



Vulnerability of Iran to Adverse Impacts of Climate Change

**National Climate Change Office
Department of Environment
Islamic Republic of Iran**

by:

Mohammad Soltanieh

National Project Manager

National Workshop on

**KYOTO PROTOCOL: Challenges and Opportunity
for Sustainable Development of I.R. Iran.**

25-26 October, 2003

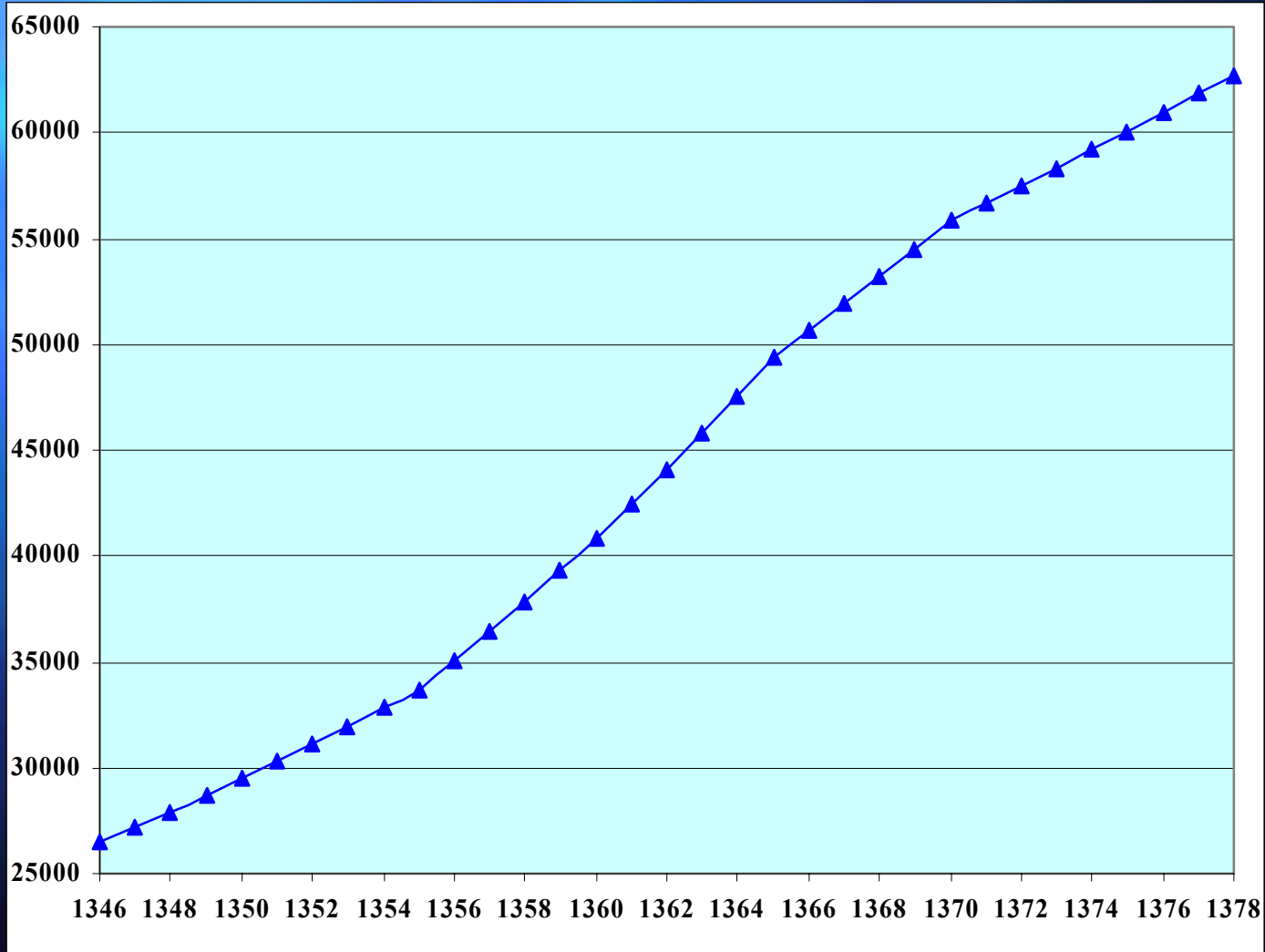
Tehran, Iran

PRESENTATION OVERVIEW

- National circumstances
- Long-term projection of temperature and precipitation in Iran
- Impact of response measures by Annex-B countries on the economy of Iran.
- Direct adverse impact of climate change on:
 - Water resource
 - Agricultural products and food security
 - Coastal and low land areas
 - Public health
- Adaptation on Climate Change

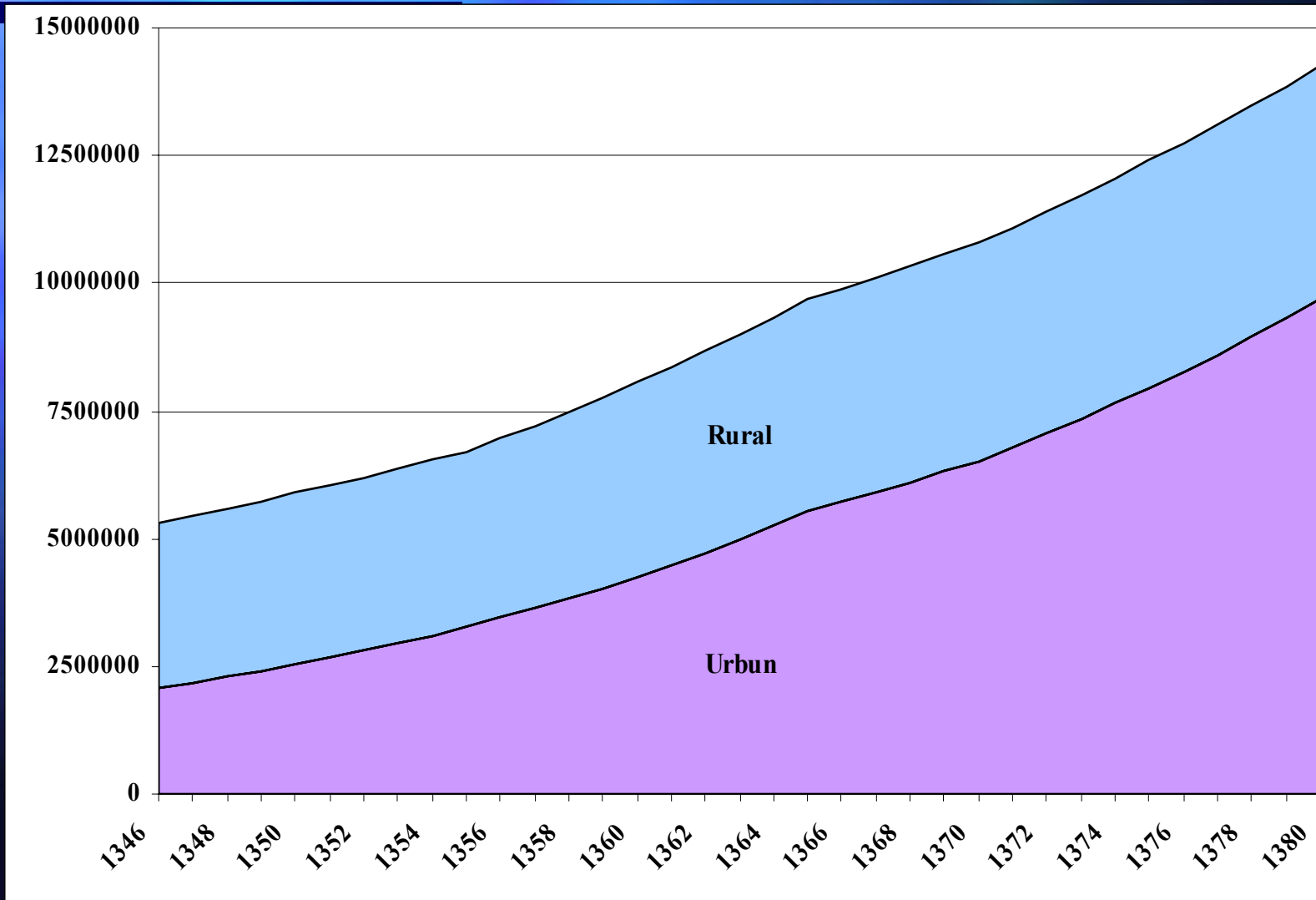
National Circumstances (I)

Trend of population growth between 1968-1998('000 person)



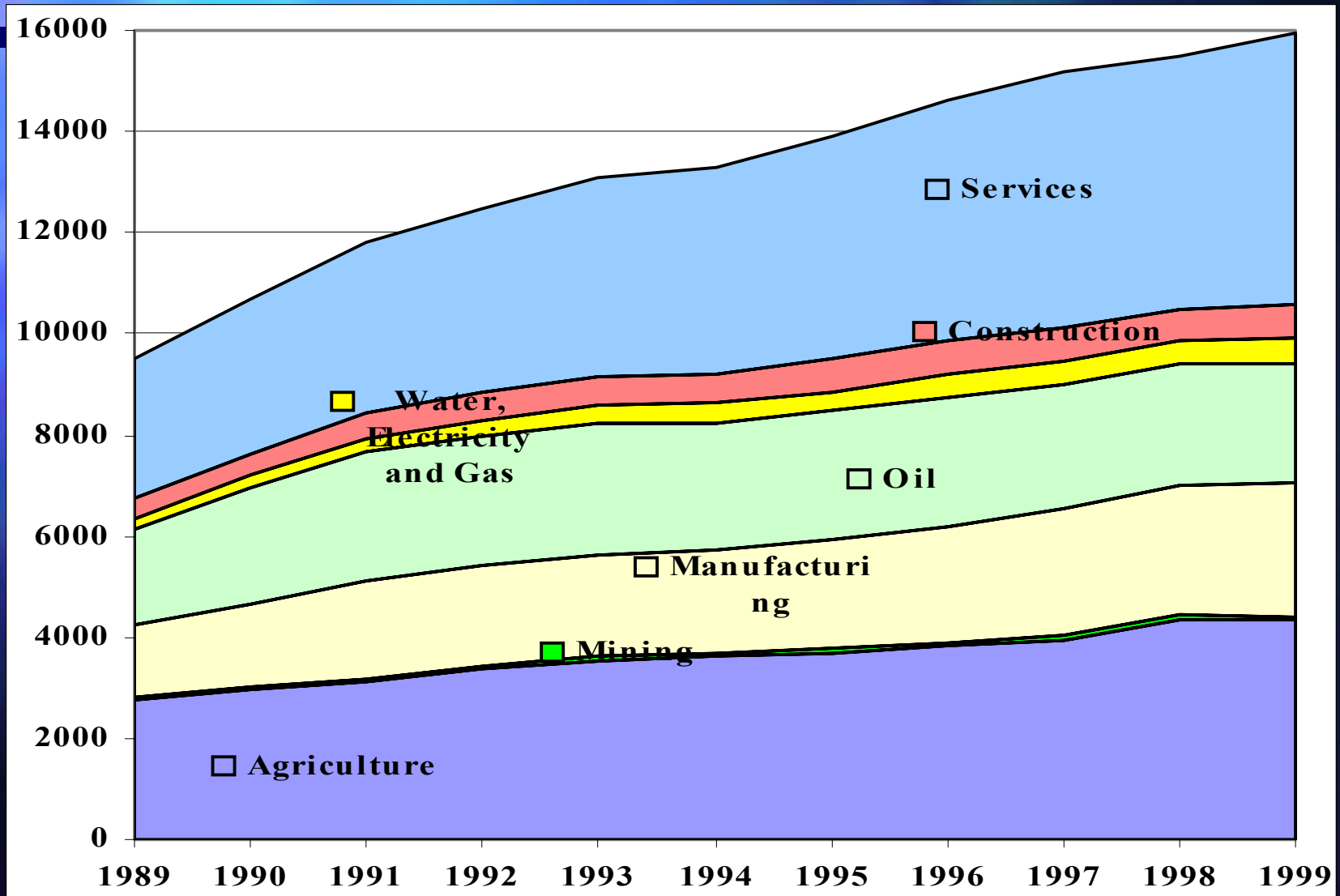
National Circumstances (II)

Trend of urban & rural household between 1968-1998



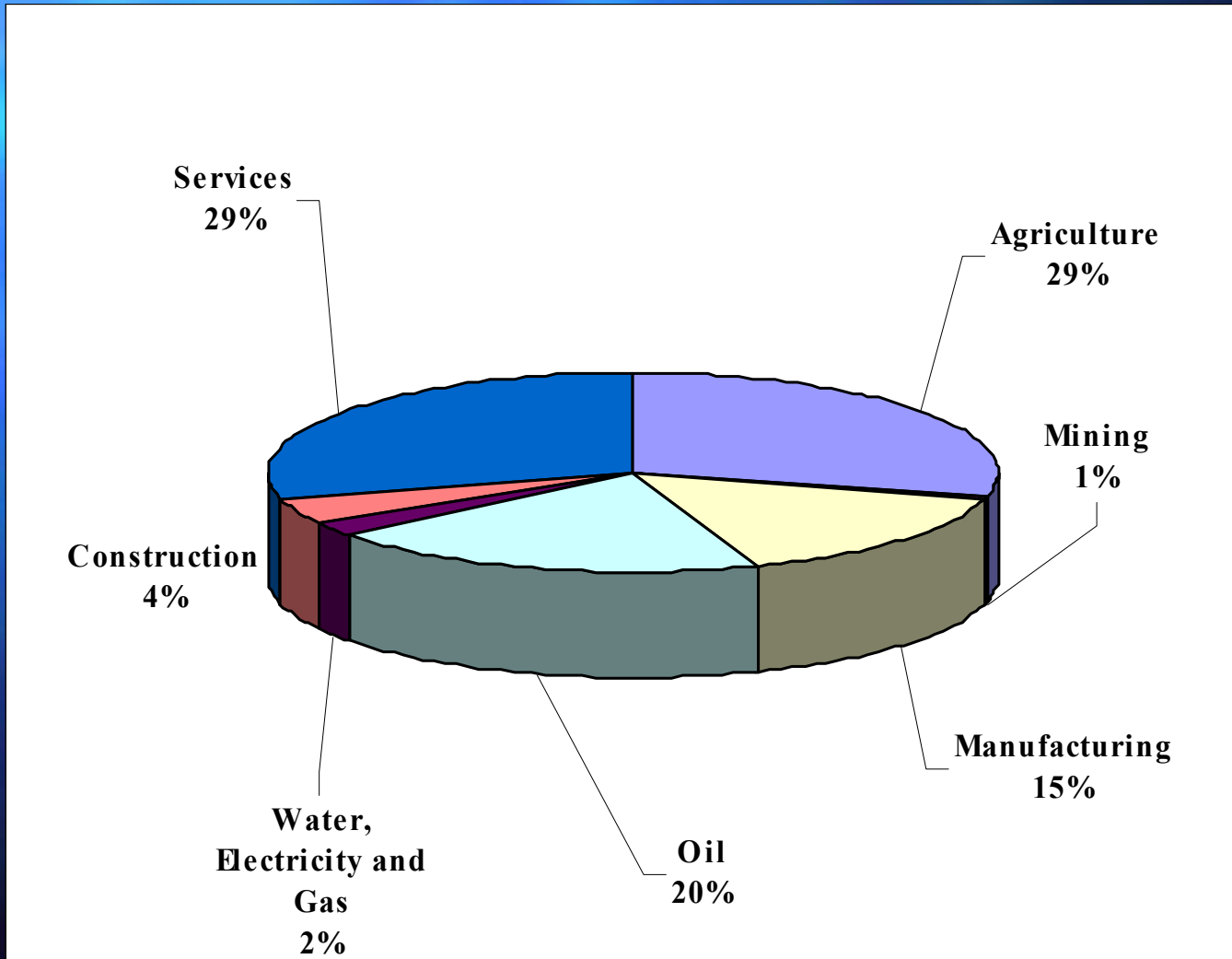
National Circumstances (III)

Trend of GDP growth by sector (bn. Rials- at constant 1982 prices)



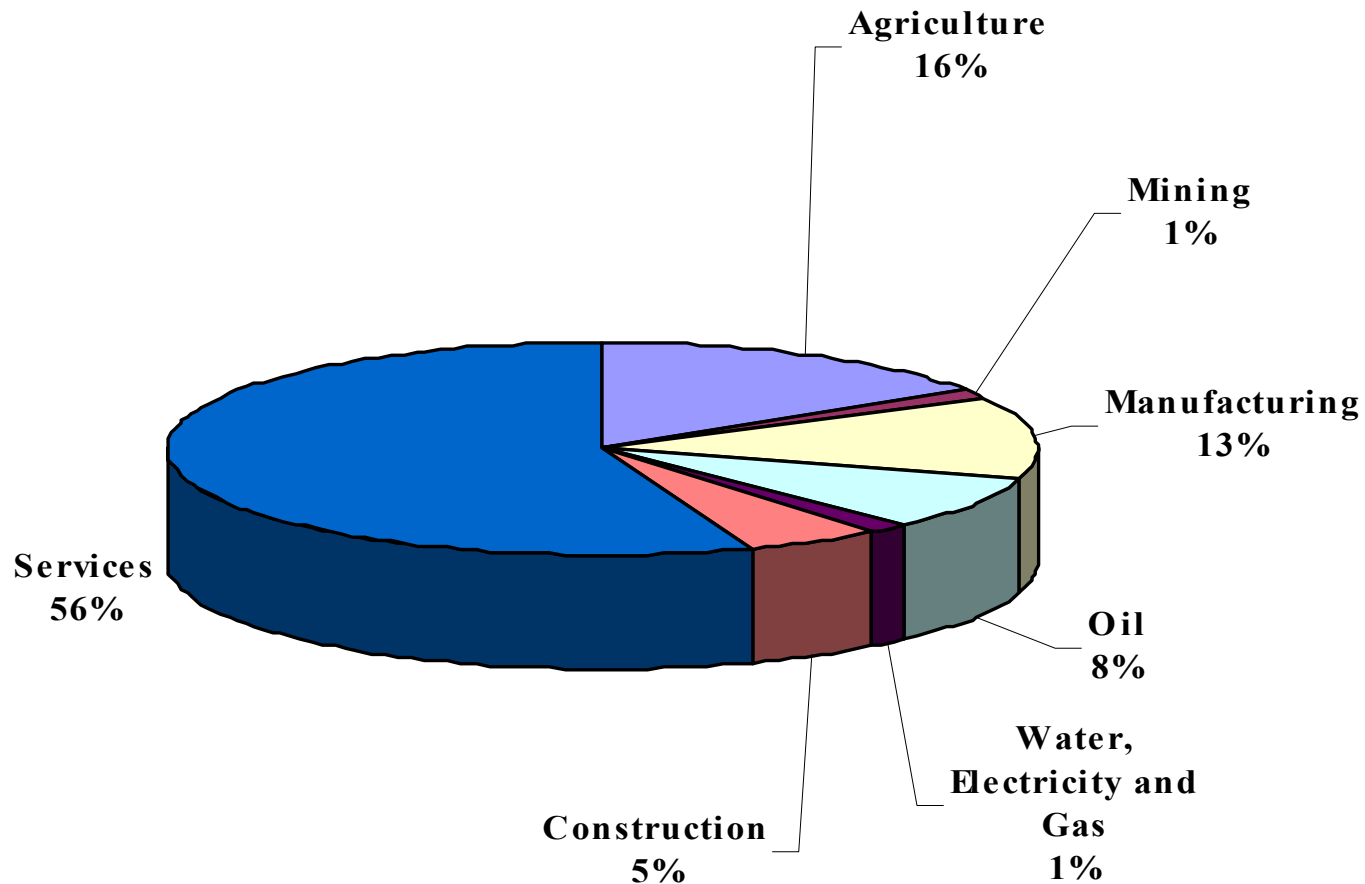
National Circumstances (IV)

Share of different economic sub-sectors in GDP in 1990
(%)



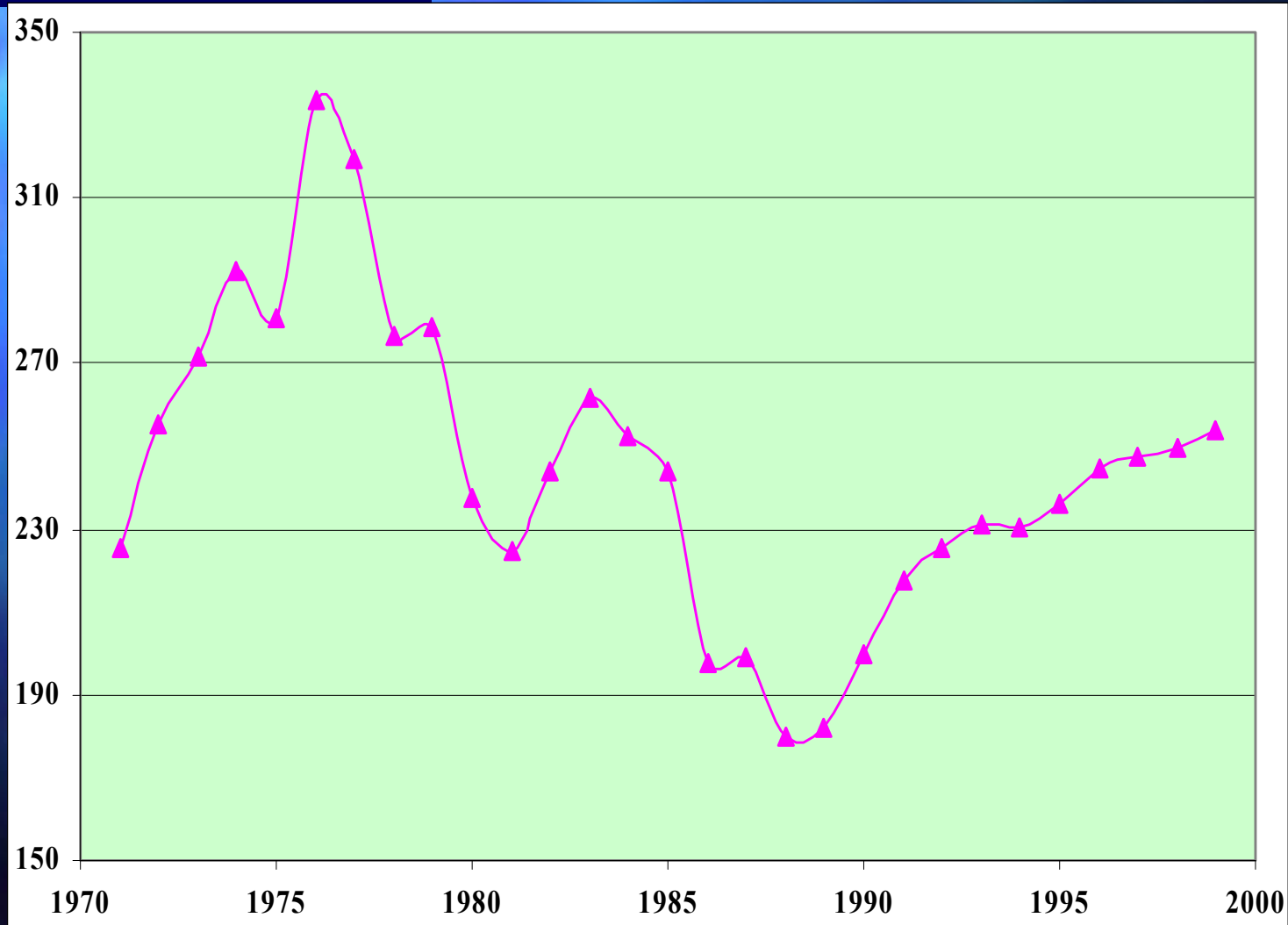
National Circumstances (V)

Share of different economic sub-sectors in GDP in 2000
(%)



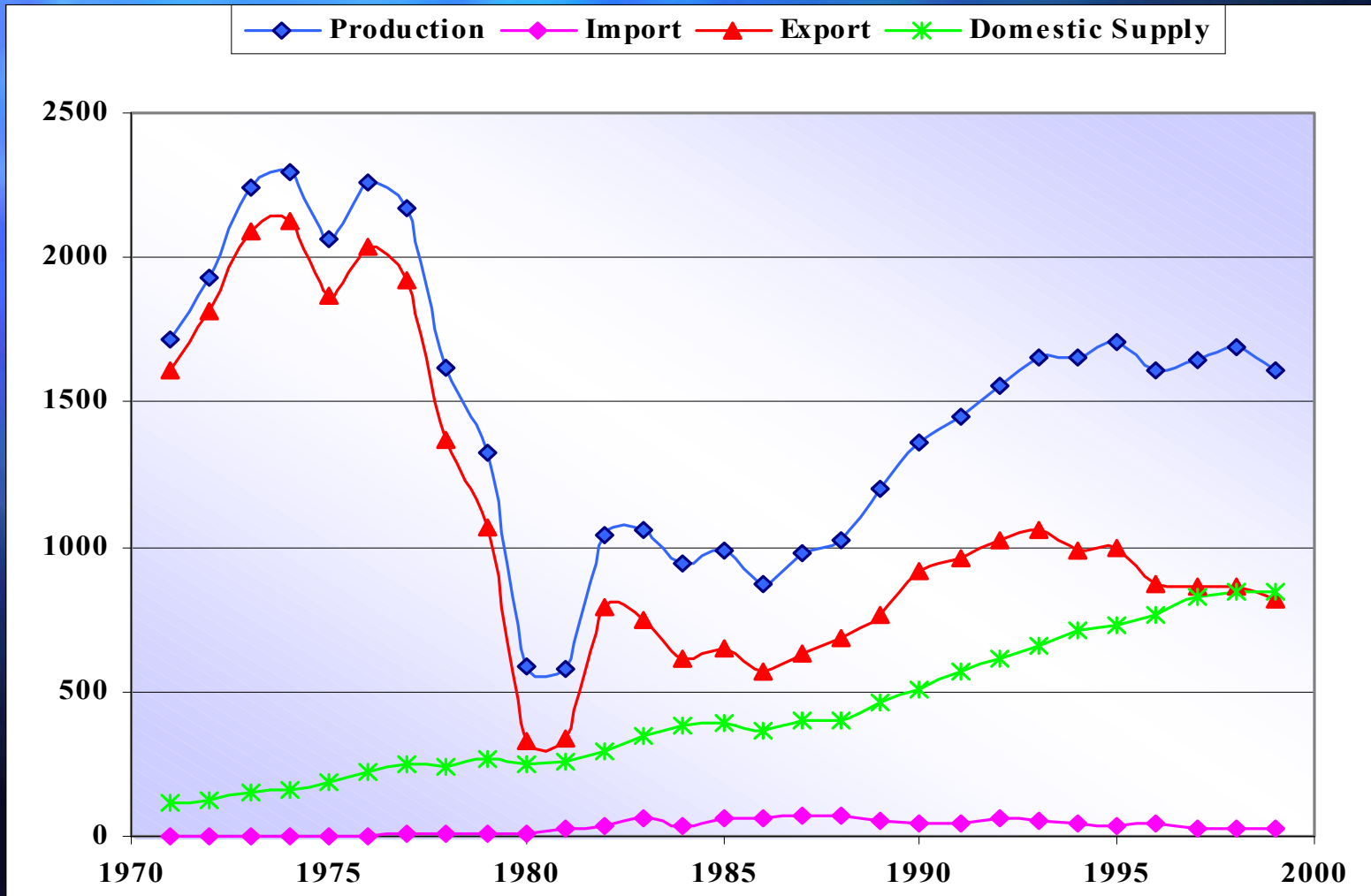
National Circumstances (VI)

Trend of per capita GDP (,000 Rial-constant 1982 prices)



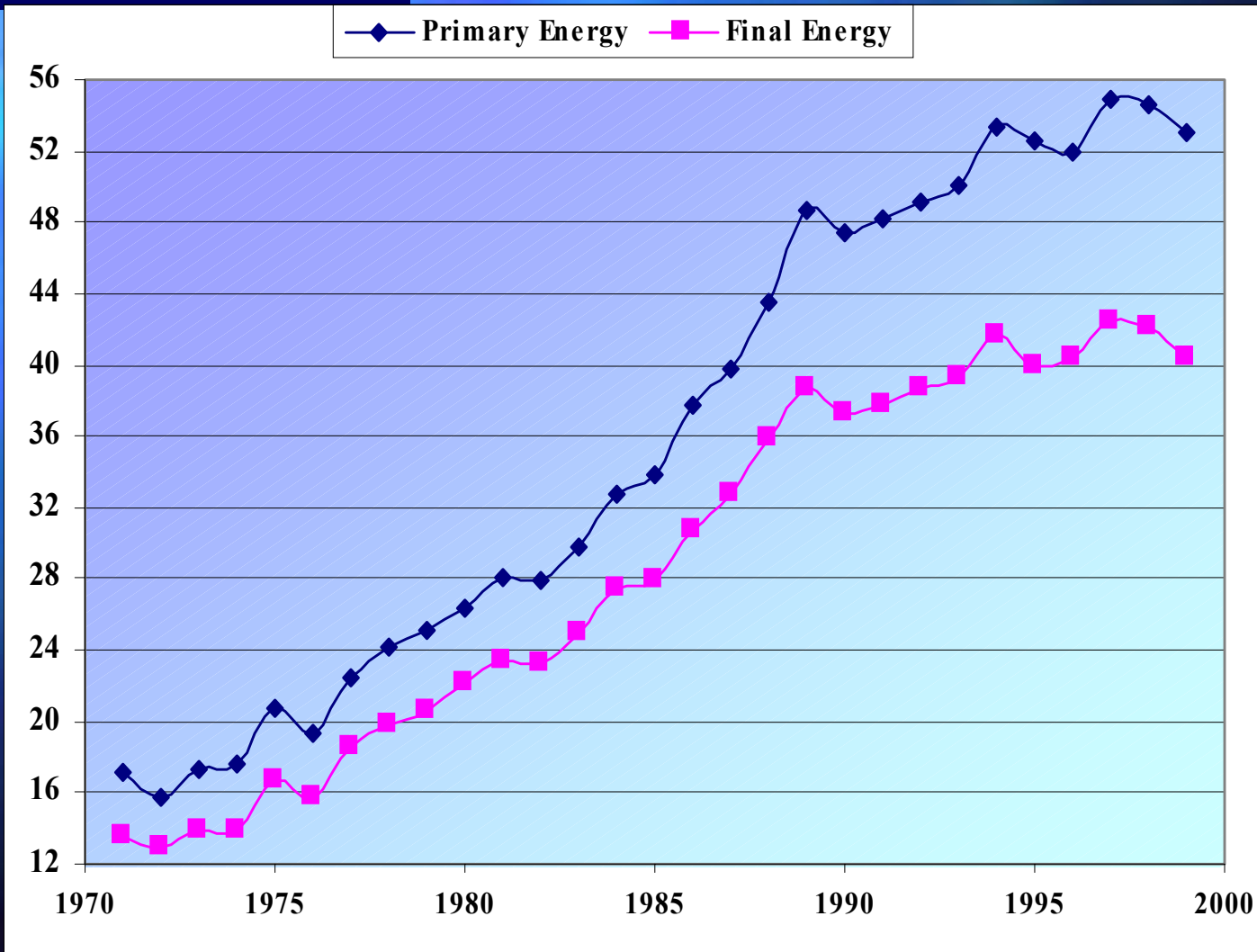
National Circumstances (VII)

Trend of primary energy production, domestic supply, import and export (MBOE)



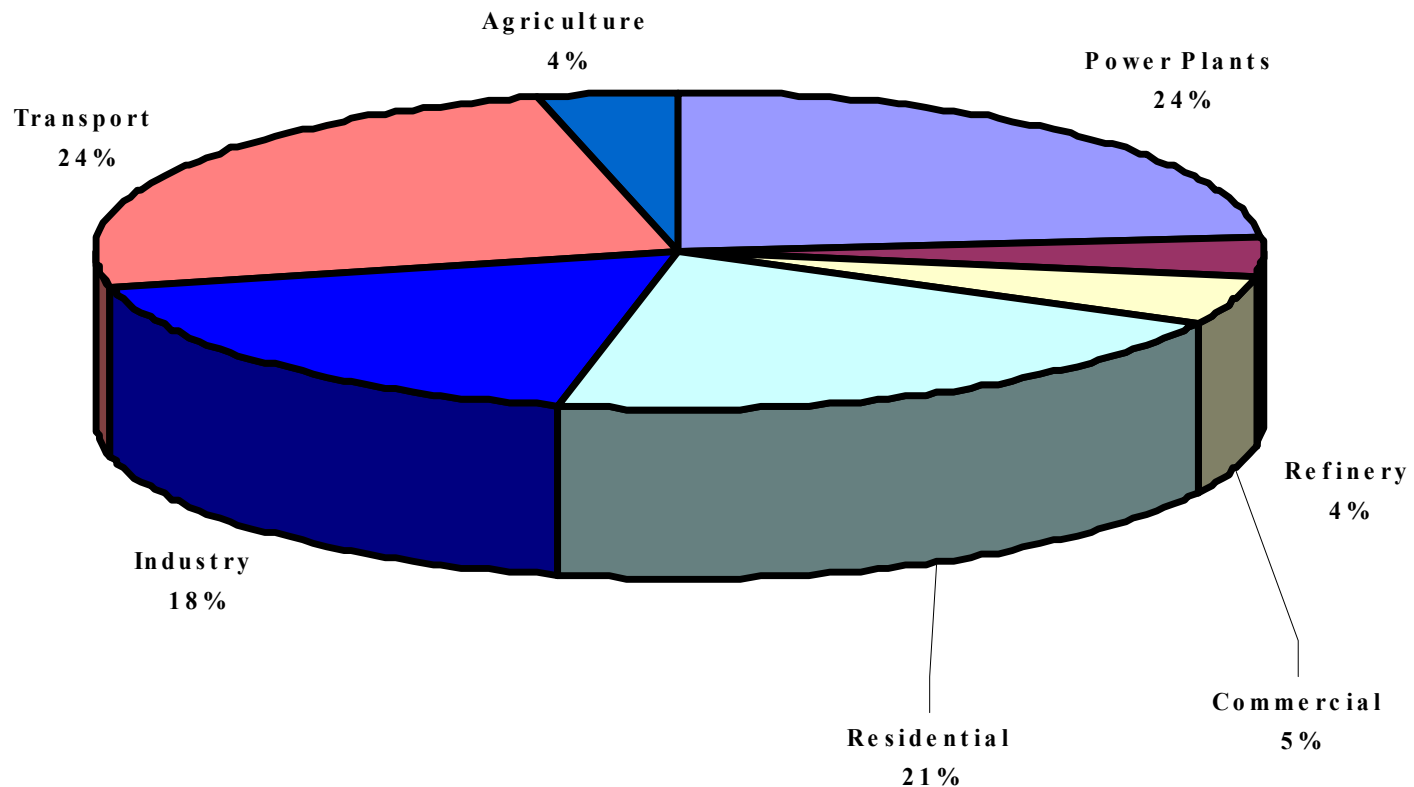
National Circumstances (VIII)

Trend of energy intensity
(BOE/Mn. Rial - at constant 1982 prices)



National Circumstances (IX)

Share of different sectors in the total energy demand in 2000 (%)



Impact of Response Measures

Estimates of adverse effects and the required compensation are based on the results from four scenarios:

- Business-as-Usual (BAU),
- Kyoto Protocol with “*no flexible mechanisms*” and “*no tax adjustment*”,
- Kyoto Protocol with “*no flexible mechanisms*” and “*tax adjustments*”, and
- Kyoto Protocol with “*flexible mechanisms*” and “*no tax adjustment*”.

Impact of Response Measures

Baseline projections for the crude oil market

	2010	2020	2030
Baseline world oil price (USD per barrel)	<i>19.2</i>	<i>20.51</i>	<i>22.14</i>
World demand (mbd)	<i>81</i>	<i>97</i>	<i>118</i>
Non-OPEC production (mbd)	<i>44</i>	<i>45</i>	<i>46</i>
OPEC share of world oil production (%)	<i>46</i>	<i>54</i>	<i>61</i>

Impact of Response Measures

World crude oil price under the three policy scenarios *with participation of the USA* (% change from baseline)

Scenarios	2000	2005	2010	2015	2020	2025	2030
<i>No Flexibility</i>	-0.13	-0.09	-15.32	-16.09	-16.48	-17.66	-18.35
<i>Tax Cut</i>	-0.02	0.06	-7.50	-9.54	-9.63	-9.97	-10.29
<i>Flexibility with CDM</i>	-0.09	-0.16	-10.61	-11.33	-11.13	-11.08	-11.16

Impact of Response Measures

Impact on Iran's Economy in "No Flexibility Scenario"

No Flexibility

Revenue losses in 2010 (Billions of 1995 USD)	% change in welfare	Cash compensation (Billions of 1995 USD)
--	---------------------	---

<i>With US</i>	<i>-6.3</i>	<i>-3.1</i>	<i>79</i>
<i>Without US</i>	<i>-1.2</i>	<i>-0.7</i>	<i>20</i>

Impact of Response Measures

Impact on Iran's Economy in "Tax Cut Scenario"

Tax Cut

Revenue losses in 2010 (Billions of 1995 USD)	% change in welfare	Cash compensation (Billions of 1995 USD)
--	---------------------	---

<i>With US</i>	<i>-3</i>	<i>1.76</i>	<i>45</i>
<i>Without US</i>	<i>1.6</i>	<i>0.4</i>	<i>0*</i>

**Zero value indicates that no compensation is needed*

Impact of Response Measures

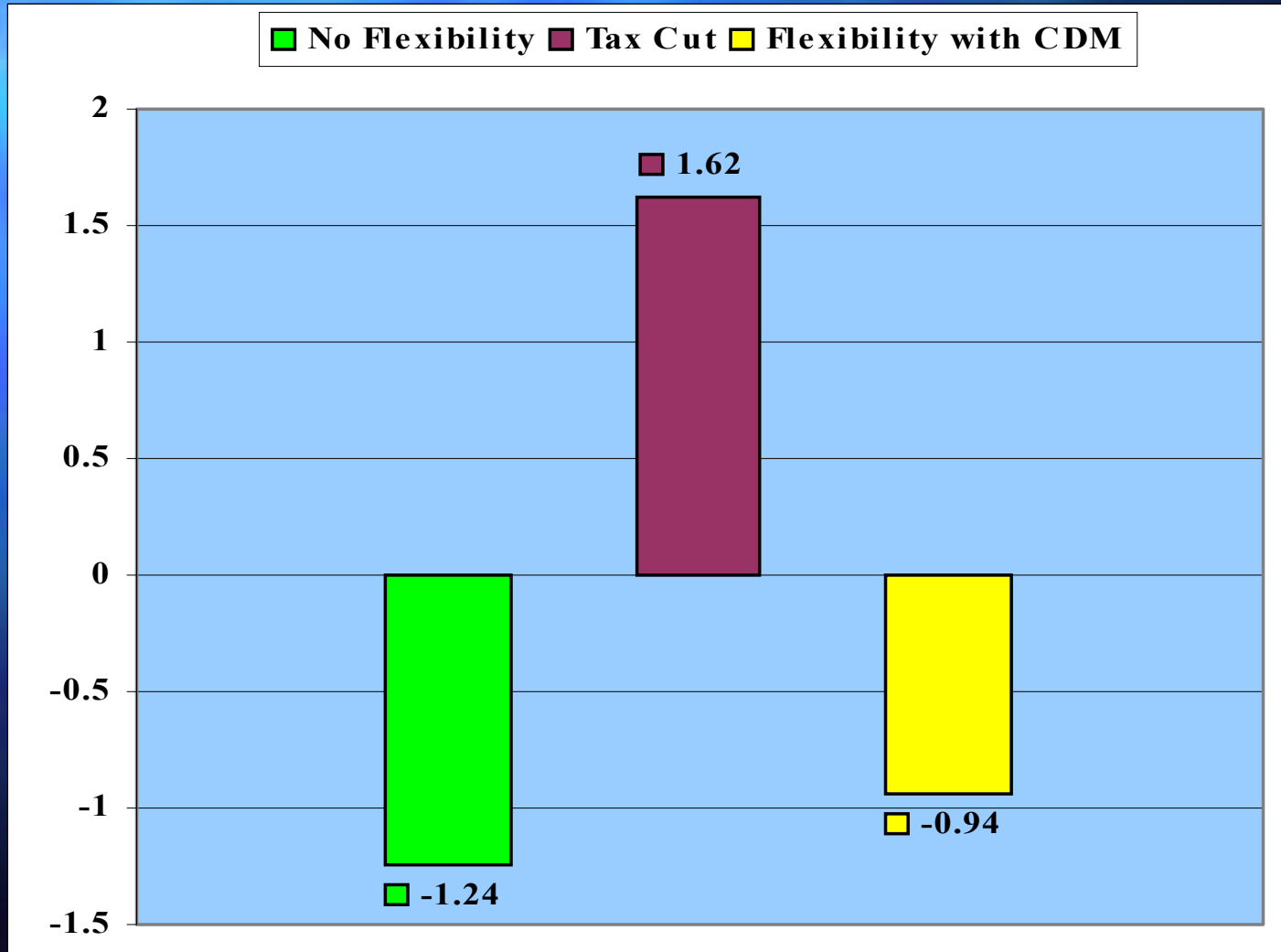
Impact on Iran's Economy in “ *Flexibility with CDM Scenario* ”

Flexibility with CDM Scenario

	Revenue losses in 2010 (Billions of 1995 USD)	% change in welfare	Cash compensation (Billions of 1995 USD)
<i>With US</i>	<i>-4.5</i>	<i>2.2</i>	<i>57</i>
<i>Without US</i>	<i>-0.9</i>	<i>-0.52</i>	<i>17</i>

Impact of Response Measures

Impact of Response Measures on Iranian Economy (USD billions)



Direct Adverse Impact of Climate Change

- Direct adverse impact of climate change on:
 - Water resource
 - Agricultural products and food security
 - Coastal and low land areas
 - Public health

Long-term projection of temperature and precipitation in Iran

The selective combinations of two GCMs (HadCM2 and ECHAM4), three IPCC emission scenarios, and three different climate sensitivities, represent the following temperature and precipitation changes in long-term (2100).

Long-term projection of temperature and precipitation in Iran

Temperature :

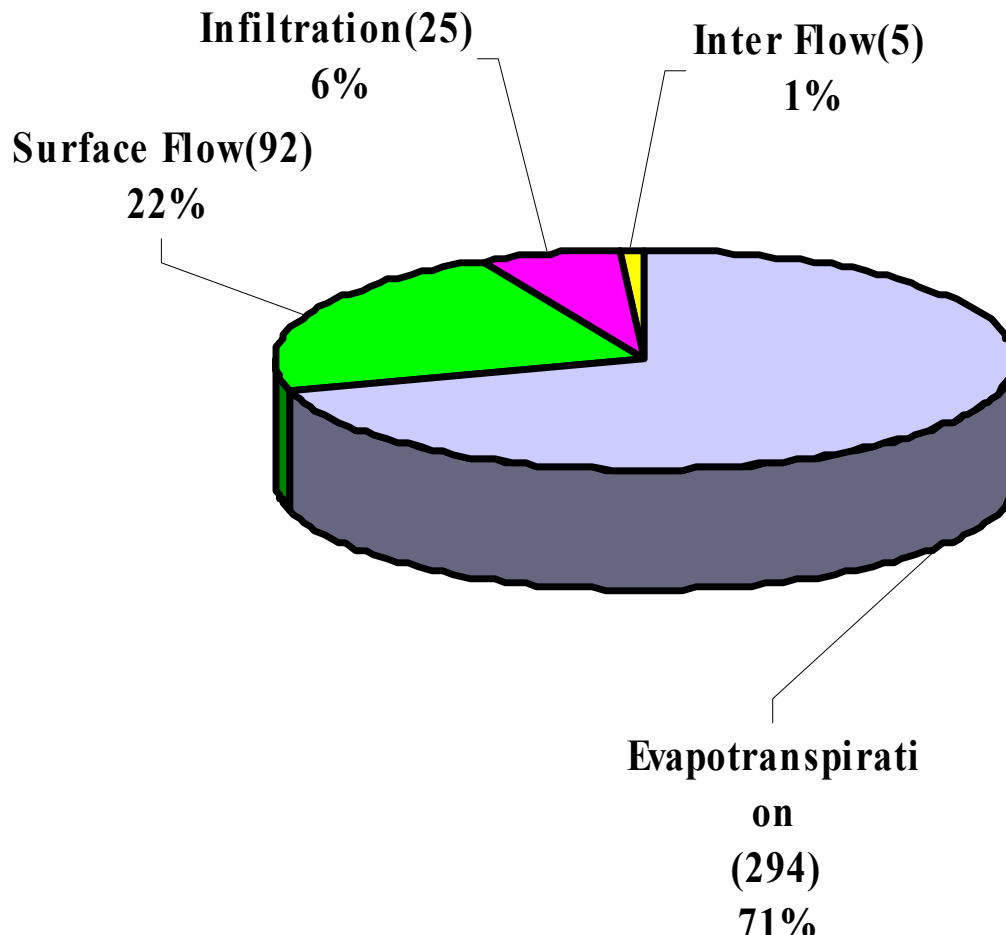
- 1°C to 1.5°C at low emission rate.
- 4.1°C to 5°C if the emission rate maintains at the present level.
- 5.9°C to 7.7°C at high emission rate.

Precipitation:

- -11% to 19.1% of the baselines for low emission rate,
- -30.9% to 50% of the baselines for medium emission rate,
- -58% to 80% of the baselines for high emission rate.

Vulnerability (Water resource)

Water balance and total precipitation in the country (billion cubic meters)



Vulnerability Assessment

(Water resource)

Sea level rise and infiltration of salt water into underground water resources

Increased vaporization from the rivers due to higher temperatures which result in drying out the rivers

Variations in intensity and the magnitude of precipitation (In 53% of the recorded stations flood index has increased)

Decreased volume and deteriorated water quality of underground reservoirs due to drought and increased surface vaporization which result in higher treatment costs

Changes in precipitation from snow to rain and changes in melting patterns

Vulnerability (Water resource)

Variation of runoff with respect to the variation of temperature and rainfall in selected main basins

Basin Name	Temp. (T)	Precipitation (P)				
		-40%	-10%	P	+10%	+40%
Aras	0	-52.2	-15.2	0.0	16.8	77.2
	+1	-53.1	-18.1	-3.8	11.9	68.2
	+6	-56.4	-28.4	-17.0	-6.1	34.1
Karkhe	0	-60.7	-18.8	0.0	21.5	102.5
	+1	-62.3	-23.9	-6.7	12.9	86.9
	+6	-67.9	-41.7	-30	-18.0	28.6

Adaptation Measures

(Water resource)

- **Water conservation in all sectors**
- **Integrated ground and surface water management**
- **Improved operation of reservoirs**
- **Construction of new dams**
- **Artificial ground water recharge**
- **Water reuse and recycling**
- **Further research and investigation to obtain hydrological data**

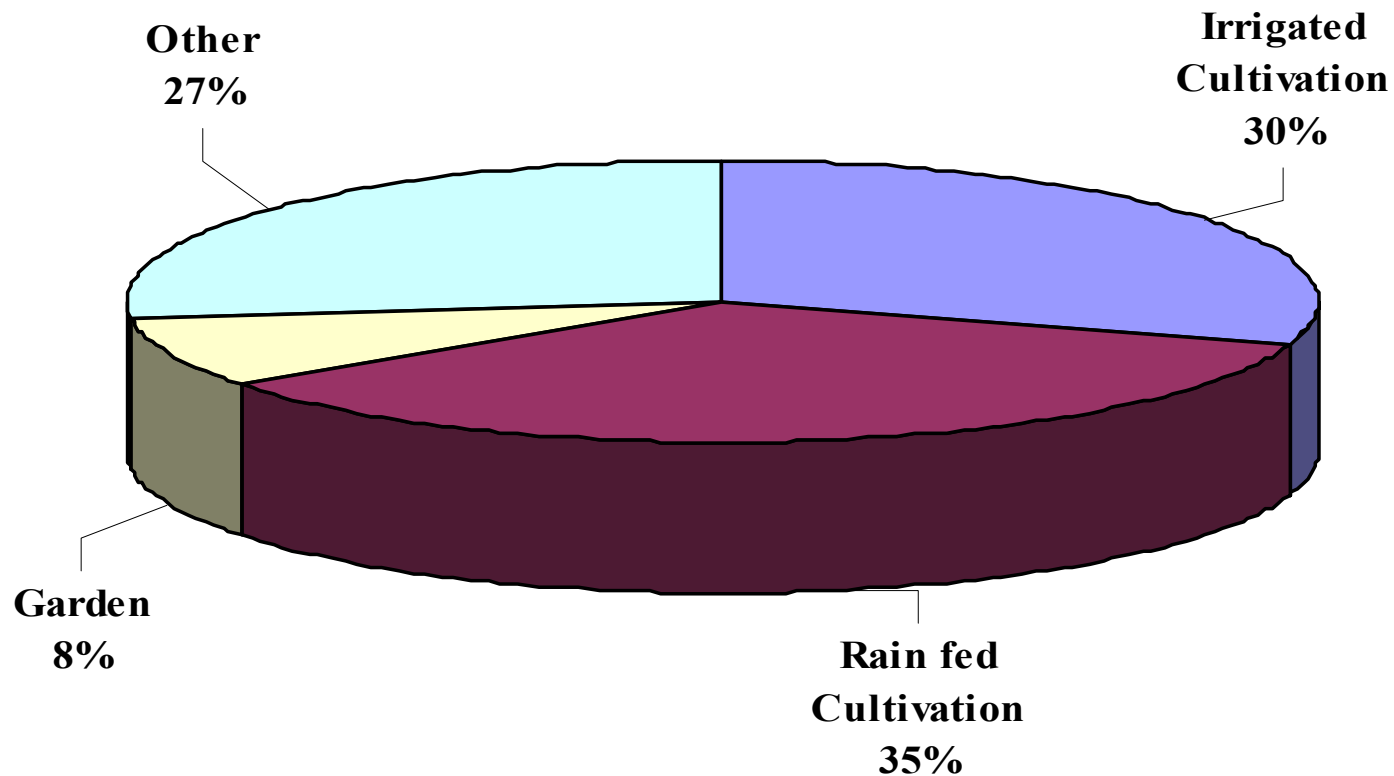
Adaptation Measures

(Water resource)

- Construction of low-cost miniature reservoirs for local irrigation
- Rehabilitation of small tanks in dry zones
- Sound watershed management
- Use of sprinkling and pressurized irrigation systems
- Water rationing and pricing policies

Vulnerability Assessment

(Agriculture and Food Security)



Vulnerability Assessment

Agriculture and Food Security

- Since 71% of cultivated land is devoted to grains with rain irrigation, climate change has significant adverse impact on food security.
- Recent droughts have resulted in 52,000 billion Rials of damage in agricultural sector and 3,600 billion Rials in water resources
- Reduction of job positions in agricultural sector
- Increased immigration of farmers into the large cities.

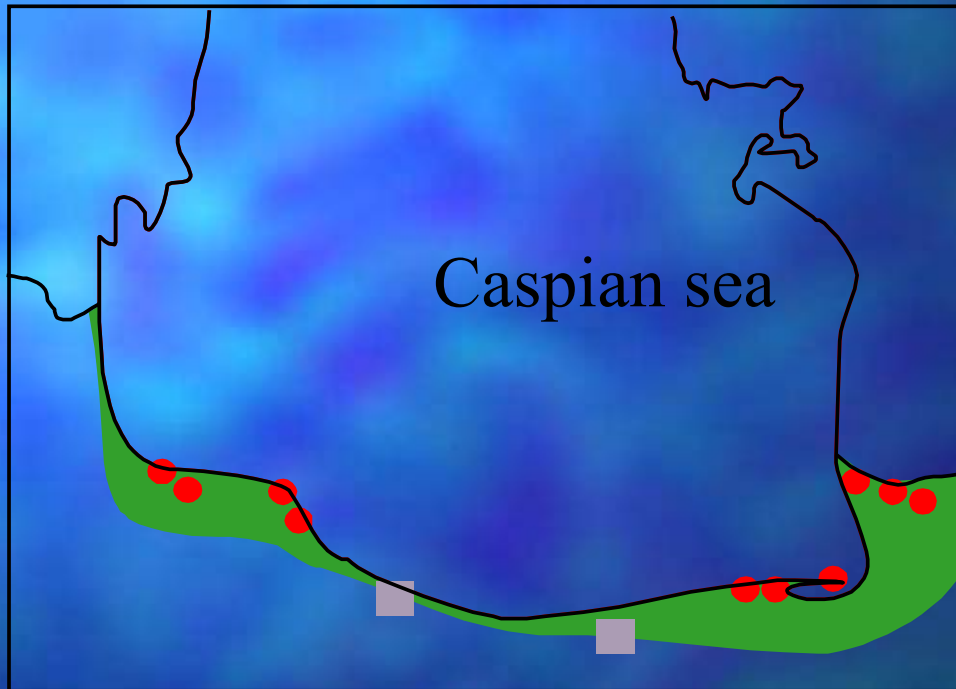
Adaptation Measures

(Agriculture and Food Security)

- Historically adaptive [for example: use of underground canals, or “Ghanats”]
- Development of new crop (early maturing type) varieties
- Deep tillage
- Timeliness of tillage
- Construction of small scale reservoirs and dams
- Enclose the irrigation canals
- Reuse of drainage water
- Pressurized irrigation systems
- Leaching of salt affected soils

Vulnerability Assessment

Costal Area & Low Land



● Wetland

■ Others

■ South Caspian shore

10/28/03

www.climate-change.ir

30

Vulnerability Assessment

Costal Area & Low Land



- | | | |
|---|---|---|
|  Coastal wetland and mud flats (Danehkar et al., 1996) |  Iranian oil platform in the Persian Gulf (D.O.E., 1993) |  Ecological sensitive areas of the Persian Gulf and Sea of Oman (Danehkar & Porvakhshouri, 1997) |
|  Major shrimping ground (D.O.E., 1993) |  Marine turtle habitats (Danehkar et al., 1996) |  Protected Area |
|  Mangrove forest (D.O.E., 1993) |  Waterbird habitat Danehkar et al., 1996) |  Wildlife shelter |
|  Sea grass (D.O.E., 1993) |  Perl oyster habitat (D.O.E. 1993) |  International wetland |
|  Coral reef islands (D.O.E., 1993) |  Perl oyster fishing ground (D.O.E., 1993) |  Biosphere reserve |
| |  Estunries (Nabavi et al., 1994) | |

10/28/03

www.climate-change.ir

Vulnerability Assessment

Coastal Areas

- **The effects of sea level rise are:**
- **Changes in geomorphology of the coastal areas**
- **Damages to oil and gas installations**
- **Salt water intrusion into the drinking water resources**
- **Changes in job market and shift to illegal traffic of goods**

Vulnerability Assessment

(Power Generation)

- **Damage to coastal installations for power plant cooling.**
- **2% loss in efficiency caused by 1 C in ambient temperature and extra cooling load.**
- **Loss of hydropower output due to lack of water supply.**
- **Increase in electricity demand for cooling.**

Adaptation Measures

(Power Generation)

Diversification of industrial activities and sources of foreign revenues.

- **Prevention of gas flaring and venting.**
- **Use of dry cooling systems in power plants.**
- **Expansion of combined cycles in power plants.**
- **Development of co-generation.**
- **Expansion of hydropower capacity.**

Vulnerability Assessment

(Forestry)

- **Intensification of forest land erosion, particularly in the arid and semi-arid areas**
- **Changes in the hydrological cycles**
- **Retrogression of forests from the sea and destruction due to the sea level rise**
- **Increase of fire danger in forests**
- **Unsuitable environment for wildlife**

Adaptation Measures

(Forestry)

- Rehabilitation, development and treatment of forest resources
- Afforestation
- Balancing forest harvesting volume with forest growth and forest ecological capacity
- Forest tree improvement and use of fast growing species for reforestation

Adaptation Measures

(Forestry)

- **Changing the abandoned farm lands to forests**
- **Developing wood farming and agro-forestry system**
- **Implementation of national plan for “Green Movement” throughout the country**

Vulnerability assessment

Public Health

The following diseases have shown increasing trend in this country:

Malaria

Leishmaniasis

Cholera

Rodents infection

Vulnerability (Public Health)

Exposure rate to Malaria(left) & Leishmaniasis in recent years

