost every state.

"These are people who want a big garden, have no close neighbors and the only land they can afford is beyond the reaches of the grid," Perez, an off-gridder himself, says. Property without utility hook-ups, he adds, can cost about a third less than a standard lot. These days, a growing number of off-gridders could link up fairly cheaply but prefer to be untethered for myriad reasons, including rising electricity rates, a desire to cut power plant pollution and concerns about blackouts or terrorism.

The Wilmington area, in rural southern Vermont, nestled at the foothills of the Green Mountains is speckled with off-grid homes on back roads where the area's criss-

crossing power lines don't reach.

Doucette, a wood carver, and some friends built his 3,200-square-foot house four years ago on a 22-acre, tree-rimmed property, moving from a smaller grid-tied house a few miles away. Considering his old electric bill ran to \$1,700 a year and was certain to go higher, Doucette figures his green energy system will pay for itself in 20 years. But money was not at the heart of their decision.

"We made a conscious choice not to get on the grid," Doucette says, noting he has long been rankled by the electricity price increases of the local resort town during ski season and by periodic winter blackouts.

Like other off-gridders, Doucette uses his gleaming blue solar panels on the roof of a small shed about 150 feet from his house, as his main energy source. The turbine, another 300 feet away, provides added juice on cloudy days when the wind is swirling.

The power generated by both solar and wind systems is stored in 24 batteries in a bin in the shed. An inverter converts the DC current produced by the systems to the AC current used in homes. The batteries could last several days in the unlikely event there is neither sun nor wind. A backup propane generator kicks in if the batteries get low.

Like other clean-energy homes, Doucette's two-story, earth-toned house is built for conservation, with energy-efficient refrigerator and dishwasher, low-voltage light bulbs and straw-bale insulation.

In nearby Marlboro, Sunny and Nat Tappan live in an older-style off-grid home, about 2½ miles up a hill off a dirt road on an isolated 90-acre tract. The rustic, timber-frame house, which sits next to a pasture with sheep and chickens, has a composting toilet and no running water (they have a well). Sunny and her former husband bought the property 18 years ago and spent a few thousand dollars on a solar power system. Connecting to the power grid would have cost \$80,000, but Sunny, 53, had no interest anyway.

"I love living off the grid and being independent," she says. "I wanted to live on a large piece of property out in the country."

**Cover story**

\*\*

Four small solar panels angled on brackets in a garden few feet from the back door supply 680 watts of power. But noting she has no TV, dishwasher or washing machine, Sunny says that's more than enough. "We use very little electricity." And if it's persistently cloudy? "So I don't vacuum one week," she says.

For others, living off the grid is a matter of principle. Maynard Kaufman, 77, who lives in a saltbox house on a farm near Bangor, Mich., could have connected to the grid for \$10,000. Instead, he spent \$30,000 on a solar power system and \$12,700 on two wind turbines. Noting he had demonstrated in front of the local nuclear plant, he said, "It was totally a matter of conscience."

### On the grid

For many utility customers, installing an alternative energy system largely boils down to the dollars and cents that state incentives help them save.

California was the first state to offer a generous package of renewable-energy incentives for homes and businesses in the late 1990s as power companies were deregulated. It's blessed with abundant sunshine and plagued by high electric rates and an overtaxed grid that led to rolling blackouts.

By 2002, California was offering households 60% rebates on solar power systems, as well as tax credits, letting homeowners pay less than 30% of retail cost. Residents send much of their solar energy into the grid during the day when they're not home, easing peak demands, and draw from it at night when the sun isn't shining.

Demand for solar power has surged, with about 15,000 utility customers installing systems, and last year the state cut the rebate to 35%. The goal is to use rebates to drive so much demand that solar prices plunge, and the rebates can be phased out. But a worldwide shortage of solar panels, spurred by even-more-generous incentives in Japan and Germany, is keeping prices high until more factories are built in 18 months.

New Jersey is the only other state with a solar incentive program to match California's. Rebates cover more than 50% of a solar power system's cost. Plus, households can sell credits for the energy they produce to utilities to meet state clean energy quotas. The program "helps reduce peak demands, and that helps dramatically," says Jeanne Fox, president of the New Jersey Board of Public Utilities. "Our goal is to drive energy generation and a lot of that is to be distributed" in neighborhoods to improve power-plant reliability and security.

# Energy laws vary from state to state

## Renewable energy incentives

States with tax breaks or rebates for residents who buy clean-energy systems and those with net metering laws permitting consumers to sell power they generate to electric companies at retail rates.

State	State rebates	Net metering	State income tax incentives
Alabama			■
Arizona			■
Arkansas		■	
California	■	■	■
Colorado		■	
Connecticut	■	■	
Delaware	■	■	
District of Columbia		■	
Florida			
Georgia		■	
Hawaii		■	■
Idaho			■
Illinois	■		
Indiana		■	
Iowa		■	■
Kentucky		■	
Louisiana		■	
Maine	■		
Maryland	■	■	■
Massachusetts	■	■	■
Michigan		■	
Minnesota	■	■	
Montana		■	■
Nevada	■	■	
New Hampshire		■	
New Jersey	■	■	
New Mexico		■	■
New York	■	■	■
North Carolina	■	■	■
North Dakota		■	■
Ohio		■	
Oklahoma		■	
Oregon	■	■	■
Pennsylvania		■	
Puerto Rico			
Rhode Island	■	■	■
South Carolina	■		
Texas		■	
Utah		■	■
Vermont	■	■	
Virginia		■	
Washington		■	
Wisconsin	■	■	
Wyoming	■	■	

Sources: North Carolina Solar Center, Interstate Renewable Energy Council

By Paul Davidson  
USA TODAY

The USA is a patchwork of alternative energy laws in which some states offer much more generous incentives than others for homeowners and businesses to install solar or wind systems.

Renewable energy representatives say the inconsistency hampers mass adoption, keeping prices high.

Thirty-five states and Washington, D.C., allow homeowners who generate their own electricity to sell their surplus to utilities at retail rates. They can offset the power they draw from the grid with what they send in, driving their bills toward zero.

But some states have more consumer-friendly rules than others. California and New Jersey, for instance, let homeowners roll over electricity credits into the next month's bill for a year. In others, such as Massachusetts and Arkansas, a customer who generates a surplus in a given month is paid a much lower, wholesale rate. Just 17 states offer rebates on solar or wind systems. Solar industry officials blame big utilities that don't want to relinquish market share and wield huge influence with state legislatures.

"It's frustrating that you don't have consistency across all 50 states," says Rhone Resch, head of the Solar Energy Industries Association.

Tom Dyer of Kyocera Solar, the No. 3 maker, says, "What I would really like to see is a federal (rebate) program" modeled after those in Japan and Germany.

But the Energy Department's Craig Stevens says, "A lot of this is handled regionally by state law. There wouldn't really be a role for the federal government."

Instead, he says, the White House wants to lower costs with improved technology. President Bush has proposed a 78% jump in solar research funding.

Meanwhile, some utilities say current laws are unfair to them and to other ratepayers. In Northern California, Pacific Gas and Electric says it should not be forced to pay customers retail rates for their surplus electricity. Customers are simply providing raw energy that doesn't account for transmission-line costs.

"We should pay you the wholesale rate for . . . your electricity," says Bruce Bowen, PG&E director of regulatory policy. Other ratepayers, he says, subsidize the gap between the two rates. The subsidy, now negligible, could total about 50 cents monthly in eight to 10 years when more people use clean energy systems.

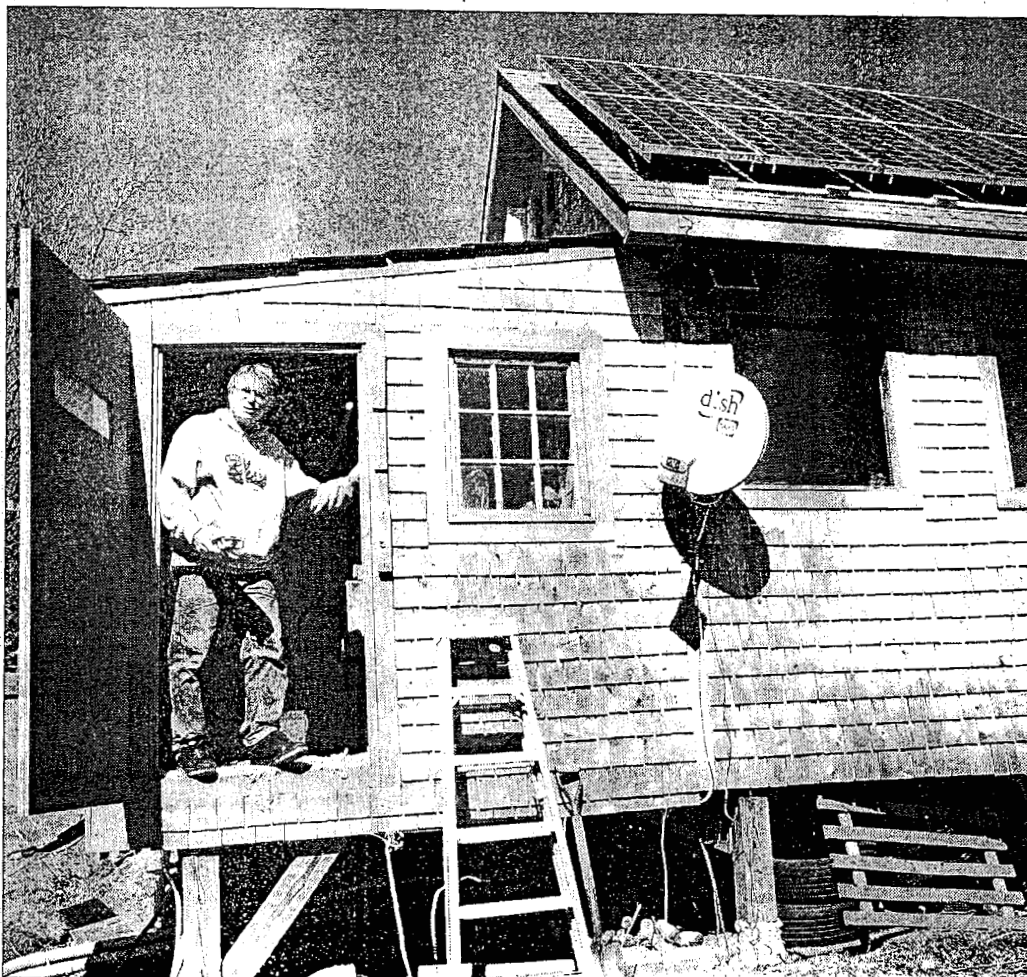
Bowen's argument doesn't account for the fact that energy produced by homes and businesses eases strains on power lines during peak midday periods, says V. John White, who heads the Center for Energy Efficiency and Renewable Technologies in California. "It's quality power that strengthens the grid," he says.

Other states with rebate programs include New York, Massachusetts, Illinois and Rhode Island, where electricity prices are high.

Clark Beebe, 57, of Springfield, N.J., bought a \$50,000 solar power system two years ago for \$15,000 after rebates, installing it on the roof of his four-bedroom house. Because he offsets what he uses with what he pumps into the grid, his annual power bill has dropped from \$1,270 to \$170, though he also installed energy-saving appliances. His \$1,100 yearly savings is supplemented by \$500 in clean energy credits, cutting the payback period for his system to nine years.

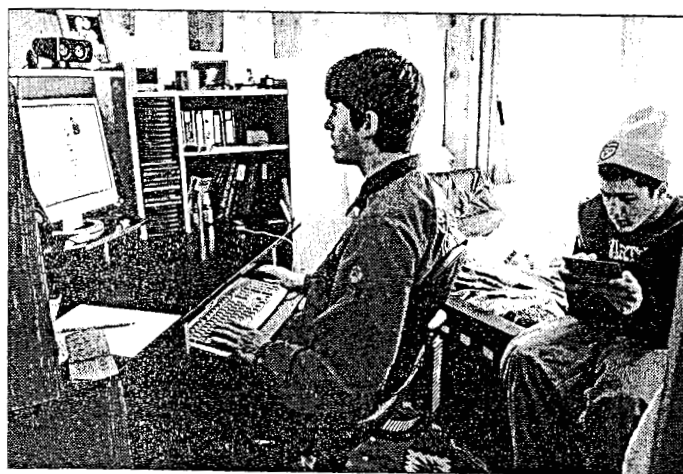
After that, he'll effectively net at least a \$200-a-year profit. "I am now an electricity company," says Beebe 57. "Plus, I'm generating electricity without any pollutants."

Carrie Buczeke, 42, of Livermore, Calif., rolled the cost of her \$54,000 solar panels — \$25,000 after rebates and tax credits — into a home-equity loan. She has wiped out her \$400 monthly electric bill and pays \$300 a month for the loan. After seven years, the loan will be paid off. "It was such a no-brainer," she says.



Photos by Nancy Palmieri for USA TODAY

**Doing double duty:** Dale Doucette climbs down from a small shed that contains the solar panels that provide all the power needs for his home. The shed also houses his chickens.



**On the Net, but not on the grid:** Justin Doucette, 17, left, works at his computer, while his friend, Stephan Ruiz, 16, uses a handheld device.

# Environmental, Social, and Economic Effects of global warming – rising exponentially

## From Wikipedia, the free encyclopedia

[http://en.wikipedia.org/wiki/Effects\\_of\\_global\\_warming#Cost\\_of\\_more\\_extreme weather](http://en.wikipedia.org/wiki/Effects_of_global_warming#Cost_of_more_extreme_weather)

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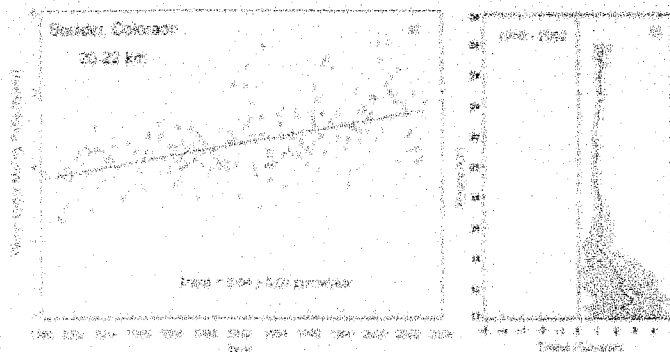
## More extreme weather

The Intergovernmental Panel on Climate Change (IPCC) third annual assessment report "Climate Change 2001" stated "there is no compelling evidence to indicate that the characteristics of tropical and extratropical storms have changed." [6] There is, however, limited evidence from a relatively short time period that storm strength is increasing, such as the Emanuel (2005) "power dissipation index" of hurricane intensity [7]. Worldwide, the proportion of hurricanes reaching categories 4 or 5 – with wind speeds above 56 metres per second – has risen from 20% in the 1970s to 35% in the 1990s.[8] Precipitation hitting the US from hurricanes increased by 7% over the twentieth century [9]. See also Time Magazine's "Global Warming: The Culprit?".

The World Meteorological Organization [10] has suggested a possible link between global warming and increasing extreme weather events, as have Hoyos *et al.* (2006), writing, "the increasing ... number of category 4 and 5 hurricanes ... is directly linked to increasing temperatures. [11] Hurricane modeling has produced similar results, e.g., "hurricanes, simulated under warmer, high-CO<sub>2</sub> conditions, are more intense ... than under present-day conditions.... greenhouse gas-induced warming may lead to ... increasing ... occurrence of highly destructive category-5 storms." [12] A paper by 14 scientists [13] notes that "research shows very little evidence to support the claim that the rising costs associated with weather ... are associated with changes in [their] frequency or intensity." The IPCC TAR, in 2001, made no strong statements on the issue.

A substantially higher risk of extreme weather does not necessarily mean a noticeably greater risk of slightly-above-average weather [14]. However, the evidence is clear that severe weather and moderate rainfall are also increasing.

Stephen Mwakifwamba, national co-ordinator of the Centre for Energy, Environment, Science and Technology - which prepared the Tanzanian government's climate change report to the UN - says that change is happening in Tanzania right now. "In the past, we had a drought about every 10 years", he says. "Now we just don't know when they will come. They are more frequent, but then so are floods. The climate is far less predictable. We might have floods in May or droughts every three years. Upland areas, which were never affected by mosquitoes, now are. Water levels are decreasing every day. The rains come at the wrong time for farmers and it is leading to many problems" [15].



Increasing water vapor .



## **Increased evaporation**

As the climate grows warmer, evaporation will increase. This may cause heavier rainfall and more erosion, and in more vulnerable tropical areas (especially in Africa), desertification due to deforestation. Many scientists think that it could result in more extreme weather as global warming progresses. The IPCC Third Annual Report says: "...global average water vapour concentration and precipitation are projected to increase during the 21st century. By the second half of the 21st century, it is likely that precipitation will have increased over northern mid- to high latitudes and Antarctica in winter. At low latitudes there are both regional increases and decreases over land areas. Larger year to year variations in precipitation are very likely over most areas where an increase in mean precipitation is projected" [16] [17].

## **Cost of more extreme weather**

The economic impact of extreme weather is rising rapidly both because of increases in the frequency and intensity of extreme weather and because of changes in human behavior. An example of how human behavior has increased exposure to extreme weather is the movement towards greater development along vulnerable seacoasts. The economic impact of hurricanes has increased because there is more development along seacoasts vulnerable to hurricanes. Similarly, the economic impact of floods has increased because there is more development in floodplains.

Choi and Fisher, writing in *Climate Change*, vol. 58 (2003) pp. 149, predict that each 1% increase in annual precipitation would enlarge the cost of catastrophic storms by 2.8%.

The Association of British Insurers has stated that limiting carbon emissions would avoid 80% of the projected additional annual cost of tropical cyclones by the 2080s. The cost is also increasing partly because of building in exposed areas such as coasts and floodplains. The ABI claims that reduction of the vulnerability to some inevitable impacts of climate change, for example through more resilient buildings and improved flood defences, could also result in considerable cost-savings in the longterm. [18]

## **Destabilization of local climates**

The first ever recorded South Atlantic hurricane, "Catarina", hit Brazil in 2004. Although there has been speculation based on satellite intensity estimates that the lowest pressure in Monica (a tropical cyclone which has since made its second Australia landfall) was lower than Wilma's Atlantic basin record of 882 millibars in 2005 and perhaps even Typhoon Tip's world record lowest measured pressure of 870 mb in 1979, with no aircraft reconnaissance in Monica we'll never know for sure. Nor will we know exactly what its winds were and whether some of the official figures that have been cited were overestimations -- I'm always a little skeptical of tropical cyclone winds estimated to be in excess of 200 mph, even in gusts -- but Monica sure was one mighty impressive tropical cyclone at its peak! And unprecedented in the Southern hemisphere.

In the northern hemisphere, the southern part of the Arctic region (home to 4,000,000 people) has experienced a temperature rise 1° to 3° Celsius over the last 50 years. Canada, Alaska and Russia are experiencing initial melting of permafrost. This may disrupt ecosystems and by increasing bacterial activity in the soil lead to these areas becoming carbon sources instead of carbon sinks [19]. A study (published in *Science*) of changes to eastern Siberia's permafrost suggests that it is gradually disappearing in the southern regions, leading to the loss of nearly 11% of Siberia's nearly 11,000 lakes since 1971 [20]. At the same time, western Siberia is at the initial stage where melting permafrost is creating new lakes, which will eventually start disappearing as in the east. Western Siberia is the world's largest peat bog, and the melting of its permafrost is likely to lead to the release, over decades, of large quantities of methane—creating an additional source of greenhouse gas emissions [21].

Hurricanes were thought to be an entirely north Atlantic phenomenon. In April 2004, the first Atlantic hurricane to form south of the Equator hit Brazil with 40 m/s (144 km/h) winds; monitoring systems may have to be extended 1,600 km (1000 miles) further south [22].

## **Oceans**

### **Sea level rise**

*Main article: sea level rise.*

With increasing average global temperature, the water in the oceans expands in volume, and additional water enters them which had previously been locked up on land in glaciers and the polar ice caps. An increase of 1.5 to 4.5 °C is estimated to lead to an increase of 15 to 95 cm (IPCC 2001).

The sea level has risen more than 120 metres since the peak of the last ice age about 18,000 years ago. The bulk of that occurred before 6000 years ago. From 3000 years ago to the start of the 19th century, sea level was almost constant, rising at 0.1 to 0.2 mm/yr; since 1900, the level has risen at 1–2 mm/yr [23]; since 1992, satellite altimetry from TOPEX/Poseidon indicates a rate of about 3 mm/yr [24].



## Temperature rise

The temperature of the Antarctic Southern Ocean rose by 0.17 °C (0.31 °F) between the 1950s and the 1980s, nearly twice the rate for the world's oceans as a whole [25]. As well as effects on ecosystems (eg by melting sea ice, affecting algae that grow on its underside), warming could reduce the ocean's ability to absorb CO<sub>2</sub>.

More important for the United States may be the temperature rise in the Gulf of Mexico. As hurricanes cross the warm Loop Current coming up from South America, they can gain great strength in under a day (as did Hurricane Katrina and Hurricane Rita in 2005), with water above 85 degrees F seemingly promoting Category 5 storms.

## Acidification

*Main article: ocean acidification.*

The world's oceans soak up much of the carbon dioxide produced by living organisms, either as dissolved gas, or in the skeletons of tiny marine creatures that fall to the bottom to become chalk or limestone. Oceans currently absorb about one metric tonne of CO<sub>2</sub> per person per year. It is estimated that the oceans have absorbed around half of all CO<sub>2</sub> generated by human activities since 1800 (120,000,000,000 tonnes or 120 petagrams of carbon) [26].

But in water, carbon dioxide becomes a weak carbonic acid, and the increase in the greenhouse gas since the industrial revolution has already lowered the average pH (the laboratory measure of acidity) of seawater by 0.1 units on the 14-point scale, to 8.2. Predicted emissions could lower it by a further 0.5 by 2100, to a level not seen for millions of years. [27]

There are concerns that increasing acidification could have a particularly detrimental effect on corals [28] (16% of the world's coral reefs have died from bleaching since 1998 [29]) and other marine organisms with calcium carbonate shells. Increased acidity may also directly affect the growth and reproduction of fish as well as the plankton on which they rely on for food [30].

## Shutdown of thermohaline circulation

*Main article: Shutdown of thermohaline circulation.*

There is some speculation that global warming could, via a shutdown or slowdown of the thermohaline circulation, trigger localised cooling in the North Atlantic and lead to cooling, or lesser warming, in that region. This would affect in particular areas like Scandinavia and Britain that are warmed by the North Atlantic drift. The chances of this occurring are unclear; there is some evidence for the stability of the Gulf Stream and possible weakening of the North Atlantic drift. There is, however, no evidence for cooling in northern Europe or nearby seas; quite the reverse.

## Ecosystems

Rising temperatures are beginning to impact on ecosystems. Butterflies have shifted their ranges northward by 200 km in Europe and North America. Plants lag behind, and larger animals' migration is slowed down by cities and highways. In Britain, spring butterflies are appearing an average of 6 days earlier than two decades ago [31]. In the Arctic, the waters of Hudson Bay are ice-free for three weeks longer than they were thirty years ago, affecting polar bears, which do not hunt on land [32].

Two 2002 studies in *Nature* (vol 421) [33] surveyed the scientific literature to find recent changes in range or seasonal behaviour by plant and animal species. Of species showing recent change, 4 out of 5 shifted their ranges towards the poles or higher altitudes, creating "refugee species". Frogs were breeding, flowers blossoming and birds migrating an average 2.3 days earlier each decade; butterflies, birds and plants moving towards the poles by 6.1 km per decade [34]. A 2005 study concludes human activity is the cause of the temperature rise and resultant changing species behaviour, and links these effects with the predictions of climate models to provide validation for them [35]. Grass has become established in Antarctica for the first time. [36]

Forests in some regions potentially face an increased risk of forest fires. The 10-year average of boreal forest burned in North America, after several decades of around 10,000 km<sup>2</sup> (2.5 million acres), has increased steadily since 1970 to more than 28,000 km<sup>2</sup> (7 million acres) annually. [37]. This change may be due in part to changes in forest management practices.

## Ecological productivity

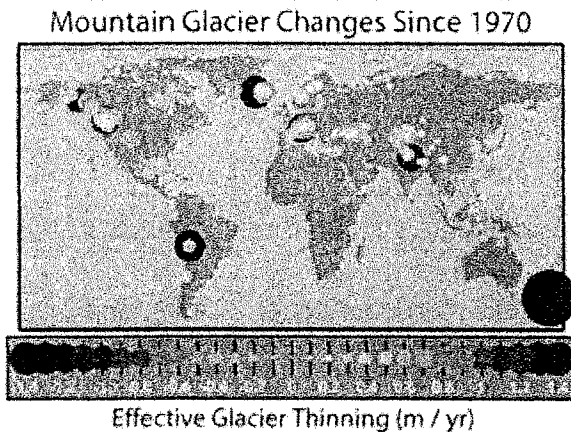
Increasing average temperature and carbon dioxide may have the effect, up to a point, of improving ecosystems' productivity. Atmospheric carbon dioxide is rare in comparison to oxygen (less than 1% of air compared to 21% of air). This carbon dioxide starvation becomes apparent in photorespiration, where there is so little carbon dioxide, that oxygen can enter a plant's chloroplasts and takes the place where carbon dioxide normally would be in the Calvin Cycle. This causes the sugars being made to be destroyed, badly suppressing growth. Satellite data shows that the productivity of the northern hemisphere has increased since 1982 (although attribution of this increase to a specific cause is difficult).

IPCC models predict that higher CO<sub>2</sub> concentrations would only spur growth of flora up to a point, because in many regions the limiting factors are water or nutrients, not temperature or CO<sub>2</sub>; after that, greenhouse effects and warming would continue but there would be no compensatory increase in growth.

Research done by the Swiss Canopy Crane Project suggests that slow-growing trees only are stimulated in growth for a short period under higher CO<sub>2</sub> levels, while faster growing

plants like liana benefit in the long term. In general, but especially in rain forests, this means that liana become the prevalent species; and because they decompose much faster than trees their carbon content is more quickly returned to the atmosphere. Slow growing trees incorporate atmospheric carbon for decades.

## Glacier Retreat



A map of the change in thickness of mountain glaciers since 1970. Thinning in orange and red, thickening in blue.



Lewis Glacier, North Cascades, WA USA is one of five glaciers in the area that melted away

In historic times, glaciers grew during the Little Ice Age, a cool period from about 1550 to 1850. Subsequently, until about 1940, glaciers around the world retreated as climate warmed. Glacier retreat declined and reversed, in many cases, from 1950 to 1980 as a slight global cooling occurred. Since 1980, glacier retreat has become increasingly rapid and ubiquitous, so much so that it has threatened the existence of many of the glaciers of the world. This process has increased markedly since 1995. [38]

The total surface area of glaciers worldwide has decreased by 50% since the end of the 19th century [39]. Currently glacier retreat rates and mass balance losses have been increasing in the Andes, Alps, Himalaya's, Rocky Mountains and North Cascades. As of

March 2005, the snow cap that has covered the top of Mount Kilimanjaro for the past 11,000 years since the last ice age has almost disappeared [40].

The loss of glaciers not only directly causes landslides, flash floods and glacial lake overflow[41], but also increases annual variation in water flows in rivers. Glacier runoff declines in the summer as glaciers decrease in size, this decline is already observable in several regions [42]. Glaciers retain water on mountains in high precipitation years, since the snow cover accumulating on glaciers protects the ice from melting. In warmer and drier years, glaciers offset the lower precipitation amounts with a higher meltwater input [43].

The recession of mountain glaciers, notably in Western North America, Franz-Josef Land, Asia, the Alps, Indonesia and Africa, and tropical and sub-tropical regions of South America, has been used to provide qualitative support to the rise in global temperatures since the late 19th century. Many glaciers are being lost to melting further raising concerns about future local water resources in these glacierized areas. The Lewis Glacier, North Cascades pictured at right after melting away in 1990 is one of the 47 North Cascade glaciers observed and all are retreating [44].

Despite their proximity and importance to human populations, the mountain and valley glaciers of temperate latitudes amount to a small fraction of glacial ice on the earth. About 99% is in the great ice sheets of polar and subpolar Antarctica and Greenland. These continuous continental-scale ice sheets, 3 km (1.8 miles) or more in thickness, cap the polar and subpolar land masses. Like rivers flowing from an enormous lake, numerous outlet glaciers transport ice from the margins of the ice sheet to the ocean.

Glacier retreat has been observed in these outlet glaciers, resulting in an increase of the ice flow rate. In Greenland the period since the year 2000 has brought retreat to several very large glaciers that had long been stable. Three glaciers that have been researched, Helheim, Jakobshavn and Kangerdlugssuaq Glaciers, jointly drain more than 16% of the Greenland Ice Sheet. Satellite images and aerial photographs from the 1950s and 1970s show that the front of the glacier had remained in the same place for decades. But in 2001 it began retreating rapidly, retreating 7.2 km (4.5 miles) between 2001 and 2005. It has also accelerated from 20 m (65 ft)/day to 32 m (104 ft)/day.[45] Jakobshavn Isbræ in west Greenland is generally considered the fastest moving glacier in the world. It had been moving continuously at speeds of over 24 m (78 ft)/day with a stable terminus since at least 1950. In 2002, the 12 km (7.5 mile) long floating terminus entered a phase of rapid retreat. The ice front started to break up and the floating terminus disintegrated accelerating to a retreat rate of over 30 m (98 ft)/day. The acceleration rate of retreat of Kangerdlugssuaq Glacier is even larger. Portions of the main trunk that were flowing at 15 m (49 ft)/day in 1988-2001 were flowing at 40 m (131 ft)/day in summer 2005. The front of the glacier has also retreated and has rapidly thinned by more than 100 m (328 ft).[46]

Glacier retreat and acceleration is also apparent on two important outlet glaciers of the West Antarctic Ice Sheet. Pine Island Glacier, which flows into the Amundsen Sea

thinned  $3.5 \pm 0.9$  m ( $11.5 \pm 3$  ft) per year and retreated five kilometers (3.1 miles) in 3.8 years. The terminus of the glacier is a floating ice shelf and the point at which it is afloat is retreating 1.2 km/year. This glacier drains a substantial portion of the West Antarctic Ice Sheet and has been referred to as the weak underbelly of this ice sheet. [47] This same pattern of thinning is evident on the neighboring Thwaites Glacier.

### **Further global warming (positive feedback)**

Some effects of global warming themselves contribute directly to further global warming.

#### **Methane release from melting permafrost peat bogs**

Wikinews has news related to:

#### **Scientists warn thawing Siberia may trigger global meltdown**

Climate scientists reported in August 2005 that a one million square kilometer region of permafrost peat bogs in western Siberia is starting to melt for the first time since it was formed 11,000 years ago at the end of the last ice age. This will release methane, an extremely effective greenhouse gas, possibly as much as 70,000 million tonnes, over the next few decades. An earlier report in May 2005 reported similar melting in eastern Siberia [48].

This positive feedback was not known about in 2001 when the IPCC issued its last major report on climate change. The discovery of permafrost peat bogs melting in 2005 implies that warming is likely to happen faster than was predicted in 2001.

#### **Carbon cycle feedbacks**

There have been predictions, and some evidence, that global warming might cause loss of carbon from terrestrial ecosystems, leading to an increase of atmospheric CO<sub>2</sub> levels. Several climate models indicate that global warming through the 21st could be accelerated by the response of the terrestrial carbon cycle to such warming [49]. The strongest feedbacks in these cases are due to increased respiration of carbon from soils throughout the high latitude boreal forests of the Northern Hemisphere. One model in particular (HadCM3) indicates a secondary carbon cycle feedback due to the loss of much of the Amazon rainforest in response to significantly reduced precipitation over tropical South America [50]. While models disagree on the strength of any terrestrial carbon cycle feedback, they each suggest any such feedback would accelerate global warming.

Observations show that soils in England have been losing carbon at the rate of four million tonnes a year for the past 25 years [51] according to a paper in *Nature* by Bellamy et al. in September 2005, who note that these results are unlikely to be explained by land use changes. Results such as this rely on a dense sampling network and thus are not available on a global scale. Extrapolating to all of the United Kingdom, they estimate

annual losses of 13 million tons per year. This is as much as the annual reductions in carbon dioxide emissions achieved by the UK under the Kyoto Treaty (12.7 million tons of carbon per year).<sup>[52]</sup>

### **Forest Fires**

Rising Global temperature might cause forest fires to occur on larger scale, and more regularly. This releases more stored carbon into the atmosphere than the carbon cycle can naturally re-absorb, as well as reducing the overall forest area on the planet, creating a positive feedback loop. Part of that feedback loop is more rapid growth of replacement forests and a northward migration of forests as northern latitudes become more suitable climates for sustaining forests. There is a question of whether the burning of renewable fuels such as forests should be counted as contributing to global warming.

(Climate Change and Fire)

(Climate Roulette: Loss of Carbon Sinks & Positive Feedbacks)

(EPA: Global Warming: Impacts: Forests)

(Feedback Cycles linking forests, climate and landuse activities)

## **Consequences**

*See also Mitigation of global warming*

### **Economic**

In addition to direct damages from extreme weather, there are other economic effects of global warming.

### **Decline of agriculture**

*Main article: Global warming and agriculture.*

For some time it was hoped that a positive effect of global warming would be increased agricultural yields, because of the role of carbon dioxide in photosynthesis, especially in preventing photorespiration, which is responsible for significant destruction of several crops. In Iceland, rising temperatures have made possible the widespread sowing of barley, which was untenable twenty years ago. Some of the warming is due to a local (possibly temporary) effect via ocean currents from the Caribbean, which have also affected fish stocks <sup>[53]</sup>.

Whilst local benefits may be felt in some regions (such as Siberia), recent evidence is that global yields will be negatively affected. "Rising atmospheric temperatures, longer droughts and side-effects of both, such as higher levels of ground-level ozone gas, are likely to bring about a substantial reduction in crop yields in the coming decades, large-scale experiments have shown" (*The Independent*, April 27, 2005, "Climate change poses threat to food supply, scientists say" - report on this event).

Moreover, the region likely to be worst affected is Africa, both because its geography makes it particularly vulnerable, and because seventy per cent of the population rely on rain-fed agriculture for their livelihoods. Tanzania's official report on climate change suggests that the areas that usually get two rainfalls in the year will probably get more, and those that get only one rainy season will get far less. The net result is expected to be that 33% less maize—the country's staple crop—will be grown [54].

## **Insurance**

An industry very directly affected by the risks is the insurance industry; the number of major natural disasters has trebled since the 1960s, and insured losses increased fifteen-fold in real terms (adjusted for inflation) [55]. According to one study, 35–40% of the worst catastrophes have been climate change related (ERM, 2002). Over the past three decades, the proportion of the global population affected by weather-related disasters has doubled in linear trend, rising from roughly 2% in 1975 to 4% in 2001 (ERM, 2002).

A June 2004 report by the Association of British Insurers declared "Climate change is not a remote issue for future generations to deal with. It is, in various forms, here already, impacting on insurers' businesses now". It noted that weather risks for households and property were already increasing by 2-4 % per year due to changing weather, and that claims for storm and flood damages in the UK had doubled to over £6 billion over the period 1998–2003, compared to the previous five years. The results are rising insurance premiums, and the risk that in some areas flood risk insurance will become unaffordable for some.

In the United States, insurance losses have also greatly increased, but according to one study those increases are attributed to increased population and property values in vulnerable coastal areas. (*Science*, 284, 1943-1947).

## **Transport**

Roads, airport runways, railway lines and pipelines, (including oil pipelines, sewers, water mains etc) may require increased maintenance and renewal as they become subject to greater temperature variation, and, in areas with permafrost, subject to subsidence [56].

## **Flood defense**

For historical reasons to do with trade, many of the world's largest and most prosperous cities are on the coast, and the cost of building better coastal defenses (due to the rising sea level) is likely to be considerable. Some countries will be more affected than others - low-lying countries such as Bangladesh and the Netherlands would be worst hit by any sea level rise, in terms of floods or the cost of preventing them.

In developing countries, the poorest often live on flood plains, because it is the only available space, or fertile agricultural land. These settlements often lack infrastructure

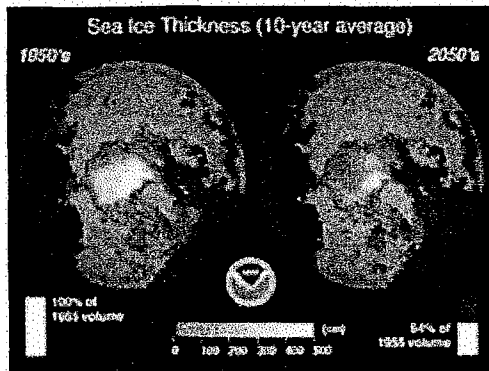
such as dykes and early warning systems. Poorer communities also tend to lack the insurance, savings or access to credit needed to recover from disasters [57].

## Migration

Some Pacific Ocean island nations, such as Tuvalu, are concerned about the possibility of an eventual evacuation, as flood defense may become economically infeasible for them. Tuvalu already has an ad hoc agreement with New Zealand to allow phased relocation [58].

In the 1990s a variety of estimates placed the number of environmental refugees at around 25 million. (Environmental refugees are not included in the official definition of refugees, which only includes migrants fleeing persecution.) The Intergovernmental Panel on Climate Change (IPCC), which advises the world's governments under the auspices of the UN, estimated that 150 million environmental refugees will exist in the year 2050, due mainly to the effects of coastal flooding, shoreline erosion and agricultural disruption. (150 million means 1.5 percent of 2050's predicted 10 billion world population.) [59]

## Northwest Passage



Melting Arctic ice may open the Northwest Passage in summer, which would cut 5,000 nautical miles (9,000 km) from shipping routes between Europe and Asia. This would be of particular relevance for supertankers which are too big to fit through the Panama Canal and currently have to go around the tip of South America. According to the Canadian Ice Service, the amount of ice in Canada's eastern Arctic Archipelago decreased by 15 percent between 1969 and 2004 [60].

While the reduction of summer ice in the Arctic may be a boon to shipping, this same phenomenon threatens the Arctic ecosystem, most notably polar bears which depend on ice floes. Subsistence hunters such as the Inuit peoples will find their livelihoods and cultures increasingly threatened as the ecosystem changes due to global warming.

## Development



The combined effects of global warming may impact particularly harshly on people and countries without the resources to mitigate those effects. This may slow economic development and poverty reduction, and make it harder to achieve the Millennium Development Goals [61], [62].

In October 2004 the Working Group on Climate Change and Development, a coalition of development and environment NGOs, issued a report Up in Smoke on the effects of climate change on development. This report, and the July 2005 report Africa - Up in Smoke? predicted increased hunger and disease due to decreased rainfall and severe weather events, particularly in Africa. These are likely to have severe impacts on development for those affected.

## **Environmental**

Secondary evidence of global warming — reduced snow cover, rising sea levels, weather changes — provides examples of consequences of global warming that may influence not only human activities but also ecosystems. Increasing global temperature means that ecosystems may change; some species may be forced out of their habitats (possibly to extinction) because of changing conditions, while others may flourish. Few of the terrestrial ecoregions on Earth could expect to be unaffected.

Increasing carbon dioxide may (up to a point) increase ecosystems' productivity; but the interaction with other aspects of climate change, means the environmental impact of this is unclear. An increase in the total amount of biomass produced is not necessarily all good, since biodiversity can still decrease even though a smaller number of species are flourishing.

## **Water scarcity**

Eustatic sea level rises threaten to contaminate groundwater, affecting drinking water and agriculture in coastal zones. Increased evaporation will reduce the effectiveness of reservoirs. Increased extreme weather means more water falls on hardened ground unable to absorb it - leading to flash floods instead of a replenishment of soil moisture or groundwater levels. In some areas, shrinking glaciers threaten the water supply [63].

Higher temperatures will also increase the demand for water for cooling purposes.

In the Sahel, there has been on average a 25 per cent decrease in annual rainfall over the past 30 years.

## **Health**

### **Direct effects of temperature rise**

Rising temperatures have two opposing direct effects on mortality: higher temperatures in winter reduce deaths from cold; higher temperatures in summer increase heat-related

deaths. The distribution of these changes obviously differs. Palutikof et al calculate that in England and Wales for a 1 °C temperature rise the reduced deaths from cold outweigh the increased deaths from heat, resulting in a reduction in annual average mortality of 7000.

The European heat wave of 2003 killed 22,000–35,000 people, based on normal mortality rates (Schär and Jendritzky, 2004). It can be said with 90% confidence that past human influence on climate was responsible for at least half the risk of the 2003 European summer heat-wave (Stott et al 2004).

If average temperatures increase by 1 degree Celsius, there will be an estimated 24,000 additional murders in the U.S. each year (as the additional heat stress leads to more frequent rage). (New Scientist 11/5/02, review of *Body Heat* by Mark Blumberg.)

### **Spread of disease**

Global warming is expected to extend the favourable zones for vectors conveying infectious disease such as malaria [64]. In poorer countries, this may simply lead to higher incidence of such diseases. In richer countries, where such diseases have been eliminated or kept in check by vaccination, draining swamps and using pesticides, the consequences may be felt more in economic than health terms, if greater spending on preventative measures is required [65].

### **Impacts of glacier retreat**

The continued retreat of glaciers will have a number of different quantitative impacts. In areas that are heavily dependent on water runoff from glaciers that melt during the warmer summer months, a continuation of the current retreat will eventually deplete the glacial ice and substantially reduce or eliminate runoff. A reduction in runoff will affect the ability to irrigate crops and will reduce summer stream flows necessary to keep dams and reservoirs replenished. This situation is particularly acute for irrigation in South America, where numerous artificial lakes are filled almost exclusively by glacial melt. <sup>(BBC)</sup> Central Asian countries have also been historically dependent on the seasonal glacier melt water for irrigation and drinking supplies. In Norway, the Alps, and the Pacific Northwest of North America, glacier runoff is important for hydropower.

Many species of freshwater and saltwater plants and animals are dependent on glacier-fed waters to ensure a cold water habitat that they have adapted to. Some species of freshwater fish need cold water to survive and to reproduce, and this is especially true with Salmon and Cutthroat trout. Reduced glacier runoff can lead to insufficient stream flow to allow these species to thrive. Ocean krill, a cornerstone species, prefer cold water and are the primary food source for aquatic mammals such as the Sperm whale. <sup>(CBS)</sup> Alterations to the ocean currents, due to increased freshwater inputs from glacier melt, and the potential alterations to thermohaline circulation of the worlds oceans, may impact existing fisheries upon which humans depend as well.

The potential for major sea level rise is mostly dependent on a significant melting of the polar ice caps of Greenland and Antarctica, as this is where the vast majority of glacial ice is located. The British Antarctic Survey has determined from climate modeling that for at least the next 50 years, snowfall on the continent of Antarctica should continue to exceed glacial losses from global warming. The amount of glacial loss on the continent of Antarctica is not increasing significantly, and it is not known if the continent will experience a warming or a cooling trend, although the Antarctic Peninsula has warmed in recent years, causing glacier retreat in that region.<sup>(BAS)</sup> If all the ice on the polar ice caps were to melt away, the oceans of the world would rise an estimated 70 m (229 ft). However, with little major melt expected in Antarctica, sea level rise of not more than 0.5 m (1.6 ft) is expected through the 21st century, with an average annual rise of 0.0004 m (0.0013 ft) per year. Thermal expansion of the world's oceans will contribute, independent of glacial melt, enough to double those figures.<sup>(NSIDC2)</sup>

## See also

- Climate change
- Global warming
- Mitigation of global warming
- Adaptation to global warming
- National Assessment on Climate Change for the United States
- Arctic Climate Impact Assessment
- Loop Current of the Gulf of Mexico

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## External links

- "Anthropogenic Effects on Tropical Cyclone Activity" (Kerry Emanuel)
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- Pezza, Alexandre Bernardes and Ian Simmonds (Aug 2005). "The first South Atlantic hurricane: Unprecedented blocking, low shear and climate change". *Geophysical Research Letters* 32 (L15712).
- Workshop on the Phenomenon Catarina (Brazilian Society of Meteorology)
- American Meteorological Society's Environmental Science Seminar Series (Oct 2005): "Hurricanes: Are They Changing and Are We Adequately Prepared for the Future?"
  - "How are hurricanes changing with global warming?" (Kevin Trenberth)
  - "Changes in hurricane intensity in a warming environment" (Judith Curry)
  - "Hurricanes and Climate" (Kerry Emanuel)
- Munich Re: World Map of Natural Hazards
- Oliver James, *The Guardian*, June 30, 2005 Face the facts: For many people climate change is too depressing to think about, and some prefer to simply pretend it doesn't exist
- Mark Lynas, *The Guardian*, March 31, 2004, "Vanishing worlds"
- Peter Schwartz and Doug Randall, Global Business Network, "An Abrupt Climate Change Scenario and Its Implications for United States National Security", A report commissioned by the U.S. Defense Department, October 2003 (executive summary)
- Effects of global warming on skiing
- Stabilisation 2005 conference: survey of scientific papers
- Elevated levels of atmospheric CO<sub>2</sub> decrease the nutritional value of plants
- Royal Society, 30 June 2005, "Ocean acidification due to increasing atmospheric carbon dioxide"
- Time Magazine's "Global Warming: The Culprit?" (Time Magazine, October 3, 2005, pages 42-46)
- The Evidence Linking Hurricanes and Climate Change: Interview with Judith Curry
- Hurricanes and Global Warming Review of most recent *Nature* and *Science* data.
- Recent ice sheet growth in the interior of Greenland
- Increased temperature and salinity in the Nordic Seas

# Insurance Industry

<http://yosemite.epa.gov/OAR/globalwarming.nsf/content/ActionsIndustryInsurance.html>

While the effects of climate change will impact every segment of the business community, the insurance industry is especially at risk. Extreme weather events of the past several years have – in addition to their human toll – caused tens of billions of dollars in losses for insurers. Given development and population trends in high-risk areas, potential future impacts of global warming – such as sea level rise and increased storm activity and severity – could prove far more costly.

- There were *four times as many natural catastrophes* in the 1990s as there were three decades ago.
- Insured *losses from natural disasters* are 15 times higher today than they were in the 1960s, even after adjusting for inflation.
- The total dollars paid out in *natural disaster-related claims* since 1990 is 50 percent greater than the losses incurred over the past 40 years combined.
- People are moving to places like Florida at the rate of 1,000 per day, substantially increasing the *value of the property* in these high-risk areas.

Lawrence Berkley National Laboratory— this DOE sponsored site describes how increasing energy efficiency has the dual benefit of reducing insurance losses and mitigating global warming. <http://eetd.lbl.gov/insurance/>

Surviving Disaster with Renewable Energy— this National Renewable Energy Laboratory sponsored site focuses on the role of renewables in emergency preparedness and response, disaster mitigation and relief, and sustainable development. [http://www.nrel.gov/surviving\\_disaster/](http://www.nrel.gov/surviving_disaster/)

General Re— Provides a search engine dedicated to the insurance industry that returns links to information relevant to the insurance industry including natural catastrophes and other disasters. <http://www.genre.com/sharedfile/pdf/NAArticleIndex200602-en.pdf>

Swiss Re Group— Swiss Re Research and Publications - Climate Change Roundtable, - Explains Swiss Re's philosophy and provides links to environmental information, organizations and business initiatives and in-depth focus reports. <http://www.swissre.com/>

U.S. Insurance Companies Staggering Under Global Warming Increasing Damages <http://www.ens-newswire.com/ens/sep2005/2005-09-13-04.asp>

***Global warming called insurance peril: State regulators and scientists warn of huge losses from climate shifts.***

<http://www.sacbee.com/content/business/story/13538388p-14378761c.html>

# State Insurance Commissioners Calculate Global Warming Pricetag

WASHINGTON - The decision to set up a task force to assess global warming effects on the insurance industry, taken by the National Association of Insurance Commissioners (NAIC), came during the same week that the world's biggest insurance broker, Marsh & McLennan, briefed its corporate clients, which include roughly 75 percent of the "Fortune 500" biggest companies, on the potential impact of global warming on their businesses.

According to a December 2005 study, U.S. insurers have seen a 15-fold increase in insured losses from catastrophic weather events in the past three decades, increases that have far outstripped the growth in premiums, population and inflation over the same time period.

"It's becoming clearer that we are experiencing more frequent and more powerful weather events that pose huge challenges for the insurance industry," according to Tim Wager, director of Nebraska's Department of Insurance and co-chairman of the new task force set up by NAIC, which originally scheduled the initiative for approval at a meeting in New Orleans that was then cancelled due to Hurricane Katrina.

"The impacts are being felt on our coasts and in the interior U.S.," he added. "We're seeing all kinds of extreme weather in the Great Plains states, including drought, tornadoes, brushfires and severe hailstorms." The task force will review whether U.S. insurers have adequately considered the consequences on their industry, including its solvency, if current trends that are believed to be related to global warming continue or intensify, according to Washington State insurance commissioner Mike Kreidler. "We had a statewide drought emergency in Washington last year," he said, noting its impact on the state's agriculture and ski industries. "As scientists predict this trend to continue, I'm concerned with the impact these changes will have on insurance availability and costs." In the U.S. system, individual states, rather than the federal government, regulate the insurance industry.

## **SCARY STATISTICS** [Dr. Greg Forbes](#), Severe Weather Expert

Not only have there been many more tornadoes than average in 2006, but many have been strong tornadoes. That goes a long way toward explaining why there have been so many fatalities from tornadoes this year. **There have been 49 deaths directly caused by tornadoes**, plus one more person who had a heart attack in an area not directly hit by a tornado. **Last year at this time there had only been 5 deaths**, and there were only 39 for the whole year.

**There have been 22 F3 tornadoes thus far this year and one F4. Last year at this time there had only been 3 F3 tornadoes. The first (and only) F4 of the year in 2005 did not occur until November 15.**

Over the years, there has been a very strong relationship between tornado strength and the number of tornado deaths. **Only 6% of all tornadoes in a decade rate F3 or stronger in intensity.** They have winds estimated above about 158 mph. However, **these tornadoes have caused 87% of the tornado deaths.**

Homes are not built to withstand those excessive wind speeds. Building codes are not higher than 90 mph in most parts of the country, so contractors are not required to build homes to resist winds stronger than that. As a standard safety rule, we tell you to go to the lowest, innermost portion (preferably the basement) of a well-built home. But the rest of the story, as one radio personality says, is that even there you are not absolutely safe if you get hit by one of those top-strength tornadoes.

CORRESPONDENCE

060220 - EC

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**Seminole Electric Coop.**  
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To: Filings@psc.state.fl.us  
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State of Florida



# Public Service Commission

CAPITAL CIRCLE OFFICE CENTER • 2540 SHUMARD OAK BOULEVARD  
TALLAHASSEE, FLORIDA 32399-0850

## -M-E-M-O-R-A-N-D-U-M-

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**DATE:** June 3, 2006  
**TO:** Kay B. Flynn, Chief of Records, Division of the Commission Clerk & Administrative Services  
**FROM:** Martha C. Brown, Senior Attorney, Office of the General Counsel *MCB*  
**RE:** Docket No. 060220-EC

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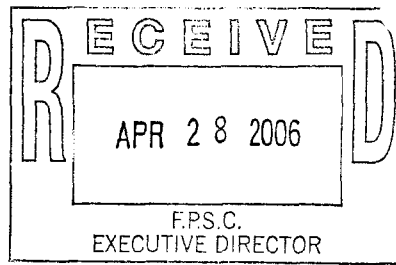
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05 JUN -5 AM 11: 22  
COMMISSION  
CLERK

Please place the attached letter from Brian Lupiani in the correspondance side of this docket.  
Thank you.



Florida Public Service Commission  
2540 Shumard Oak Blvd  
Tallahassee, FL 32399

April 28, 2006



Re: Docket 060220

Dear Commissioners,

Studies heard at a number of Public Utility Commissions across the country have shown that the **economic** costs of health and environmental effects of coal plants, not including the cost of global warming, are as high as the generation cost.

Recent studies by insurance companies, analysts, government agencies, and economists have demonstrated that the economic costs of global warming are already comparable to the generation cost - and are increasing exponentially. The costs of stronger storms and sea level rise alone are projected to be of similar magnitude over the next 30 years on an annual basis as the full annual generation cost. Attached is one of many studies documenting the huge social and economic costs of global warming / climate change.

Since credible evidence now places the externality cost of power generation for some fuels as more than the generation cost, it is no longer reasonable or prudent to take only generation cost into account when decisions on power production are made. Economists agree that decisions should be made based on the best estimates of total societal and economic cost for the future period being considered - not on historical data for a **portion** of the total cost under conditions unlikely to be similar to future conditions. The Sierra Club believes that it is time for the Florida Public Service Commission to include externality cost in the decision-making process, and Docket 060220 (Seminole Unit 3) is a good place to start.

Thank you for your consideration.

Sincerely,

Brian Lupiani  
Vice Chair, Florida Sierra Club Energy Committee  
607 McDaniel Street  
Tallahassee FL 32303  
brianlupiani@yahoo.com

cc: Mary Andrews Bane  
Charles Hill  
Tim Devlin

cc: Rick Melson ✓

# Environmental, Social, and Economic Effects of global warming – rising exponentially

## From Wikipedia, the free encyclopedia

[http://en.wikipedia.org/wiki/Effects\\_of\\_global\\_warming#Cost\\_of\\_more\\_extreme weather](http://en.wikipedia.org/wiki/Effects_of_global_warming#Cost_of_more_extreme_weather)

- - 1.1 Effects on weather
    - 1.1.1 More extreme weather
    - 1.1.2 Increased evaporation
    - 1.1.3 Cost of more extreme weather
    - 1.1.4 Destabilization of local climates
  - 1.2 Oceans
    - 1.2.1 Sea level rise
    - 1.2.2 Temperature rise
    - 1.2.3 Acidification
    - 1.2.4 Shutdown of thermohaline circulation
  - 1.3 Ecosystems
    - 1.3.1 Ecological productivity
  - 1.4 Glacier Retreat
  - 1.5 Further global warming (positive feedback)
    - 1.5.1 Methane release from melting permafrost peat bogs
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- 2 Consequences
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    - 2.1.4 Flood defense
    - 2.1.5 Migration
    - 2.1.6 Northwest Passage
    - 2.1.7 Development
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    - 2.2.1 Water scarcity
  - 2.3 Health
    - 2.3.1 Direct effects of temperature rise
    - 2.3.2 Spread of disease
  - 2.4 Impacts of glacier retreat
- 3 See also
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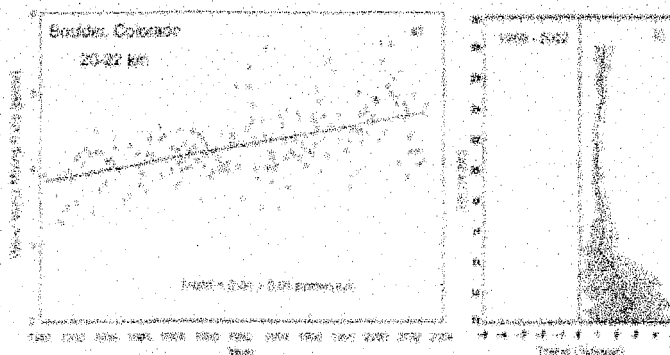
## More extreme weather

The Intergovernmental Panel on Climate Change (IPCC) third annual assessment report "Climate Change 2001" stated "there is no compelling evidence to indicate that the characteristics of tropical and extratropical storms have changed." [6] There is, however, limited evidence from a relatively short time period that storm strength is increasing, such as the Emanuel (2005) "power dissipation index" of hurricane intensity [7]. Worldwide, the proportion of hurricanes reaching categories 4 or 5 – with wind speeds above 56 metres per second – has risen from 20% in the 1970s to 35% in the 1990s.[8] Precipitation hitting the US from hurricanes increased by 7% over the twentieth century [9]. See also Time Magazine's "Global Warming: The Culprit?".

The World Meteorological Organization [10] has suggested a possible link between global warming and increasing extreme weather events, as have Hoyos *et al.* (2006), writing, "the increasing ... number of category 4 and 5 hurricanes ... is directly linked to" increasing temperatures. [11] Hurricane modeling has produced similar results, e.g., "hurricanes, simulated under warmer, high-CO<sub>2</sub> conditions, are more intense ... than under present-day conditions... greenhouse gas-induced warming may lead to ... increasing ... occurrence of highly destructive category-5 storms." [12] A paper by 14 scientists [13] notes that "research shows very little evidence to support the claim that the rising costs associated with weather ... are associated with changes in [their] frequency or intensity." The IPCC TAR, in 2001, made no strong statements on the issue.

A substantially higher risk of extreme weather does not necessarily mean a noticeably greater risk of slightly-above-average weather [14]. However, the evidence is clear that severe weather and moderate rainfall are also increasing.

Stephen Mwakifwamba, national co-ordinator of the Centre for Energy, Environment, Science and Technology - which prepared the Tanzanian government's climate change report to the UN - says that change is happening in Tanzania right now. "In the past, we had a drought about every 10 years", he says. "Now we just don't know when they will come. They are more frequent, but then so are floods. The climate is far less predictable. We might have floods in May or droughts every three years. Upland areas, which were never affected by mosquitoes, now are. Water levels are decreasing every day. The rains come at the wrong time for farmers and it is leading to many problems" [15].



Increasing water vapor .

## **Increased evaporation**

As the climate grows warmer, evaporation will increase. This may cause heavier rainfall and more erosion, and in more vulnerable tropical areas (especially in Africa), desertification due to deforestation. Many scientists think that it could result in more extreme weather as global warming progresses. The IPCC Third Annual Report says: "...global average water vapour concentration and precipitation are projected to increase during the 21st century. By the second half of the 21st century, it is likely that precipitation will have increased over northern mid- to high latitudes and Antarctica in winter. At low latitudes there are both regional increases and decreases over land areas. Larger year to year variations in precipitation are very likely over most areas where an increase in mean precipitation is projected" [16] [17].

## **Cost of more extreme weather**

The economic impact of extreme weather is rising rapidly both because of increases in the frequency and intensity of extreme weather and because of changes in human behavior. An example of how human behavior has increased exposure to extreme weather is the movement towards greater development along vulnerable seacoasts. The economic impact of hurricanes has increased because there is more development along seacoasts vulnerable to hurricanes. Similarly, the economic impact of floods has increased because there is more development in floodplains.

Choi and Fisher, writing in *Climate Change*, vol. 58 (2003) pp. 149, predict that each 1% increase in annual precipitation would enlarge the cost of catastrophic storms by 2.8%.

The Association of British Insurers has stated that limiting carbon emissions would avoid 80% of the projected additional annual cost of tropical cyclones by the 2080s. The cost is also increasing partly because of building in exposed areas such as coasts and floodplains. The ABI claims that reduction of the vulnerability to some inevitable impacts of climate change, for example through more resilient buildings and improved flood defences, could also result in considerable cost-savings in the longterm.[18]

## **Destabilization of local climates**

The first ever recorded South Atlantic hurricane, "Catarina", hit Brazil in 2004. Although there has been speculation based on satellite intensity estimates that the lowest pressure in Monica (a tropical cyclone which has since made its second Australia landfall) was lower than Wilma's Atlantic basin record of 882 millibars in 2005 and perhaps even Typhoon Tip's world record lowest measured pressure of 870 mb in 1979, with no aircraft reconnaissance in Monica we'll never know for sure. Nor will we know exactly what its winds were and whether some of the official figures that have been cited were overestimations -- I'm always a little skeptical of tropical cyclone winds estimated to be in excess of 200 mph, even in gusts -- but Monica sure was one mighty impressive tropical cyclone at its peak! And unprecedented in the Southern hemisphere.

In the northern hemisphere, the southern part of the Arctic region (home to 4,000,000 people) has experienced a temperature rise 1° to 3° Celsius over the last 50 years. Canada, Alaska and Russia are experiencing initial melting of permafrost. This may disrupt ecosystems and by increasing bacterial activity in the soil lead to these areas becoming carbon sources instead of carbon sinks [19]. A study (published in *Science*) of changes to eastern Siberia's permafrost suggests that it is gradually disappearing in the southern regions, leading to the loss of nearly 11% of Siberia's nearly 11,000 lakes since 1971 [20]. At the same time, western Siberia is at the initial stage where melting permafrost is creating new lakes, which will eventually start disappearing as in the east. Western Siberia is the world's largest peat bog, and the melting of its permafrost is likely to lead to the release, over decades, of large quantities of methane—creating an additional source of greenhouse gas emissions [21].

Hurricanes were thought to be an entirely north Atlantic phenomenon. In April 2004, the first Atlantic hurricane to form south of the Equator hit Brazil with 40 m/s (144 km/h) winds; monitoring systems may have to be extended 1,600 km (1000 miles) further south [22].

## **Oceans**

### **Sea level rise**

*Main article: sea level rise.*

With increasing average global temperature, the water in the oceans expands in volume, and additional water enters them which had previously been locked up on land in glaciers and the polar ice caps. An increase of 1.5 to 4.5 °C is estimated to lead to an increase of 15 to 95 cm (IPCC 2001).

The sea level has risen more than 120 metres since the peak of the last ice age about 18,000 years ago. The bulk of that occurred before 6000 years ago. From 3000 years ago to the start of the 19th century, sea level was almost constant, rising at 0.1 to 0.2 mm/yr; since 1900, the level has risen at 1–2 mm/yr [23]; since 1992, satellite altimetry from TOPEX/Poseidon indicates a rate of about 3 mm/yr [24].

## Temperature rise

The temperature of the Antarctic Southern Ocean rose by 0.17 °C (0.31 °F) between the 1950s and the 1980s, nearly twice the rate for the world's oceans as a whole [25]. As well as effects on ecosystems (eg by melting sea ice, affecting algae that grow on its underside), warming could reduce the ocean's ability to absorb CO<sub>2</sub>.

More important for the United States may be the temperature rise in the Gulf of Mexico. As hurricanes cross the warm Loop Current coming up from South America, they can gain great strength in under a day (as did Hurricane Katrina and Hurricane Rita in 2005), with water above 85 degrees F seemingly promoting Category 5 storms.

## Acidification

*Main article: ocean acidification.*

The world's oceans soak up much of the carbon dioxide produced by living organisms, either as dissolved gas, or in the skeletons of tiny marine creatures that fall to the bottom to become chalk or limestone. Oceans currently absorb about one metric tonne of CO<sub>2</sub> per person per year. It is estimated that the oceans have absorbed around half of all CO<sub>2</sub> generated by human activities since 1800 (120,000,000,000 tonnes or 120 petagrams of carbon) [26].

But in water, carbon dioxide becomes a weak carbonic acid, and the increase in the greenhouse gas since the industrial revolution has already lowered the average pH (the laboratory measure of acidity) of seawater by 0.1 units on the 14-point scale, to 8.2. Predicted emissions could lower it by a further 0.5 by 2100, to a level not seen for millions of years. [27]

There are concerns that increasing acidification could have a particularly detrimental effect on corals [28] (16% of the world's coral reefs have died from bleaching since 1998 [29]) and other marine organisms with calcium carbonate shells. Increased acidity may also directly affect the growth and reproduction of fish as well as the plankton on which they rely on for food [30].

## Shutdown of thermohaline circulation

*Main article: Shutdown of thermohaline circulation.*

There is some speculation that global warming could, via a shutdown or slowdown of the thermohaline circulation, trigger localised cooling in the North Atlantic and lead to cooling, or lesser warming, in that region. This would affect in particular areas like Scandinavia and Britain that are warmed by the North Atlantic drift. The chances of this occurring are unclear; there is some evidence for the stability of the Gulf Stream and possible weakening of the North Atlantic drift. There is, however, no evidence for cooling in northern Europe or nearby seas; quite the reverse.

## Ecosystems

Rising temperatures are beginning to impact on ecosystems. Butterflies have shifted their ranges northward by 200 km in Europe and North America. Plants lag behind, and larger animals' migration is slowed down by cities and highways. In Britain, spring butterflies are appearing an average of 6 days earlier than two decades ago [31]. In the Arctic, the waters of Hudson Bay are ice-free for three weeks longer than they were thirty years ago, affecting polar bears, which do not hunt on land [32].

Two 2002 studies in *Nature* (vol 421) [33] surveyed the scientific literature to find recent changes in range or seasonal behaviour by plant and animal species. Of species showing recent change, 4 out of 5 shifted their ranges towards the poles or higher altitudes, creating "refugee species". Frogs were breeding, flowers blossoming and birds migrating an average 2.3 days earlier each decade; butterflies, birds and plants moving towards the poles by 6.1 km per decade [34]. A 2005 study concludes human activity is the cause of the temperature rise and resultant changing species behaviour, and links these effects with the predictions of climate models to provide validation for them [35]. Grass has become established in Antarctica for the first time. [36]

Forests in some regions potentially face an increased risk of forest fires. The 10-year average of boreal forest burned in North America, after several decades of around 10,000 km<sup>2</sup> (2.5 million acres), has increased steadily since 1970 to more than 28,000 km<sup>2</sup> (7 million acres) annually. [37]. This change may be due in part to changes in forest management practices.

## Ecological productivity

Increasing average temperature and carbon dioxide may have the effect, up to a point, of improving ecosystems' productivity. Atmospheric carbon dioxide is rare in comparison to oxygen (less than 1% of air compared to 21% of air). This carbon dioxide starvation becomes apparent in photorespiration, where there is so little carbon dioxide, that oxygen can enter a plant's chloroplasts and takes the place where carbon dioxide normally would be in the Calvin Cycle. This causes the sugars being made to be destroyed, badly suppressing growth. Satellite data shows that the productivity of the northern hemisphere has increased since 1982 (although attribution of this increase to a specific cause is difficult).

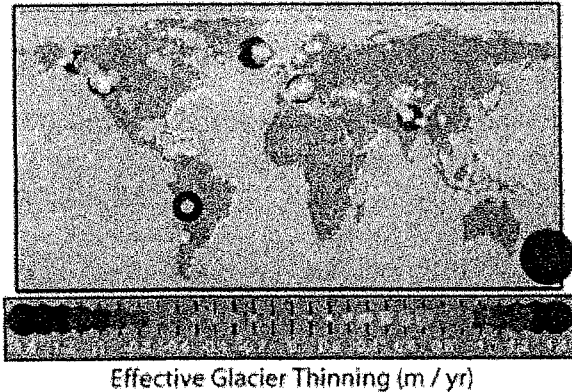
IPCC models predict that higher CO<sub>2</sub> concentrations would only spur growth of flora up to a point, because in many regions the limiting factors are water or nutrients, not temperature or CO<sub>2</sub>, after that, greenhouse effects and warming would continue but there would be no compensatory increase in growth.

Research done by the Swiss Canopy Crane Project suggests that slow-growing trees only are stimulated in growth for a short period under higher CO<sub>2</sub> levels, while faster growing

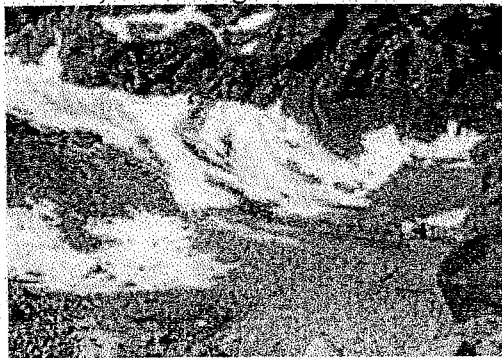
plants like liana benefit in the long term. In general, but especially in rain forests, this means that liana become the prevalent species; and because they decompose much faster than trees their carbon content is more quickly returned to the atmosphere. Slow growing trees incorporate atmospheric carbon for decades.

## Glacier Retreat

Mountain Glacier Changes Since 1970



A map of the change in thickness of mountain glaciers since 1970. Thinning in orange and red, thickening in blue.



Lewis Glacier, North Cascades, WA USA is one of five glaciers in the area that melted away

In historic times, glaciers grew during the Little Ice Age, a cool period from about 1550 to 1850. Subsequently, until about 1940, glaciers around the world retreated as climate warmed. Glacier retreat declined and reversed, in many cases, from 1950 to 1980 as a slight global cooling occurred. Since 1980, glacier retreat has become increasingly rapid and ubiquitous, so much so that it has threatened the existence of many of the glaciers of the world. This process has increased markedly since 1995. [38]

The total surface area of glaciers worldwide has decreased by 50% since the end of the 19th century [39]. Currently glacier retreat rates and mass balance losses have been increasing in the Andes, Alps, Himalaya's, Rocky Mountains and North Cascades. As of



March 2005, the snow cap that has covered the top of Mount Kilimanjaro for the past 11,000 years since the last ice age has almost disappeared [40].

The loss of glaciers not only directly causes landslides, flash floods and glacial lake overflow[41], but also increases annual variation in water flows in rivers. Glacier runoff declines in the summer as glaciers decrease in size, this decline is already observable in several regions [42]. Glaciers retain water on mountains in high precipitation years, since the snow cover accumulating on glaciers protects the ice from melting. In warmer and drier years, glaciers offset the lower precipitation amounts with a higher meltwater input [43].

The recession of mountain glaciers, notably in Western North America, Franz-Josef Land, Asia, the Alps, Indonesia and Africa, and tropical and sub-tropical regions of South America, has been used to provide qualitative support to the rise in global temperatures since the late 19th century. Many glaciers are being lost to melting further raising concerns about future local water resources in these glacierized areas. The Lewis Glacier, North Cascades pictured at right after melting away in 1990 is one of the 47 North Cascade glaciers observed and all are retreating [44].

Despite their proximity and importance to human populations, the mountain and valley glaciers of temperate latitudes amount to a small fraction of glacial ice on the earth. About 99% is in the great ice sheets of polar and subpolar Antarctica and Greenland. These continuous continental-scale ice sheets, 3 km (1.8 miles) or more in thickness, cap the polar and subpolar land masses. Like rivers flowing from an enormous lake, numerous outlet glaciers transport ice from the margins of the ice sheet to the ocean.

Glacier retreat has been observed in these outlet glaciers, resulting in an increase of the ice flow rate. In Greenland the period since the year 2000 has brought retreat to several very large glaciers that had long been stable. Three glaciers that have been researched, Helheim, Jakobshavns and Kangerdlugssuaq Glaciers, jointly drain more than 16% of the Greenland Ice Sheet. Satellite images and aerial photographs from the 1950s and 1970s show that the front of the glacier had remained in the same place for decades. But in 2001 it began retreating rapidly, retreating 7.2 km (4.5 miles) between 2001 and 2005. It has also accelerated from 20 m (65 ft)/day to 32 m (104 ft)/day.[45] Jakobshavn Isbræ in west Greenland is generally considered the fastest moving glacier in the world. It had been moving continuously at speeds of over 24 m (78 ft)/day with a stable terminus since at least 1950. In 2002, the 12 km (7.5 mile) long floating terminus entered a phase of rapid retreat. The ice front started to break up and the floating terminus disintegrated accelerating to a retreat rate of over 30 m (98 ft)/day. The acceleration rate of retreat of Kangerdlugssuaq Glacier is even larger. Portions of the main trunk that were flowing at 15 m (49 ft)/day in 1988-2001 were flowing at 40 m (131 ft)/day in summer 2005. The front of the glacier has also retreated and has rapidly thinned by more than 100 m (328 ft).[46]

Glacier retreat and acceleration is also apparent on two important outlet glaciers of the West Antarctic Ice Sheet. Pine Island Glacier, which flows into the Amundsen Sea

thinned  $3.5 \pm 0.9$  m ( $11.5 \pm 3$  ft) per year and retreated five kilometers (3.1 miles) in 3.8 years. The terminus of the glacier is a floating ice shelf and the point at which it is afloat is retreating 1.2 km/year. This glacier drains a substantial portion of the West Antarctic Ice Sheet and has been referred to as the weak underbelly of this ice sheet.[47] This same pattern of thinning is evident on the neighboring Thwaites Glacier.

### **Further global warming (positive feedback)**

Some effects of global warming themselves contribute directly to further global warming.

#### **Methane release from melting permafrost peat bogs**

Wikinews has news related to:

#### ***Scientists warn thawing Siberia may trigger global meltdown***

Climate scientists reported in August 2005 that a one million square kilometer region of permafrost peat bogs in western Siberia is starting to melt for the first time since it was formed 11,000 years ago at the end of the last ice age. This will release methane, an extremely effective greenhouse gas, possibly as much as 70,000 million tonnes, over the next few decades. An earlier report in May 2005 reported similar melting in eastern Siberia [48].

This positive feedback was not known about in 2001 when the IPCC issued its last major report on climate change. The discovery of permafrost peat bogs melting in 2005 implies that warming is likely to happen faster than was predicted in 2001.

#### **Carbon cycle feedbacks**

There have been predictions, and some evidence, that global warming might cause loss of carbon from terrestrial ecosystems, leading to an increase of atmospheric CO<sub>2</sub> levels. Several climate models indicate that global warming through the 21st could be accelerated by the response of the terrestrial carbon cycle to such warming [49]. The strongest feedbacks in these cases are due to increased respiration of carbon from soils throughout the high latitude boreal forests of the Northern Hemisphere. One model in particular (HadCM3) indicates a secondary carbon cycle feedback due to the loss of much of the Amazon rainforest in response to significantly reduced precipitation over tropical South America [50]. While models disagree on the strength of any terrestrial carbon cycle feedback, they each suggest any such feedback would accelerate global warming.

Observations show that soils in England have been losing carbon at the rate of four million tonnes a year for the past 25 years [51] according to a paper in *Nature* by Bellamy et al. in September 2005, who note that these results are unlikely to be explained by land use changes. Results such as this rely on a dense sampling network and thus are not available on a global scale. Extrapolating to all of the United Kingdom, they estimate

annual losses of 13 million tons per year. This is as much as the annual reductions in carbon dioxide emissions achieved by the UK under the Kyoto Treaty (12.7 million tons of carbon per year).[52]

### **Forest Fires**

Rising Global temperature might cause forest fires to occur on larger scale, and more regularly. This releases more stored carbon into the atmosphere than the carbon cycle can naturally re-absorb, as well as reducing the overall forest area on the planet, creating a positive feedback loop. Part of that feedback loop is more rapid growth of replacement forests and a northward migration of forests as northern latitudes become more suitable climates for sustaining forests. There is a question of whether the burning of renewable fuels such as forests should be counted as contributing to global warming.

([Climate Change and Fire](#))

([Climate Roulette: Loss of Carbon Sinks & Positive Feedbacks](#))

([EPA: Global Warming: Impacts: Forests](#))

([Feedback Cycles linking forests, climate and landuse activities](#))

## **Consequences**

*See also [Mitigation of global warming](#)*

### **Economic**

In addition to direct damages from extreme weather, there are other economic effects of global warming.

### **Decline of agriculture**

*Main article: [Global warming and agriculture](#).*

For some time it was hoped that a positive effect of global warming would be increased agricultural yields, because of the role of carbon dioxide in photosynthesis, especially in preventing photorespiration, which is responsible for significant destruction of several crops. In Iceland, rising temperatures have made possible the widespread sowing of barley, which was untenable twenty years ago. Some of the warming is due to a local (possibly temporary) effect via ocean currents from the Caribbean, which have also affected fish stocks [53].

Whilst local benefits may be felt in some regions (such as Siberia), recent evidence is that global yields will be negatively affected. "Rising atmospheric temperatures, longer droughts and side-effects of both, such as higher levels of ground-level ozone gas, are likely to bring about a substantial reduction in crop yields in the coming decades, large-scale experiments have shown" (*The Independent*, April 27, 2005, "Climate change poses threat to food supply, scientists say" - report on [this event](#)).

Moreover, the region likely to be worst affected is Africa, both because its geography makes it particularly vulnerable, and because seventy per cent of the population rely on rain-fed agriculture for their livelihoods. Tanzania's official report on climate change suggests that the areas that usually get two rainfalls in the year will probably get more, and those that get only one rainy season will get far less. The net result is expected to be that 33% less maize—the country's staple crop—will be grown [54].

## **Insurance**

An industry very directly affected by the risks is the insurance industry; the number of major natural disasters has trebled since the 1960s, and insured losses increased fifteen-fold in real terms (adjusted for inflation) [55]. According to one study, 35–40% of the worst catastrophes have been climate change related (ERM, 2002). Over the past three decades, the proportion of the global population affected by weather-related disasters has doubled in linear trend, rising from roughly 2% in 1975 to 4% in 2001 (ERM, 2002).

A June 2004 report by the Association of British Insurers declared "Climate change is not a remote issue for future generations to deal with. It is, in various forms, here already, impacting on insurers' businesses now". It noted that weather risks for households and property were already increasing by 2-4 % per year due to changing weather, and that claims for storm and flood damages in the UK had doubled to over £6 billion over the period 1998–2003, compared to the previous five years. The results are rising insurance premiums, and the risk that in some areas flood risk insurance will become unaffordable for some.

In the United States, insurance losses have also greatly increased, but according to one study those increases are attributed to increased population and property values in vulnerable coastal areas. (*Science*, 284, 1943-1947).

## **Transport**

Roads, airport runways, railway lines and pipelines, (including oil pipelines, sewers, water mains etc) may require increased maintenance and renewal as they become subject to greater temperature variation, and, in areas with permafrost, subject to subsidence [56].

## **Flood defense**

For historical reasons to do with trade, many of the world's largest and most prosperous cities are on the coast, and the cost of building better coastal defenses (due to the rising sea level) is likely to be considerable. Some countries will be more affected than others - low-lying countries such as Bangladesh and the Netherlands would be worst hit by any sea level rise, in terms of floods or the cost of preventing them.

In developing countries, the poorest often live on flood plains, because it is the only available space, or fertile agricultural land. These settlements often lack infrastructure

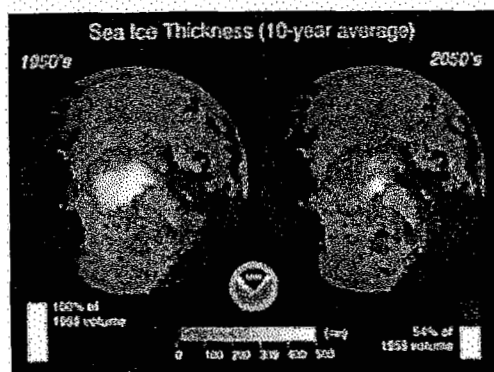
such as dykes and early warning systems. Poorer communities also tend to lack the insurance, savings or access to credit needed to recover from disasters [57].

## Migration

Some Pacific Ocean island nations, such as Tuvalu, are concerned about the possibility of an eventual evacuation, as flood defense may become economically infeasible for them. Tuvalu already has an ad hoc agreement with New Zealand to allow phased relocation [58].

In the 1990s a variety of estimates placed the number of environmental refugees at around 25 million. (Environmental refugees are not included in the official definition of refugees, which only includes migrants fleeing persecution.) The Intergovernmental Panel on Climate Change (IPCC), which advises the world's governments under the auspices of the UN, estimated that 150 million environmental refugees will exist in the year 2050, due mainly to the effects of coastal flooding, shoreline erosion and agricultural disruption. (150 million means 1.5 percent of 2050's predicted 10 billion world population.) [59]

## Northwest Passage



Melting Arctic ice may open the Northwest Passage in summer, which would cut 5,000 nautical miles (9,000 km) from shipping routes between Europe and Asia. This would be of particular relevance for supertankers which are too big to fit through the Panama Canal and currently have to go around the tip of South America. According the Canadian Ice Service, the amount of ice in Canada's eastern Arctic Archipelago decreased by 15 percent between 1969 and 2004 [60].

While the reduction of summer ice in the Arctic may be a boon to shipping, this same phenomenon threatens the Arctic ecosystem, most notably polar bears which depend on ice floes. Subsistence hunters such as the Inuit peoples will find their livelihoods and cultures increasingly threatened as the ecosystem changes due to global warming.

## Development

The combined effects of global warming may impact particularly harshly on people and countries without the resources to mitigate those effects. This may slow economic development and poverty reduction, and make it harder to achieve the Millennium Development Goals [61], [62].

In October 2004 the Working Group on Climate Change and Development, a coalition of development and environment NGOs, issued a report Up in Smoke on the effects of climate change on development. This report, and the July 2005 report Africa - Up in Smoke? predicted increased hunger and disease due to decreased rainfall and severe weather events, particularly in Africa. These are likely to have severe impacts on development for those affected.

## **Environmental**

Secondary evidence of global warming — reduced snow cover, rising sea levels, weather changes — provides examples of consequences of global warming that may influence not only human activities but also ecosystems. Increasing global temperature means that ecosystems may change; some species may be forced out of their habitats (possibly to extinction) because of changing conditions, while others may flourish. Few of the terrestrial ecoregions on Earth could expect to be unaffected.

Increasing carbon dioxide may (up to a point) increase ecosystems' productivity; but the interaction with other aspects of climate change, means the environmental impact of this is unclear. An increase in the total amount of biomass produced is not necessarily all good, since biodiversity can still decrease even though a smaller number of species are flourishing.

### **Water scarcity**

Eustatic sea level rises threaten to contaminate groundwater, affecting drinking water and agriculture in coastal zones. Increased evaporation will reduce the effectiveness of reservoirs. Increased extreme weather means more water falls on hardened ground unable to absorb it - leading to flash floods instead of a replenishment of soil moisture or groundwater levels. In some areas, shrinking glaciers threaten the water supply [63].

Higher temperatures will also increase the demand for water for cooling purposes.

In the Sahel, there has been on average a 25 per cent decrease in annual rainfall over the past 30 years.

## **Health**

### **Direct effects of temperature rise**

Rising temperatures have two opposing direct effects on mortality: higher temperatures in winter reduce deaths from cold; higher temperatures in summer increase heat-related



deaths. The distribution of these changes obviously differs. Palutikof et al calculate that in England and Wales for a 1 °C temperature rise the reduced deaths from cold outweigh the increased deaths from heat, resulting in a reduction in annual average mortality of 7000.

The European heat wave of 2003 killed 22,000–35,000 people, based on normal mortality rates (Schär and Jendritzky, 2004). It can be said with 90% confidence that past human influence on climate was responsible for at least half the risk of the 2003 European summer heat-wave (Stott et al 2004).

If average temperatures increase by 1 degree Celsius, there will be an estimated 24,000 additional murders in the U.S. each year (as the additional heat stress leads to more frequent rage). (New Scientist 11/5/02, review of *Body Heat* by Mark Blumberg.)

### **Spread of disease**

Global warming is expected to extend the favourable zones for vectors conveying infectious disease such as malaria [64]. In poorer countries, this may simply lead to higher incidence of such diseases. In richer countries, where such diseases have been eliminated or kept in check by vaccination, draining swamps and using pesticides, the consequences may be felt more in economic than health terms, if greater spending on preventative measures is required [65].

### **Impacts of glacier retreat**

The continued retreat of glaciers will have a number of different quantitative impacts. In areas that are heavily dependent on water runoff from glaciers that melt during the warmer summer months, a continuation of the current retreat will eventually deplete the glacial ice and substantially reduce or eliminate runoff. A reduction in runoff will affect the ability to irrigate crops and will reduce summer stream flows necessary to keep dams and reservoirs replenished. This situation is particularly acute for irrigation in South America, where numerous artificial lakes are filled almost exclusively by glacial melt. <sup>(BBC)</sup> Central Asian countries have also been historically dependent on the seasonal glacier melt water for irrigation and drinking supplies. In Norway, the Alps, and the Pacific Northwest of North America, glacier runoff is important for hydropower.

Many species of freshwater and saltwater plants and animals are dependent on glacier-fed waters to ensure a cold water habitat that they have adapted to. Some species of freshwater fish need cold water to survive and to reproduce, and this is especially true with Salmon and Cutthroat trout. Reduced glacier runoff can lead to insufficient stream flow to allow these species to thrive. Ocean krill, a cornerstone species, prefer cold water and are the primary food source for aquatic mammals such as the Sperm whale. <sup>(CBS)</sup> Alterations to the ocean currents, due to increased freshwater inputs from glacier melt, and the potential alterations to thermohaline circulation of the world's oceans, may impact existing fisheries upon which humans depend as well.

The potential for major sea level rise is mostly dependent on a significant melting of the polar ice caps of Greenland and Antarctica, as this is where the vast majority of glacial ice is located. The British Antarctic Survey has determined from climate modeling that for at least the next 50 years, snowfall on the continent of Antarctica should continue to exceed glacial losses from global warming. The amount of glacial loss on the continent of Antarctica is not increasing significantly, and it is not known if the continent will experience a warming or a cooling trend, although the Antarctic Peninsula has warmed in recent years, causing glacier retreat in that region.<sup>(BAS)</sup> If all the ice on the polar ice caps were to melt away, the oceans of the world would rise an estimated 70 m (229 ft). However, with little major melt expected in Antarctica, sea level rise of not more than 0.5 m (1.6 ft) is expected through the 21st century, with an average annual rise of 0.0004 m (0.0013 ft) per year. Thermal expansion of the world's oceans will contribute, independent of glacial melt, enough to double those figures.<sup>(NSIDC2)</sup>

## See also

- Climate change
- Global warming
- Mitigation of global warming
- Adaptation to global warming
- National Assessment on Climate Change for the United States
- Arctic Climate Impact Assessment
- Loop Current of the Gulf of Mexico

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- Increased temperature and salinity in the Nordic Seas

# Insurance Industry

<http://yosemite.epa.gov/OAR/globalwarming.nsf/content/ActionsIndustryInsurance.html>

While the effects of climate change will impact every segment of the business community, the insurance industry is especially at risk. Extreme weather events of the past several years have – in addition to their human toll – caused tens of billions of dollars in losses for insurers. Given development and population trends in high-risk areas, potential future impacts of global warming – such as sea level rise and increased storm activity and severity – could prove far more costly.

- There were *four times as many natural catastrophes* in the 1990s as there were three decades ago.
- Insured *losses from natural disasters* are 15 times higher today than they were in the 1960s, even after adjusting for inflation.
- The total dollars paid out in *natural disaster-related claims* since 1990 is 50 percent greater than the losses incurred over the past 40 years combined.
- People are moving to places like Florida at the rate of 1,000 per day, substantially increasing the *value of the property* in these high-risk areas.

Lawrence Berkley National Laboratory— this DOE sponsored site describes how increasing energy efficiency has the dual benefit of reducing insurance losses and mitigating global warming. <http://eetd.lbl.gov/insurance/>

Surviving Disaster with Renewable Energy— this National Renewable Energy Laboratory sponsored site focuses on the role of renewables in emergency preparedness and response, disaster mitigation and relief, and sustainable development. [http://www.nrel.gov/surviving\\_disaster/](http://www.nrel.gov/surviving_disaster/)

General Re— Provides a search engine dedicated to the insurance industry that returns links to information relevant to the insurance industry including natural catastrophes and other disasters. <http://www.genre.com/sharedfile/pdf/NAArticleIndex200602-en.pdf>

Swiss Re Group— Swiss Re Research and Publications - Climate Change Roundtable, - Explains Swiss Re's philosophy and provides links to environmental information, organizations and business initiatives and in-depth focus reports. <http://www.swissre.com/>

**U.S. Insurance Companies Staggering Under Global Warming Increasing Damages** <http://www.ens-newswire.com/ens/sep2005/2005-09-13-04.asp>

**Global warming called insurance peril: State regulators and scientists warn of huge losses from climate shifts.**

<http://www.sacbee.com/content/business/story/13538388p-14378761c.html>

# State Insurance Commissioners Calculate Global Warming Pricetag

WASHINGTON - The decision to set up a task force to assess global warming effects on the insurance industry, taken by the National Association of Insurance Commissioners (NAIC), came during the same week that the world's biggest insurance broker, Marsh & McLennan, briefed its corporate clients, which include roughly 75 percent of the "Fortune 500" biggest companies, on the potential impact of global warming on their businesses.

According to a December 2005 study, U.S. insurers have seen a 15-fold increase in insured losses from catastrophic weather events in the past three decades, increases that have far outstripped the growth in premiums, population and inflation over the same time period.

"It's becoming clearer that we are experiencing more frequent and more powerful weather events that pose huge challenges for the insurance industry," according to Tim Wager, director of Nebraska's Department of Insurance and co-chairman of the new task force set up by NAIC, which originally scheduled the initiative for approval at a meeting in New Orleans that was then cancelled due to Hurricane Katrina.

"The impacts are being felt on our coasts and in the interior U.S.," he added. "We're seeing all kinds of extreme weather in the Great Plains states, including drought, tornadoes, brushfires and severe hailstorms." The task force will review whether U.S. insurers have adequately considered the consequences on their industry, including its solvency, if current trends that are believed to be related to global warming continue or intensify, according to Washington State insurance commissioner Mike Kreidler. "We had a statewide drought emergency in Washington last year," he said, noting its impact on the state's agriculture and ski industries. "As scientists predict this trend to continue, I'm concerned with the impact these changes will have on insurance availability and costs." In the U.S. system, individual states, rather than the federal government, regulate the insurance industry.

## **SCARY STATISTICS** Dr. Greg Forbes, Severe Weather Expert

Not only have there been many more tornadoes than average in 2006, but many have been strong tornadoes. That goes a long way toward explaining why there have been so many fatalities from tornadoes this year. **There have been 49 deaths directly caused by tornadoes**, plus one more person who had a heart attack in an area not directly hit by a tornado. **Last year at this time there had only been 5 deaths**, and there were only 39 for the whole year.

**There have been 22 F3 tornadoes thus far this year and one F4. Last year at this time there had only been 3 F3 tornadoes. The first (and only) F4 of the year in 2005 did not occur until November 15.**

Over the years, there has been a very strong relationship between tornado strength and the number of tornado deaths. **Only 6% of all tornadoes in a decade rate F3 or stronger in intensity.** They have winds estimated above about 158 mph. However, **these tornadoes have caused 87% of the tornado deaths.**

Homes are not built to withstand those excessive wind speeds. Building codes are not higher than 90 mph in most parts of the country, so contractors are not required to build homes to resist winds stronger than that. As a standard safety rule, we tell you to go to the lowest, innermost portion (preferably the basement) of a well-built home. But the rest of the story, as one radio personality says, is that even there you are not absolutely safe if you get hit by one of those top-strength tornadoes.

Cover story

# Off the grid or on, solar and wind power gain

## Incentives, savings push more families to renewable energy

By Paul Davidson  
USA TODAY

WILMINGTON, Vt.— The wind whips up in Dale Doucette's expansive backyard, furiously spinning the blades on his 80-foot-tall silver wind turbine and leaving a broad smile on his square-jawed face.

The gusts nudge the voltage on his battery bank and help power Doucette's wood-carving saw, as well as the PC, printer and recessed lights in his wife Michele's home-based chiropractic office.

But overcast skies mean the Doucettes' 10 solar panels won't be as productive as usual. So his two teenage sons can use the computer but not the TV or GameCube.

"I'm the power Nazi," Doucette, 47, says as the turbine blades emit a shrill hum on a late March afternoon.

The Doucettes live off the power grid, but they're far from granola-crunching hippies eking out a bare-bones existence in the hinterlands. They live in a sleek \$500,000 plaster-and-tile house a quarter mile from electric lines and could have hooked in for \$10,000. Instead, they opted to pay about \$41,000 for their own solar and wind energy systems.

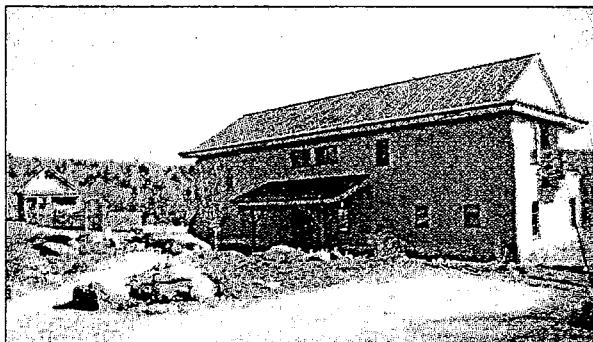
"We want to be as self-sustaining as possible and get out from under Big Brother," Doucette says. "I enjoy not getting an electric bill."

Amid soaring electricity prices, the renewable energy industry is increasingly being driven by families such as the Doucettes who choose to be off the grid for environmental or political reasons and by a



Photos by Nancy Palmieri for USA TODAY

**"Power" station:** Dale Doucette, with cat Nitro, stands near the windmill on his property that supplements solar panels that provide power for his home.



**Elbow room:** Dale and Michele Doucette's home is powered by a solar power system in the shed, left.

Please see COVER STORY next page ▶

# 17 states offer rebates on solar or wind systems

Continued from 1B

much faster-rising number of Americans adding solar and wind systems to grid-connected houses. Such equipment used to be bought almost exclusively by off-the-grid-dwellers in remote rural reaches who couldn't afford fees of \$30,000 or more to tie in to electric lines.

Now, in 27 states, homeowners on the grid can get state rebates or tax breaks that subsidize up to 50% or more of the cost of clean energy systems. They then sell the electricity they generate, but don't use themselves, to utilities, offsetting the cost of the power they draw from the grid as they spin their meters backward and drive their electric bills toward zero.

Seventeen states, and some power companies themselves, now offer utility customers rebates on the purchase and installation of solar or wind systems, up from three in 2000. Florida and Pennsylvania are among those considering rebates. Meanwhile, the number of states with "net metering" laws — which permit customers to sell the power they produce to the electric utility at retail rates — has nearly doubled to 36 in the past six years.

Despite a hodgepodge of state laws, the trend points up a budding

**"I love living off the grid and being independent. I wanted to live on a large piece of property out in the country."**

— Sunny Tappan

grass-roots movement to displace at least some of the nation's power generation from pollution-belching plants to small, clean neighborhood nodes. That eases strains on transmission lines. Some 180,000 families live off-grid, a figure that has jumped 33% a year for a decade, says Richard Perez, publisher of *Home Power* magazine.

Yet, thanks to the incentives, another 27,000 grid-connected houses supplement the utility's power with their own energy systems, most of which are solar, says the Interstate Renewable Energy Council and the American Wind Energy Association. Perez expects the number of utility customers using clean energy to overtake off-the-grid households in a decade.

"It's accelerating very quickly," says Michael Eckhart, of the American Council on Renewable Energy.

The movement got an added jolt in January when utility customers could start taking advantage of a new \$2,000 federal tax credit for solar power system purchases as part of the Energy Policy Act of 2005.

After soaring 30% a year the past five years, sales of solar, or photovoltaic, systems could ratchet even higher this year. Bob-O Schultze, owner of Electron Connection in Northern California, says solar sales have risen 50% annually since 2002. About 75% of his business is from on-grid customers, vs. just 1% four years ago.

## Off the grid

For decades, dealers in small solar and wind systems depended on the small band of mavericks who moved off the grid to live in the countryside, where land is plentiful and inexpensive. California, Washington, Oregon, Colorado, Vermont and Maine have long been havens, though people live off the grid in almost every state.

"These are people who want a big garden, have no close neighbors and the only land they can afford is beyond the reaches of the grid," Perez, an off-gridder himself, says. Property without utility hook-ups, he adds, can cost about a third less than a standard lot. These days, a growing number of off-grid-dwellers could link up fairly cheaply but prefer to be untethered for myriad reasons, including rising electricity rates, a desire to cut power plant pollution and concerns about blackouts or terrorism.

The Wilmington area, in rural southern Vermont, nestled at the foothills of the Green Mountains is speckled with off-grid homes on back roads where the area's criss-

crossing power lines don't reach.

Doucette, a wood carver, and some friends built his 3,200-square-foot house four years ago on a 22-acre, tree-rimmed property, moving from a smaller grid-tied house a few miles away. Considering his old electric bill ran to \$1,700 a year and was certain to go higher, Doucette figures his green energy system will pay for itself in 20 years. But money was not at the heart of their decision.

"We made a conscious choice not to get on the grid," Doucette says, noting he has long been rankled by the electricity price increases of the local resort town during ski season and by periodic winter blackouts.

Like other off-grid-dwellers, Doucette uses his gleaming blue solar panels on the roof of a small shed about 150 feet from his house, as his main energy source. The turbine, another 300 feet away, provides added juice on cloudy days when the wind is swirling.

The power generated by both solar and wind systems is stored in 24 batteries in a bin in the shed. An inverter converts the DC current produced by the systems to the AC current used in homes. The batteries could last several days in the unlikely event there is neither sun nor wind. A backup propane generator kicks in if the batteries get low.

Like other clean-energy homes, Doucette's two-story, earth-toned house is built for conservation, with energy-efficient refrigerator and dishwasher, low-voltage light bulbs and straw-bale insulation.

In nearby Marlboro, Sunny and Nat Tappan live in an older-style off-grid home, about 2½ miles up a hill off a dirt road on an isolated 90-acre tract. The rustic, timber-frame house, which sits next to a pasture with sheep and chickens, has a composting toilet and no running water (they have a well). Sunny and her former husband bought the property 18 years ago and spent a few thousand dollars on a solar power system. Connecting to the power grid would have cost \$80,000, but Sunny, 53, had no interest anyway.

"I love living off the grid and being independent," she says. "I wanted to live on a large piece of property out in the country."

**Cover story**

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Four small solar panels angled on brackets in a garden few feet from the back door supply 680 watts of power. But noting she has no TV, dishwasher or washing machine, Sunny says that's more than enough. "We use very little electricity." And if it's persistently cloudy? "So I don't vacuum one week," she says.

For others, living off the grid is a matter of principle. Maynard Kaufman, 77, who lives in a saltbox house on a farm near Bangor, Mich., could have connected to the grid for \$10,000. Instead, he spent \$30,000 on a solar power system and \$12,700 on two wind turbines. Noting he had demonstrated in front of the local nuclear plant, he said, "It was totally a matter of conscience."

### On the grid

For many utility customers, installing an alternative energy system largely boils down to the dollars and cents that state incentives help them save.

California was the first state to offer a generous package of renewable-energy incentives for homes and businesses in the late 1990s as power companies were deregulated. It's blessed with abundant sunshine and plagued by high electric rates and an overtaxed grid that led to rolling blackouts.

By 2002, California was offering households 60% rebates on solar power systems, as well as tax credits, letting homeowners pay less than 30% of retail cost. Residents send much of their solar energy into the grid during the day when they're not home, easing peak demands, and draw from it at night when the sun isn't shining.

Demand for solar power has surged, with about 15,000 utility customers installing systems, and last year the state cut the rebate to 35%. The goal is to use rebates to drive so much demand that solar prices plunge, and the rebates can be phased out. But a worldwide shortage of solar panels, spurred by even-more-generous incentives in Japan and Germany, is keeping prices high until more factories are built in 18 months.

New Jersey is the only other state with a solar incentive program to match California's. Rebates cover more than 50% of a solar power system's cost. Plus, households can sell credits for the energy they produce to utilities to meet state clean energy quotas. The program "helps reduce peak demands, and that helps dramatically," says Jeanne Fox, president of the New Jersey Board of Public Utilities. "Our goal is to drive energy generation and a lot of that is to be distributed" in neighborhoods to improve power-plant reliability and security.

# Energy laws vary from state to state

## Renewable energy incentives

States with tax breaks or rebates for residents who buy clean-energy systems and those with net metering laws permitting consumers to sell power they generate to electric companies at retail rates.

State	State rebates	Net metering	State income tax incentives
Alabama			■
Arizona			■
Arkansas		■	
California	■	■	■
Colorado		■	
Connecticut	■	■	
Delaware	■	■	
District of Columbia		■	
Florida			
Georgia		■	
Hawaii		■	■
Idaho			■
Illinois	■		
Indiana		■	
Iowa		■	■
Kentucky		■	
Louisiana		■	
Maine	■		
Maryland	■	■	■
Massachusetts	■	■	■
Michigan		■	
Minnesota	■	■	
Montana		■	■
Nevada	■	■	
New Hampshire		■	
New Jersey	■	■	
New Mexico		■	■
New York	■	■	■
North Carolina	■	■	■
North Dakota		■	■
Ohio		■	
Oklahoma		■	
Oregon	■	■	■
Pennsylvania		■	
Puerto Rico			
Rhode Island	■	■	■
South Carolina	■		
Texas		■	
Utah		■	■
Vermont	■	■	
Virginia		■	
Washington		■	
Wisconsin	■	■	
Wyoming	■	■	

Sources: North Carolina Solar Center, Interstate Renewable Energy Council

By Paul Davidson  
USA TODAY

The USA is a patchwork of alternative energy laws in which some states offer much more generous incentives than others for homeowners and businesses to install solar or wind systems.

Renewable energy representatives say the inconsistency hampers mass adoption, keeping prices high.

Thirty-five states and Washington, D.C., allow homeowners who generate their own electricity to sell their surplus to utilities at retail rates. They can offset the power they draw from the grid with what they send in, driving their bills toward zero.

But some states have more consumer-friendly rules than others. California and New Jersey, for instance, let homeowners roll over electricity credits into the next month's bill for a year. In others, such as Massachusetts and Arkansas, a customer who generates a surplus in a given month is paid a much lower, wholesale rate. Just 17 states offer rebates on solar or wind systems. Solar industry officials blame big utilities that don't want to relinquish market share and wield huge influence with state legislatures.

"It's frustrating that you don't have consistency across all 50 states," says Rhone Resch, head of the Solar Energy Industries Association.

Tom Dyer of Kyocera Solar, the No. 3 maker, says, "What I would really like to see is a federal (rebate) program" modeled after those in Japan and Germany.

But the Energy Department's Craig Stevens says, "A lot of this is handled regionally by state law. There wouldn't really be a role for the federal government."

Instead, he says, the White House wants to lower costs with improved technology. President Bush has proposed a 78% jump in solar research funding.

Meanwhile, some utilities say current laws are unfair to them and to other ratepayers. In Northern California, Pacific Gas and Electric says it should not be forced to pay customers retail rates for their surplus electricity. Customers are simply providing raw energy that doesn't account for transmission-line costs.

"We should pay you the wholesale rate for ... your electricity," says Bruce Bowen, PG&E director of regulatory policy. Other ratepayers, he says, subsidize the gap between the two rates. The subsidy, now negligible, could total about 50 cents monthly in eight to 10 years when more people use clean energy systems.

Bowen's argument doesn't account for the fact that energy produced by homes and businesses eases strains on power lines during peak midday periods, says V. John White, who heads the Center for Energy Efficiency and Renewable Technologies in California. "It's quality power that strengthens the grid," he says.

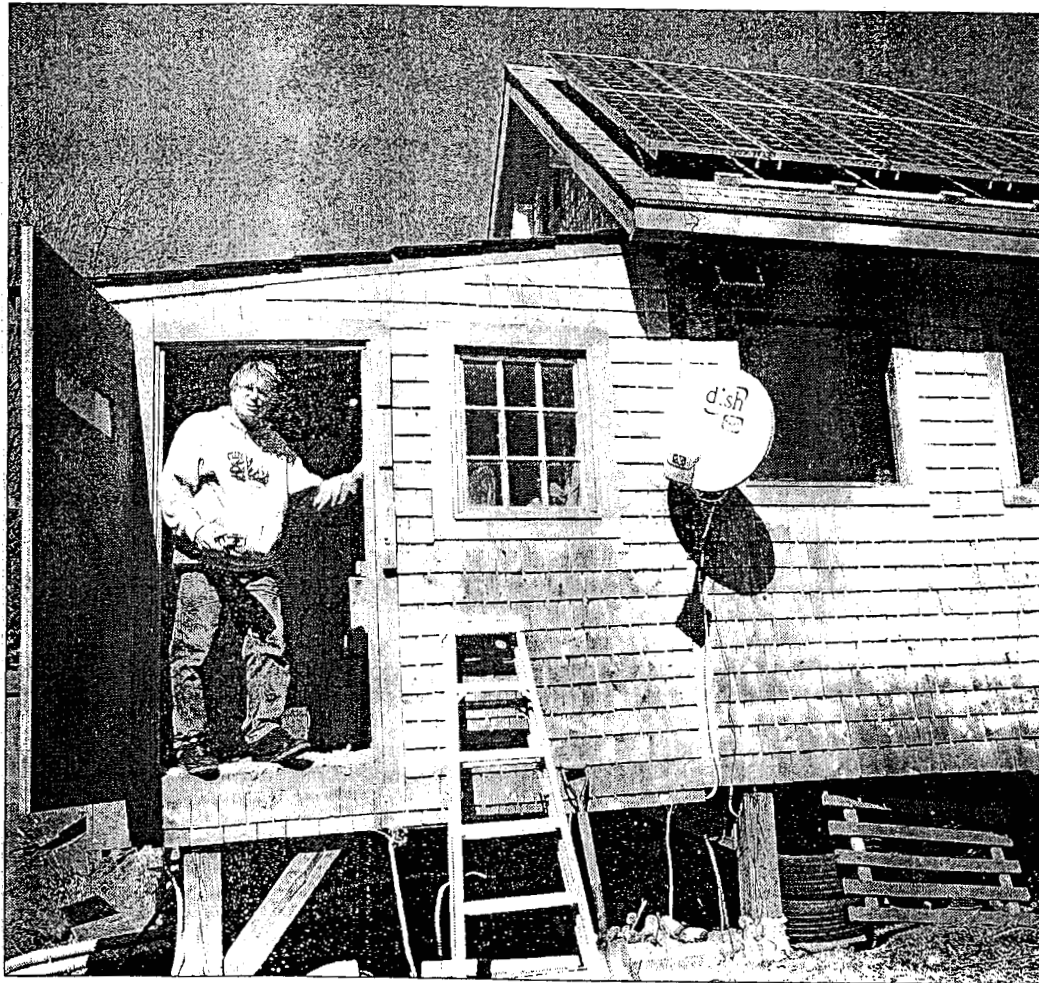
Other states with rebate programs include New York, Massachusetts, Illinois and Rhode Island, where electricity prices are high.

Clark Beebe, 57, of Springfield, N.J., bought a \$50,000 solar power system two years ago for \$15,000 after rebates, installing it on the roof of his four-bedroom house. Because he offsets what he uses with what he pumps into the grid, his annual power bill has dropped from \$1,270 to \$170, though he also installed energy-saving appliances. His \$1,100 yearly savings is supplemented by \$500 in clean energy credits, cutting the payback period for his system to nine years.

After that, he'll effectively net at least a \$200-a-year profit. "I am now an electricity company," says Beebe 57. "Plus, I'm generating electricity without any pollutants."

Carrie Buczeke, 42, of Livermore, Calif., rolled the cost of her \$54,000 solar panels — \$25,000 after rebates and tax credits — into a home-equity loan. She has wiped out her \$400 monthly electric bill and pays \$300 a month for the loan. After seven years, the loan will be paid off. "It was such a no-brainer," she says.





Photos by Nancy Palmeri for USA TODAY

**Doing double duty:** Dale Doucette climbs down from a small shed that contains the solar panels that provide all the power needs for his home. The shed also houses his chickens.



**On the Net, but not on the grid:** Justin Doucette, 17, left, works at his computer, while his friend, Stephan Ruiz, 16, uses a handheld device.

State of Florida



## Public Service Commission

-M-E-M-O-R-A-N-D-U-M-

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**DATE:** June 12, 2006

**TO:** Blanca S. Bayó, Director, Division of the Commission Clerk and Administrative Services

**FROM:** Jane Faurot, Chief, Office of Hearing Reporter Section, Division of the Commission Clerk and Administrative Services

**RE:** DOCKET NO. 060220-EC, PREHEARING HELD 05/30/06.

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Re: PETITION FOR DETERMINATION OF NEED FOR SEMINOLE GENERATING STATION UNIT 3 ELECTRICAL POWER PLANT IN PUTNAM COUNTY, BY SEMINOLE ELECTRIC COOPERATIVE, INC.

DOCUMENT No: 04709-06, 05/31/06

The transcript for the above proceedings has been completed and is forwarded for placement in the docket file, including attachments.

Please note that Staff distribution of this transcript was made to:

LEGAL, ECR

Acknowledged by:

A handwritten signature in black ink, appearing to be "JF", written over a horizontal line.

JF/rIm



State of Florida



**Public Service Commission**  
**-M-E-M-O-R-A-N-D-U-M-**

---

**DATE:** June 12, 2006

**TO:** Blanca S. Bayó, Director, Division of the Commission Clerk and Administrative Services

**FROM:** Jane Faurot, Chief, Office of Hearing Reporter Section, Division of the Commission Clerk and Administrative Services

**RE:** DOCKET NO. 060220-EC, HEARING HELD 06/07/06.

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Re: PETITION FOR DETERMINATION OF NEED FOR SEMINOLE GENERATING STATION UNIT 3 ELECTRICAL POWER PLANT IN PUTNAM COUNTY, BY SEMINOLE ELECTRIC COOPERATIVE, INC.

DOCUMENT No: 04984-06, 06/09/06

The transcript for the above proceedings has been completed and is forwarded for placement in the docket file, including attachments.

Please note that Staff distribution of this transcript was made to:

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JF/rlm

Kay Flynn

060220

**From:** Donna Jones  
**Sent:** Friday, July 14, 2006 3:14 PM  
**To:** Commissioners & Staffs; All PSC Staff  
**Subject:** Items of Interest at Upcoming Agenda Conference 7/18/2006

A news release was distributed to the daily newspapers this afternoon, 7/14/2006, and is now available on the PSC website:

<http://www.psc.state.fl.us/general/news/pressrelease.cfm?release=102>

*Donna Jones  
Office of Public Information  
Public Service Commission  
Telephone: 413-6656, Intercom 431*



State of Florida  
**Public Service Commission**  
**NEWS RELEASE**

July 14, 2006

Contact: 850-413-6482

**Items of Interest at Upcoming Agenda Conference 7/18/06**

**TALLAHASSEE** — The following items are among those scheduled for consideration by the Commission at the July 18, 2006, Agenda Conference:

**ITEM NO. 5 DOCKET NO. 060038-EI** – PETITION FOR ISSUANCE OF A STORM RECOVERY FINANCING ORDER, BY FLORIDA POWER & LIGHT COMPANY – The Commission will consider a staff recommendation addressing FPL's motion for reconsideration and clarification of specified portions of the Financing Order.

**ITEM NO. 7 DOCKET NO. 060300-TL** – PETITION FOR RECOVERY OF INTRASTATE COSTS AND EXPENSES RELATING TO REPAIR, RESTORATION AND REPLACEMENT OF FACILITIES DAMAGED BY HURRICANE DENNIS BY GTC, INC. D/B/A/ GT COM. – The Commission will take up a staff recommendation on GT Com's cost recovery petition relating to Hurricane Dennis. This is a case of first impression concerning a new statute.

**ITEM NO. 8 DOCKET NO. 060077-TL** – PROPOSAL TO REQUIRE LOCAL EXCHANGE TELECOMMUNICATIONS COMPANIES TO IMPLEMENT TEN-YEAR WOOD POLE INSPECTION PROGRAM – The Commission will consider a staff recommendation addressing whether or not to approve Verizon's revised wood pole inspection plan.

**ITEM NO. 9 DOCKET NO. 040604-TL** – ADOPTION OF THE NATIONAL SCHOOL LUNCH PROGRAM AND AN INCOME-BASED CRITERION AT OR BELOW 135% OF THE FEDERAL POVERTY GUIDELINES AS ELIGIBILITY CRITERIA FOR THE LIFELINE AND LINK-UP PROGRAMS - The Commission will take up a staff recommendation on whether or not a simplified certification process and the National School Lunch, Free Lunch Program should be used by all Florida eligible telecommunications carriers for the Link-Up Florida and Lifeline programs.

**ITEM NO. 16 DOCKET NO. 060220-EC** – PETITION FOR DETERMINATION OF NEED FOR SEMINOLE GENERATING STATION UNIT 3 ELECTRICAL POWER PLANT IN PUTNAM COUNTY, BY SEMINOLE ELECTRIC COOPERATIVE, INC. - The Commission will consider a staff recommendation which addresses a determination of need request from Seminole Electric Cooperative, Inc. The request is for the location of a 750 MW supercritical pulverized coal electrical power plant in Putnam County.

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Website - <http://www.floridapsc.com>  
Kevin Bloom, Director, Office of Public Information  
Additional Press Contact: Todd Brown  
2540 Shumard Oak Boulevard, Tallahassee, Florida 32399-0850

Kay Flynn

060220-EC

**From:** Donna Jones  
**Sent:** Tuesday, July 18, 2006 10:10 AM  
**To:** All PSC Staff; Commissioners & Staffs  
**Subject:** Commission Gives Green Light To New Plant for Seminole Electric Cooperative

A news release was distributed to the daily newspapers this morning, 7/18/06, and is now available on the PSC website:

<http://www.psc.state.fl.us/general/news/pressrelease.cfm?release=104>



State of Florida  
**Public Service Commission**  
**NEWS RELEASE**

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July 18, 2006

Contact: 850-413-6482

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**Commission Gives Green Light To New Plant for Seminole Electric Cooperative**

**TALLAHASSEE** — The Florida Public Service Commission gave unanimous consent Tuesday for a 750 megawatt coal-fired power plant to serve customers of Seminole Electric Cooperative.

“The cooperative’s customers need reliable power at reasonable prices,” Commission Chairman Lisa Polak Edgar said. “This plant is the most cost-effective way to meet those needs, and it helps reduce Florida’s dependence on natural gas.”

The plant, which is scheduled to go into operation in May 2012, will be built at the utility’s existing Palatka site, beside two existing coal plants. The utility conducted analyses to compare the cost of various fuels and found the coal option would yield savings of \$476 million compared with natural gas over the life of the plant.

Seminole provides electricity to 10 member cooperatives, which are projected to have a combined total of more than one million residential customers by 2015.

###

Website - <http://www.floridapsc.com>  
Kevin Bloom, Director, Office of Public Information  
Additional Press Contact: Todd Brown  
2540 Shumard Oak Boulevard, Tallahassee, Florida 32399-0850

State of Florida



**Public Service Commission**  
**-M-E-M-O-R-A-N-D-U-M-**

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**DATE:** July 20, 2006  
**TO:** Blanca Bayó, Director, Commission Clerk and Administrative Services  
**FROM:** Jane Furot, Chief, Office of Hearing Reporter Services  
**RE:** DOCKET NO. 060220-EC, HEARING HELD 06/07/06.

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Attached for filing are Exhibits 1 through 39 representing a complete filing of the exhibits identified and admitted into the record during the proceedings held in the above docket.

Acknowledged BY:

*A. V. Nett*

JF/rlm