A Talk on Air Engine

The Technology That Can Curb Global Warming Issues

On auspicious

"National Technology Day Celebration"

(11th May' 2012)

organised by-

Institution of Engineers (India),

State Centre, Lucknow

By-

Dr. Bharat Raj Singh,

Professor & Associate Director,

School of Management Sciences,

Technical Campus,

Lucknow-227125,(UP),India

ABC of Awareness about Global Warming

«Time for Change»

Personal Development as the Meaning of Life

SMS Group of Institutions, Lucknow

An Overview

Global warming is the serious issue for survival of livelihoods on

Earth Planet

But *if **atmospheric air is compressed** by alternative energy sources like: wind, solar energy, muscular energy etc., or by utilizing disaster energy, **and stored in energy tanks**; it could be utilised as clean energy source for running domestic appliances, light vehicles etc. as zero pollution fuel source & could check the global warming!!!*

An Overview

What is the problem !

Is it man made??

Good karma/Bad Karma

Environmental Change / Damage

Global Warming

An Overview

Definition:

Global warming is the observed and projected increases in the average temperature of Earth's atmosphere and oceans.

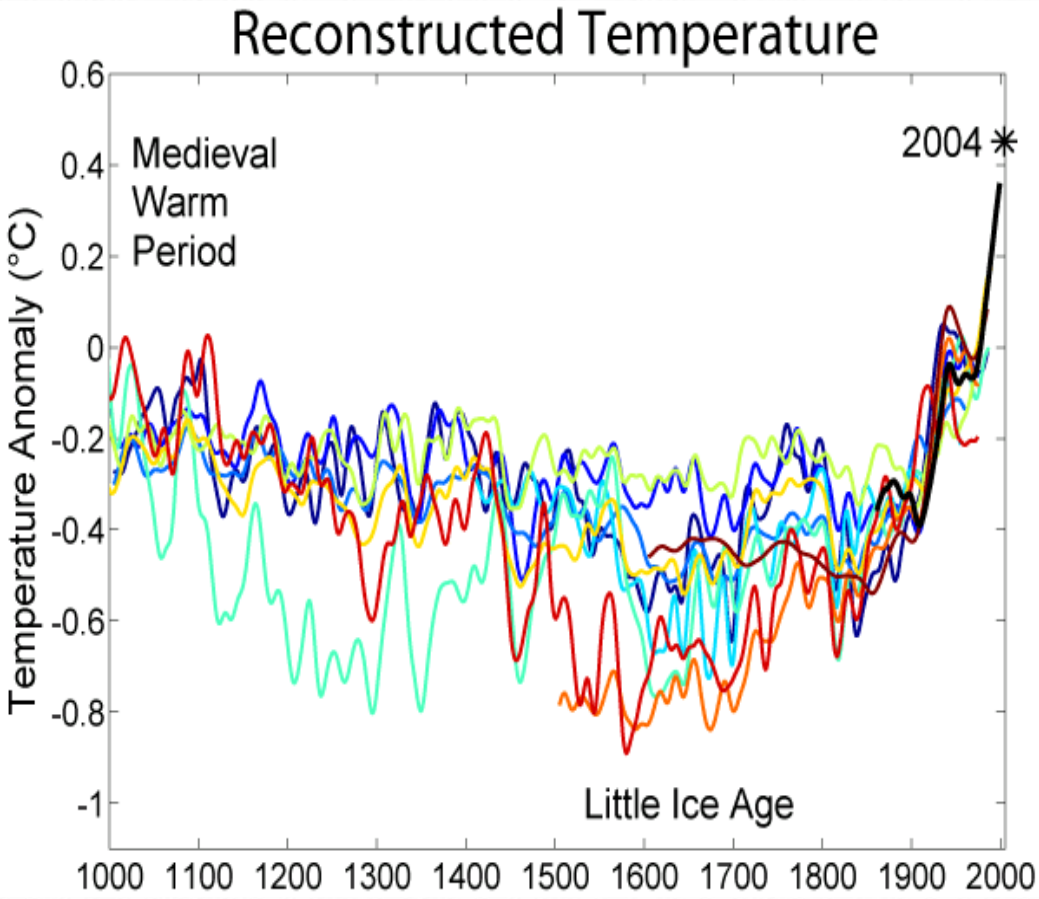


Fig. 1: **Definition for global warming: Temp. increase in the last 1'000 years**

An Overview

Cause of the problem

??

Excessive Use of Fossil Fuel

Deforestation

Ozone Layer Depletion

Population Increase

Lack of Awareness

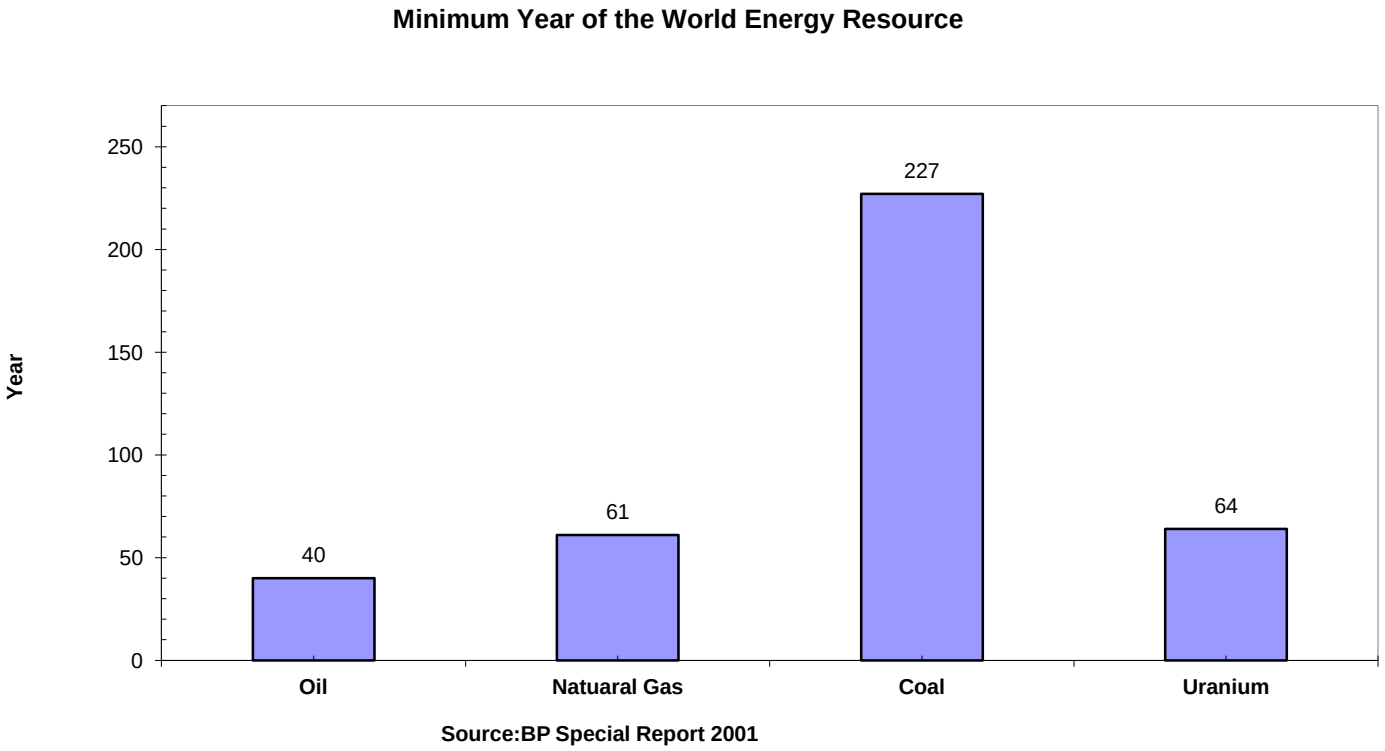
An Overview

- **Cause and effect for global warming**
- **The last 50 years**-increase in the atmosphere of greenhouse gas (concentrations like water vapour, carbon dioxide (CO_2), methane and ozone.)
- The reflecting back of heat energy by the atmosphere is called the "greenhouse effect"-act like a mirror and reflect back to the Earth a part of the heat radiation, which would otherwise be lost to space.
- The major natural greenhouse gases are :
  - water vapor, which causes about 36-70% of the greenhouse effect on Earth (not including clouds);
  - carbon dioxide CO_2, which causes 9-26%;
  - methane, which causes 4-9%, and
  - ozone, which causes 3-7%.

An Overview

Cause of the problem ??

Excessive Use and availability of Fossil Fuel



An Overview

How serious is the problem

??

Temperature Rise-2°-6°C

Climate Change- Flood, Draught

Glassier Melting- Rise in Sea level 2cm/ yr

Disaster Frequency- hurricane, tsunami etc.

An Overview

Global warming problem ??

Effects of global warming

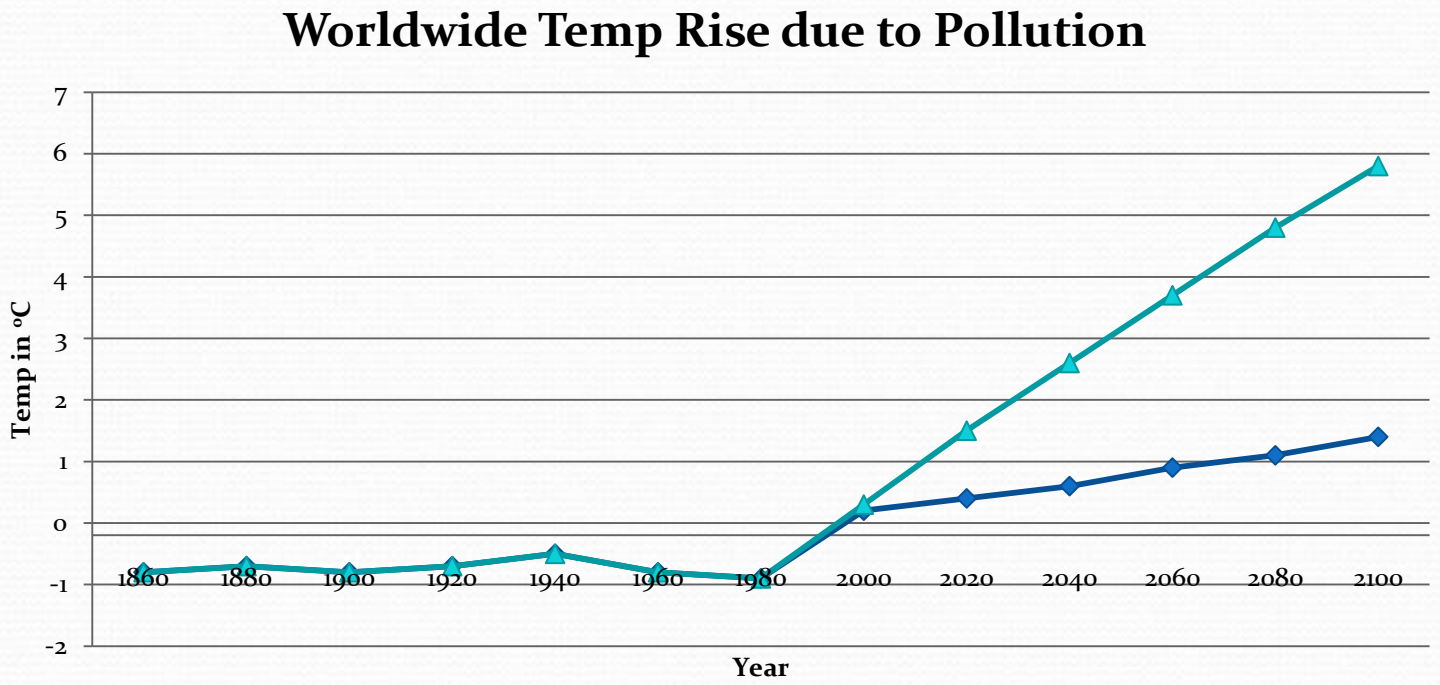
There are two major effects of global warming:

- Increase of temperature on the earth by about 3 to 5 C (5.4 to 9 Fahrenheit) by the year 2100.
- Rise of sea levels by at least 25 meters (82 feet) by the year 2100.

An Overview

How serious is the problem ??

Temperature Rise-2°-6°C



Source: IPCC Report-2001

An Overview

Who is responsible ??

End Users

Developed Countries

Developing Countries

Bulk producers

An Overview

Who is Sufferer

??

Coastal Area- Especially Low sea level area & Gulf

Developed Countries

Developing Countries

Mankind as a Whole

An Overview

Solutions to Current Challenges

??

Awareness to Humanities /Students

Lead to Alternative Energy

Lead to Renewable Energy

Serious Business to Researchers

Implementing Engineers / authorities

Global Warming –Issues and Challenges of 21st Century

Noble Prize Winner-2007,
Dr RK Pachauri, Director General, The Energy Resource Institute, New Delhi
Chairman, Intergovernmental Panel on Climate Change , USA

An Overview

Let's sum up the current knowledge:

- Survival of livelihoods is at Risk.
- Rise in Sea Level - melting of glaciers and polar ice.
- Extreme weather conditions.
- Increase in Disasters Frequency like: droughts, floods, tornadoes, etc.
- Drastic reduction of waste gas emissions- can stop the trend.
- CO_2 (Carbon dioxide) emissions –Serious cause of global warming.

Thus burning of fossil fuels like: Coal, oil, natural gas, diesel, organic-diesel, petrol, organic-petrol, ethanol, need to be reduced by:

Change of Technology is essential.

1.Background for Change of Technology

- **Conversion of Energy or Energy Storage System -** the atmospheric air can also be one of the cost effective energy conversion system over other options like: Solar Photo-Voltaic, Capacitor, Flywheel, Battery etc.
- **Compressed Air-** can be utilized as potential zero pollution working fluid when ***multi- vane type air turbine*** is used. Such novel air turbine can be utilized for producing shaft work and running as prime-mover to the motorcycles or light vehicles and domestic appliances.

Contd...1.Background for Change of Technology

- **Manufacturer:**
- India became the fifth largest motor vehicle/car manufacturer in the world in 2011.
- Indian auto manufacturers produced a record 14.82 millions (1.48 crores) motor vehicles in 2010.
- **Exports:**
- India's automobile exports in 2008-09 (1,530,660 units in total) included 331,539 passenger cars and 1,004,174 two-wheelers.

Contd…1.Background for Change of Technology

- **Current Status of Registered Transport Vehicles in India**

Lucknow: Total vehicles Registered 11 lacs and 2-wheeled are 8.8 lacs up to Dec 2010.

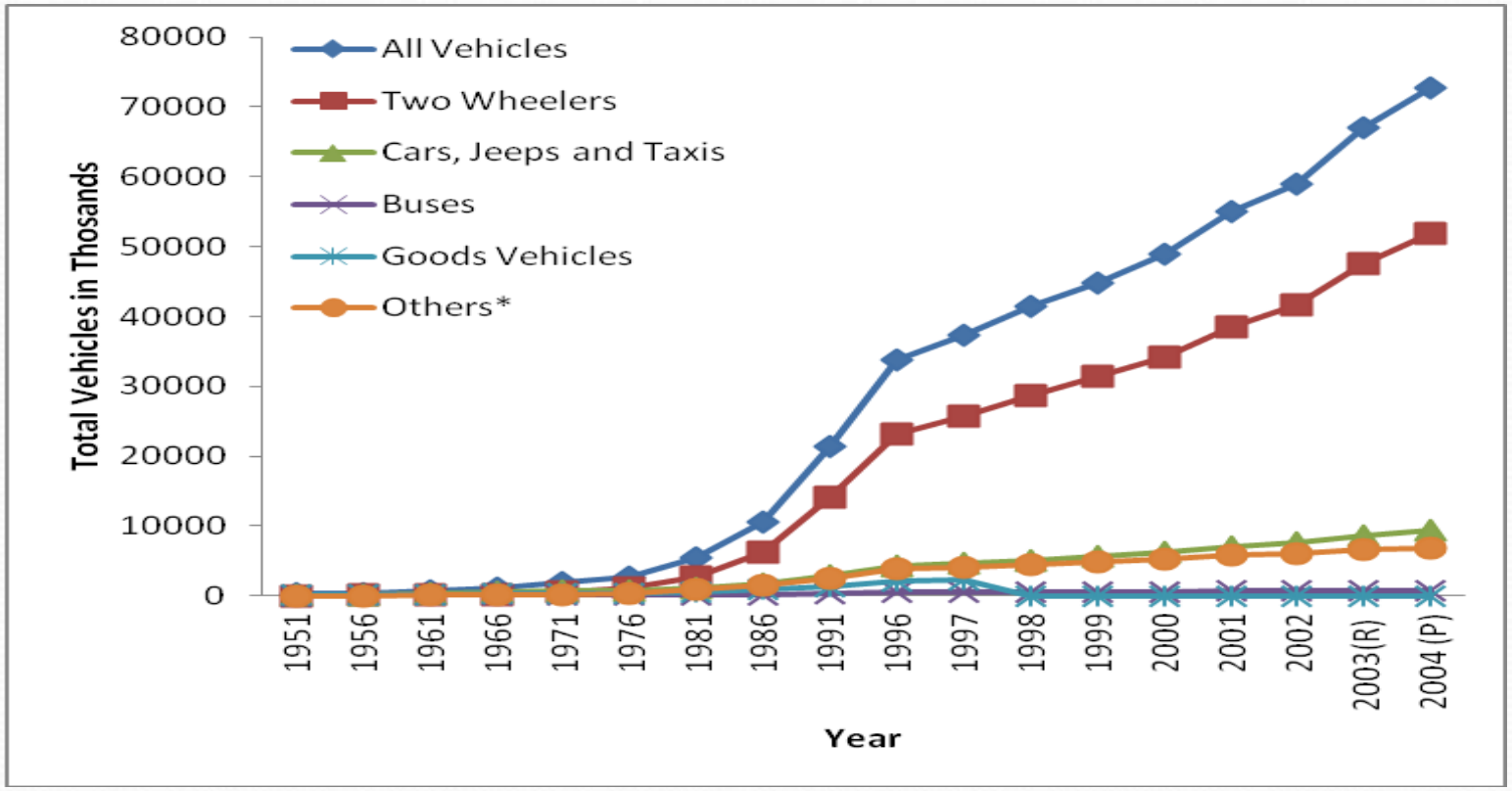
Uttar Pradesh: About 1.08 crores of vehicles are registered in UP and out of which 84.3 lac are 2-wheeled up to Nov 2011.

India: About 11.49 crores vehicles registered and 2-wheeled are 8.24 crores up to 2009.

India is the second largest motorcycle producer:

65.4 lacs produced in 2007-08 and the fourth largest commercial vehicle manufacturer in the world

1.1 Study of Population of Vehicles in India



- **Fig.** Year wise Total Registered Vehicles in India

1.2 Indian Contribution to Emission

India is rated 5^{th} country producing highest emission

In India vehicular population is estimated to have increased eight times over the last two decades.

In 1999, India released 243.7 million tones of ***Carbon Dioxide*** from consumption and combustion of hydrocarbon fuel and rated 5^{th} country after USA, Russia, China & Japan. As per 2007 data, India is releasing 1227 millions tones.

Contd…1.2 Indian Contribution to Emission

India's contribution to world ***carbon emissions*** is expected to ***increase*** in the coming years due to:

- ***rapid pace of urbanization***,
- ***shift from non-commercial to commercial fuels***,
- ***increased vehicular usage*** and
- ***continued use*** of ***older*** and more ***inefficient coal-fired*** and fuel power-plants.

Now India is rated 4th highest emission generating Country in 2011.

Indian Contribution to Emission

Table-1

List of 15-Countries Contributing Highest CO_2

S.No.	Name of Major Countries	Population In Millions	Total CO2 Yearly Release (In Million Tonnes)	Remarks
1.	China	1334.8	6,126.7	
2.	USA	311.3	5,983.0	
3.	Russia	138.9	1,572.4	
4.	India	1183.3	1,526.5	
5.	Japan	126.6	1,316.6	
6.	Germany	82.1	878.5	
7.	Canada	33.8	561.0	
8.	Iran	77.5	519.3	
9.	Italy	57.9	486.4	
10.	South Korea	48.7	475.8	
11.	Mexico	113.5	440.0	
12.	South Africa	49.2	415.3	
13.	France	64.6	409.6	
14.	Australia	21.6	392.0	
15.	Saudi Arabia	26.0	385.6	

(Source: www.Breathingearth.net Feb'2011)

2.0 Sustainability to Energy Source

Sustainability- 'It is meeting the needs of current and future generations through simultaneous environmental, social and economic improvement'.

Sustainability to energy source –is to preserve the oil and to make the future of mankind brighter by adding ***Alternative energy sources and Renewable energy***, which is going to help current problem to some extent.

- **Researchers and Inventers-** are paying full attention to this issue. ***The Energy Storage System or Power Conversion*** System with focus on
  - Waste energy management
  - Energy efficiency

  may be the one of solution for 21st century energy sustainability.

Contd...2.0 Sustainability to Energy Source

- **Issues-** On account of heavy consumption of fossil fuel, there are ***two distinct reasons*** to go for the search of alternatives to fossil fuel and make sustainable energy source:
  - the first one is ***depletion*** of oil reservoirs and
  - the other one is ***higher rate of emission*** due to rapid use of hydrocarbon fuel especially in ***Transport and Power sectors.***

3.0 COMPRESSED AIR - TWENTY FIRST CENTURY ENERGY STORAGE SYSTEM

- **Air Engine Technology** – It is very old as Sterling air engine was developed in 1790-1810, but due to some limitations much work was not carried out.
- **In 1979-** When cost of petroleum product had gone very high, the technology again took its rolling pace, but from 1979 to 1990 much work did not take place.
- **Last two decades-** lots of researches are being carried out to tap down air freely available in atmosphere and compressing it into storage cylinders for its further use. This compressed air can be used to run combustion engine.

Contd..3.0 COMPRESSED AIR - TWENTY FIRST CENTURY ENERGY STORAGE SYSTEM

3.1 Availability of Air-

- It is natural source and available freely in atmosphere, which can be compressed & stored at desired pressure such as 90- 350 psi.
- **Easy in Storage-**Air can be stored at very high pressure and can be retained without any loss after lapse or with passage of time.
- **Uses-**The compressed air can drive many ***domestic appliances*** *such as:*
  - *vacuum cleaner, mixers, pumps, electric generators when electric power fails instead of using invertors to have clumsy arrangements of battery etc.*

Contd..3.0 COMPRESSED AIR - TWENTY FIRST CENTURY ENERGY STORAGE SYSTEM

3.2 Sustainability, Economics and Advantages

- Compressed air is most sustainable. It has no volatility or adverse weather effect. It can be utilized at any time without loss of pressure.
- **Preventive cost-** it is low as compared to other available alternate to ***Energy Conversion system***; e.g.,
  - **Battery** needs constant maintenance even for charging and discharging cycle,
  - **Hydrogen cell** is very costly due to its storage problems,
  - **Photo voltaic cells** also need some storage devices may be of high bank capacitors or batteries that need constant and recurring expenditures on its upkeep.

Contd..3.0 COMPRESSED AIR - TWENTY FIRST CENTURY ENERGY STORAGE SYSTEM

3.3 Influences on Environment and Ecology

- **Tail pipe emission-** The light vehicles presently running on ***fossil fuel*** releases emission and creates imbalances to ecology, ultimately hazardous to public health.
- **Compressed air Engine-**The light vehicles running on air turbine have no ill effect on ***ecology*** and reduce the ***health hazards***.

Contd..3.0 COMPRESSED AIR - TWENTY FIRST CENTURY ENERGY STORAGE SYSTEM

3.4 Cost Comparison

- **Costing Analysis in respect of Fossil Fuel-** The air is freely available in atmosphere and offers zero cost of basic working fluid and the cost involvement in its compression is also nominal.
- Cost of 7.5 to 10 HP electric motor coupled with 2-3 stage compressors: Rs. 25,000.00
- Cost of electricity for filling the compressed air cylinder once: *{Rs. 5.00 to Rs. 7.00}

Contd..3.0 COMPRESSED AIR - TWENTY FIRST CENTURY ENERGY STORAGE SYSTEM

- *Consumption of electric power for running it for 5-10 min** to fill the cylinder of 1.2 m long and 0.65 m diameter at 15-20 bar (225 – 300 psi) may cost [(10 kWh X Rs 4.00# to 5.00#) / 7min**]=*{Rs.5.00 to 7.00} including depreciation, running and maintenance of compressor devices.
- # - Cost of electricity per unit in Rupees
- Once filed compressed air cylinder can run vehicle up to: 40 km
- Cost of running vehicle per km using compressed air: Re. 0.12 to Rs. 0.17

Contd..3.0 COMPRESSED AIR - TWENTY FIRST CENTURY ENERGY STORAGE SYSTEM

- Present cost of running vehicle per km using hydrocarbon fuel : Re. 0.62 to Rs. 0.75
- This shows that the motor bike may run 40 km in Rs.5 to Rs. 7, whereas cost of same travel distance with hydrocarbon fuel may be around between Rs. 25 to Rs.30 and hence compressed air cost is almost one fifth of fossil fuel cost.
- Thus the use of compressed air is economical too, apart from being environment friendly.

Contd..3.0 COMPRESSED AIR - TWENTY FIRST CENTURY ENERGY STORAGE SYSTEM

3.5 Energy Storage-

How??

The air can be compressed and stored in tank through conventional or non conventional devices *such as:*

- Wind mill, solar energy motor, and human or animal power etc.
- The compressed energy may be utilized to run other domestic appliances such as grinders / mixers, air cleaners, exhaust fans, small generator set when power supplies are not available.
- Compressed air tank can be used for running multi-vane type air turbine as energy storage device.

Days are not for away when every house will have own energy storage tank like water tank.

4.0 UTILIZATIONS OF COMPRESSED AIR AS AN ALTERNATIVE TO FOSSIL FUEL

Need for Change of Combustion Technology (especially in Transport)**-**

- **India is a developing country** and its average per person income is very low to meet out the minimum requirement of person.
- **Maximum population** of the country is still living in villages where means of transport is either bi-cycle or motorbike. Currently prices of fossil fuel are increasing tremendously up to 30-40 % every year.
- **With this pace by 2020 prices** may go double than what is today and by 2030-40, it may touch to **Rs.1000 per litre**. A time will come when common person would not be able to purchase fuel to run the motorbike.

CONTD...4.0 UTILIZATIONS OF COMPRESSED AIR AS AN ALTERNATIVE TO FOSSIL FUEL

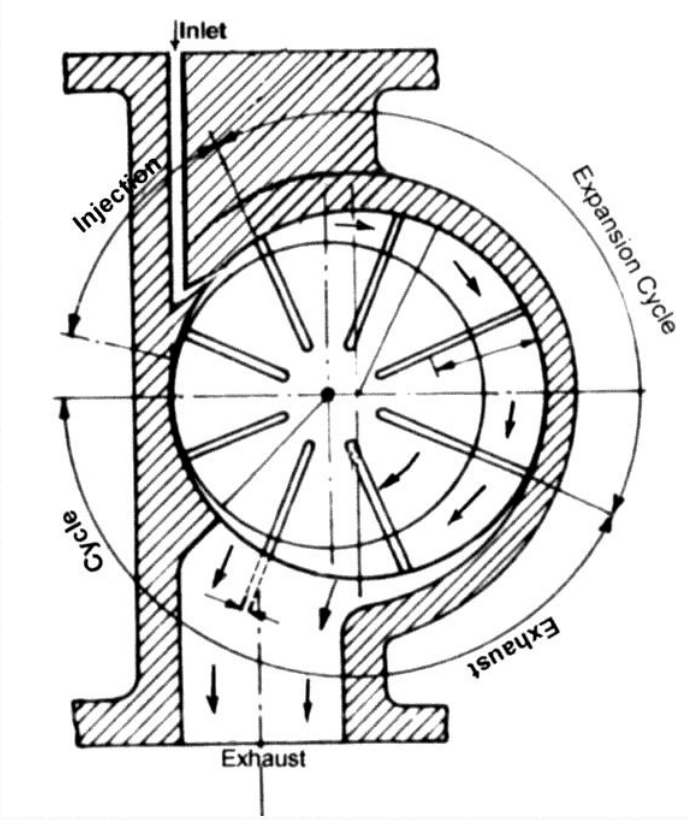


FIGURE 1
Model of Air Turbine

- ***4.1Model of Air Turbine***
- **Objective of this paper-** is to investigate the performance of an air turbine with the variation of rotor / casing dimension. The air turbine considered has capability to yield output of 5.50 to 6.80 HP at 4-6 bar air pressure and for speed of 2000–2500 rpm, which is suitable for a motorbike.
- **Storage Cylinder-**a minimum capacity of storing air is of 30 minutes running at pressure of 20 bar and attached with filter, regulator and lubricator to release clean air and regulated constant pressure to developed required torque.

CONTD...4.0 UTILIZATIONS OF COMPRESSED AIR AS AN ALTERNATIVE TO FOSSIL FUEL

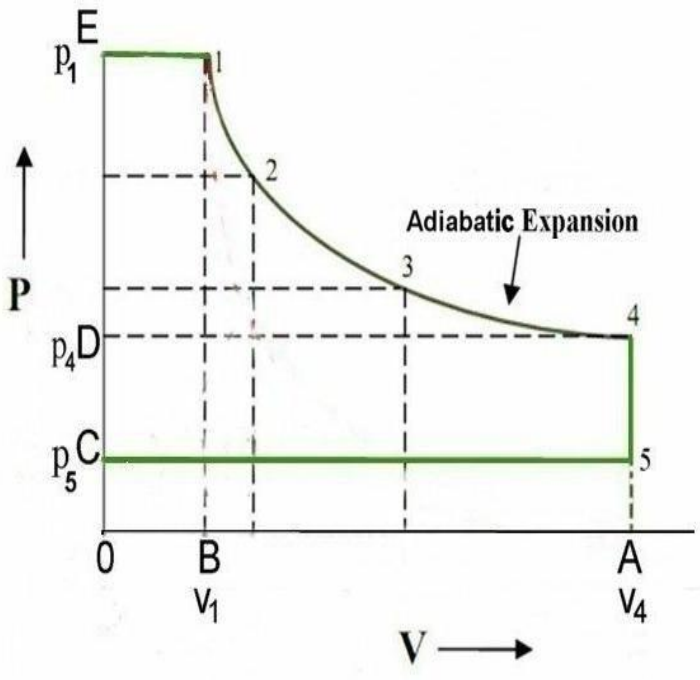


FIGURE 2
Thermodynamic Process (Isobaric, adiabatic and isochoric expansions)

- **4.2 Mathematic Model-**

The high pressure of air at ambient temperature drives the rotor in novel air turbine shown in Figure 1. When high pressure air enters through the inlet passage and impinges upon the vanes it produces impulse. Also the high pressure air entering the rotor in consecutive vanes is gradually expanded up to exit passage and exit produces Flow work and both is contributing in producing the shaft work.

From Figure 2, work output is due to isobaric admission (E to 1), and adiabatic expansion (1 to 4). Thus, total work done due to thermodynamic expansion process may be written as:

- [Area under (E145CE)] = [Area under (E1BOE) +Area under (14AB1) – Area under (5AOC5)]

CONTD...4.0 UTILIZATIONS OF COMPRESSED AIR AS AN ALTERNATIVE TO FOSSIL FUEL

- The total power output (work done per unit time) for speed of rotation N rpm will be mentioned as:

$$W_{total} = n.(N/60).\left(\frac{\gamma}{\gamma-1}\right).p_1.v_1.\left\{1-\left(\frac{p_4}{p_1}\right)^{\frac{\gamma-1}{\gamma}}\right\}+n.(N/60).\ p_4-p_5\ .v_4$$

CONTD...4.0 UTILIZATIONS OF COMPRESSED AIR AS AN ALTERNATIVE TO FOSSIL FUEL

- From Figure 3, it is seen that when two consecutive vanes at OK and OL moves to position OH and OB, the extended vane lengths varies from SK to IH and LM to BG, thus the variable length BG at variable is assumed as:

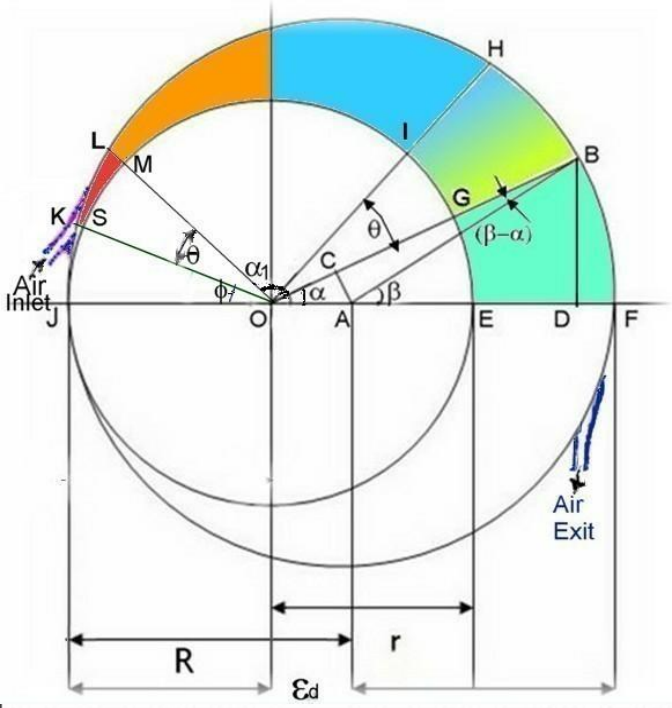


FIGURE 3
Variable length BG and IH and injection angle ø

$$X_{variable} = R\cos\left[\sin^{-1}\left\{\left(\frac{R-r}{R}\right)\sin\alpha\right\}\right] + R-r\ \cos\alpha - r$$

and variable volume of cuboids (B-G-I-H-B):

$$v_{cuboid} = L\left\{\frac{X_1 + X_2 \quad 2r + X_1}{4}\right\}\sin\theta$$

CONTD...4.0 UTILIZATIONS OF COMPRESSED AIR AS AN ALTERNATIVE TO FOSSIL FUEL

- The total power output available , can be written as:

$$W_{total} = n.\left[\frac{N}{60}\right].\left(\frac{\gamma}{\gamma-1}\right).\left\{1-\left(\frac{p_4}{p_1}\right)^{\frac{\gamma-1}{\gamma}}\right\} p_1.\left[L.\left\{\frac{X_{1\min}+X_{2\min}\ .\ 2r+X_{1\min}}{4}\right\}.\sin\theta\right]$$

$$+n.\left[\frac{N}{60}\right].\ p_4-p_5\ .\left[L.\left\{\frac{X_{1\max}+X_{2\max}\ .\ 2r+X_{1\max}}{4}\right\}.\sin\theta\right]$$

5.0 Assumptions and Parameters for Investigation

Various input parameters are considered and listed in Table-2 for investigation of effect of rotor length and its optimization:

- The rotor/casing diameter ratio (d/D) =0.75; d=75mm & D=100mm
- Speed of rotations 500 rpm, 1000 rpm, 1500 rpm, 2000 rpm and 2500 rpm.
- Vane angle of 45°, injection angle of 60° at different injection pressures of 2-6 bar (30, 45, 60, 75 and 90 psi).

The results obtained have been plotted in Figs. 5 to 8, the expansion power output, flow work output and total power output from air turbine is studied.

CONTD...5.0 ASSUMPTIONS AND PARAMETERS FOR INVESTIGATION

Table- 2 Input Parameters

Symbols	Parameters
Rotor to Casing (d/D) ratio	0.75, when casing diameter is kept D=100 mm and rotor diameter d=75 mm.
p_1	2 bar (≈30 psi), 3 bar (≈45psi), 4bar (≈60psi), 5bar (≈75psi), 6bar (≈90psi) –inlet pressures
p_4	$(v_1 / v_4)^{\gamma} . p_1 > p_5$ assuming adiabatic expansion
p_5	(p_4/1.1)= 1.0132 bar- exit pressure
N	500 rpm, 1000 rpm, 1500 rpm, 2000 rpm, 2500 rpm and 3000 rpm
L	45 mm length of rotor (assumed minimum)
n	(360/θ) number of vanes in rotor
γ	1.4 for air
θ	45° angle between 2-vanes, (i.e. rotor contains correspondingly 8 number of vanes)
ϕ	60°, injection angle at which air enters into turbine.

- * For optimum output, exit pressure may fall up to atmospheric pressure (i.e. ≈1 bar).
- ** 45° angle between 2-vanes (assumed) and 30° angle at which compressed air through nozzle enters into rotor, for ease of rotation.

6.0 Results and Discussion

- **6.1 Theoretical Investigation**
- From the author's earlier study for investigation of optimum input parameters, Fig. 5 shows that the theoretical power at different speed of rotation is increasing with increase of injection pressure. The rate of increase of power is higher at higher injection pressure compared to lower injection pressure.

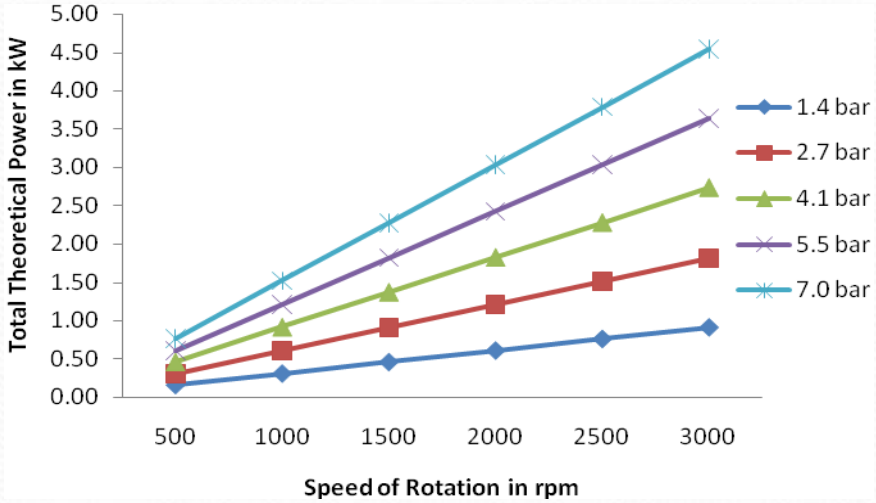


Fig 5: Total theretical power output (*Wttheo*) vs speed of rotation

CONTD....6.0 RESULTS AND DISCUSSION

6.2 Experimental Investigation

6.2.1 Experimental Test setup

- The complete schematic of test setup is shown in Fig. 6. It consists of compressor, compressed air storage cylinder, supply of compressed air through air filter, regulator and lubricator to air turbine. The dynamometer consisting of load pulley, weight load and load dial gauge are also shown in the set up.

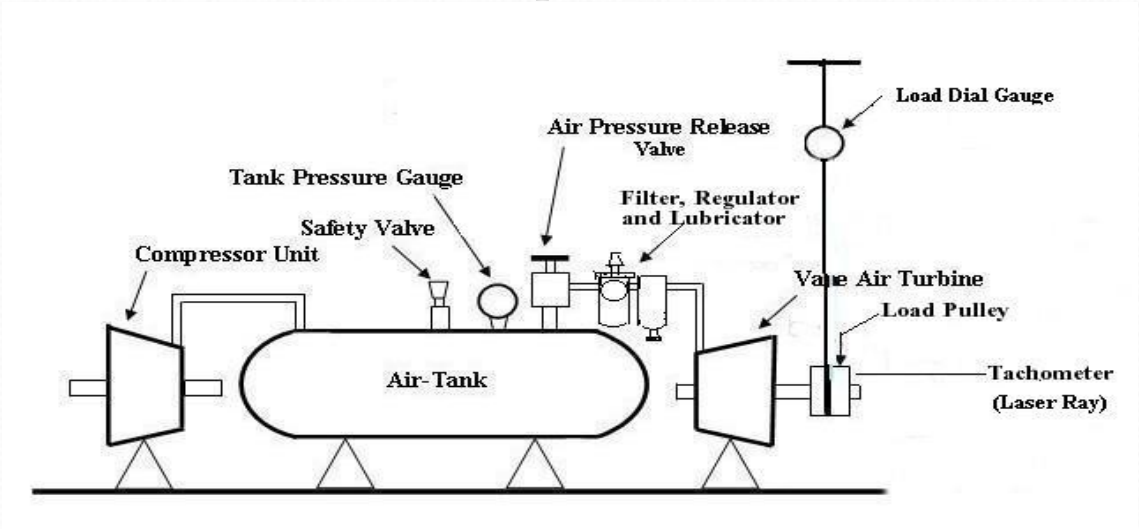


Fig. 6: Schematic Test Setup

CONTD....6.0 RESULTS AND DISCUSSION

6.2 Experimental Results

- Performance evaluation is conducted on a compressed air driven vaned type novel air turbine. The comparison of theoretical total shaft outputs with respect to experimental values are carried out on following optimum input parameters such as high pressure air 1.4 bar (20 psi), 2.8 bar (40 psi), 4.2 bar (60 psi), 5.6 bar (80 psi) and 7 bar (100 psi), at different input parameters (injection angle 60°, vane angle 45°, L=45 mm, and d= 75 mm rotor diameter and D= 100 mm casing diameter (

FIGURE 7
Actual air turbine under test

CONTD....6.0 RESULTS AND DISCUSSION

Figure 8 shows that the experimental values of power output increases with higher injection pressure and at different speeds of rotation. Comparison of power output for theoretical and experimental conditions shows that for a given injection pressure the experimental power output is less than theoretical value at same operating condition. This is because of leakage at interface of vane and casing, throttling of air at admission, and friction losses. From Figs. 5 and 8, the theoretical performance of the air turbine can be compared with the experimental performance. It is seen that the results obtained experimentally match significantly with the theoretical results to the extent of around 70% to 98% for different operating parameters. .

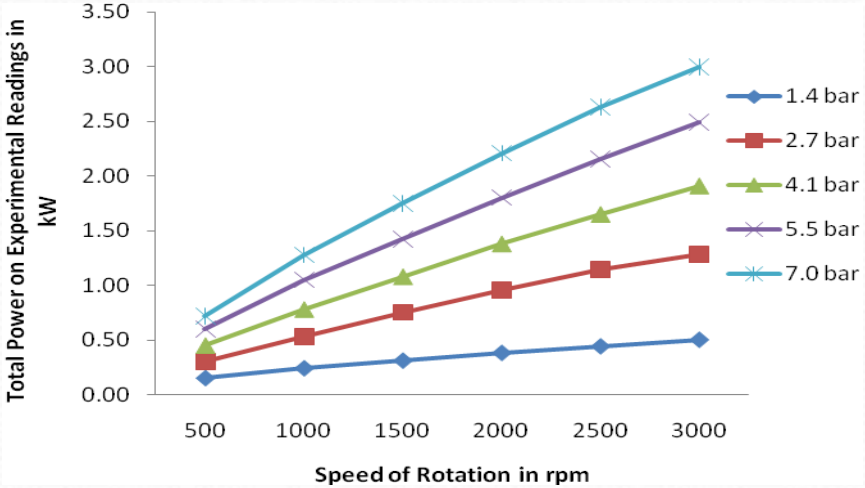


FIGURE 8

Total experimental power (W_{texper}) versus speed of rotation

CONTD....6.0 RESULTS AND DISCUSSION

- **Figure 9** depicts the variation of performance efficiency of air turbine for different injection pressure at different speeds of rotation such as: 99%, 89.8%, 84.3%, 79.8%, 76.5% and 72.5% at speed of rotation 500 rpm, 1000 rpm, 1500 rpm, 2000 rpm, 2500 rpm and 3000 rpm respectively when injection pressure varies from 2.8 - 4.2 bar. But the performance efficiency for injection pressure 1.4 bar is not in parity with higher pressure. This indicates that turbine power output is utilized in overcoming the friction losses at injection pressure 1.4 bar and centrifugal forces on vanes are also not effective at speed of rotation 500-3000 rpm. Thus air turbine offers best performance at injection pressure 2.8 to 4.2 bar (40-60 psi).

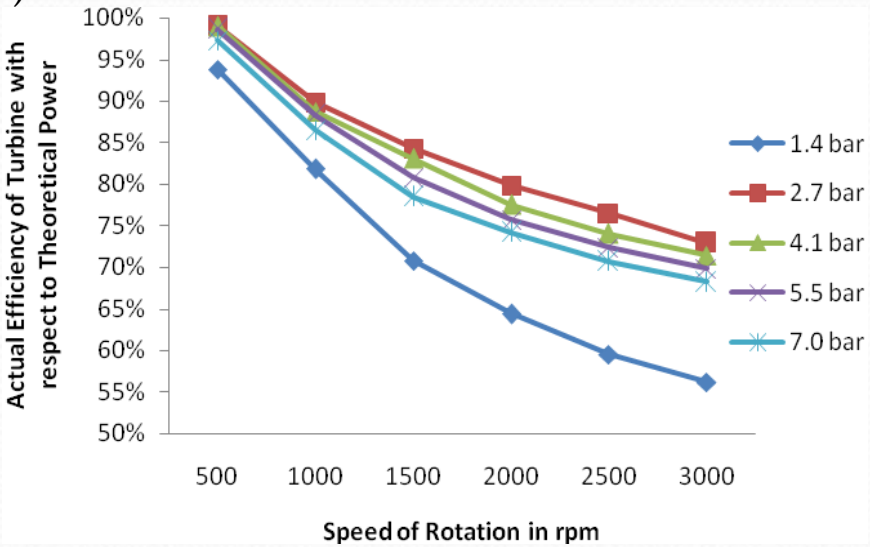


Fig. 9: Actual performance of vane turbine with respect to theoretical power

7.0 CONCLUSIONS

- **From the above study, following conclusions are drawn :**
- The expansion power output is found maximum as **3.65 kW** for moderate / minimum air consumption.
- The significant contribution of exit flow power with respect to total power output varies from 6.68% to 11.33%.
- The total optimal power output is obtained as 3.98 kW for minimum air consumption, at rotor/casing diameter ratio 0.70, injection pressure 6 bar and speed of rotation 2500 rpm.
- The theoretical optimum shaft power output 3.98 kW match significantly from the results obtained experimentally and performance efficiency of the novel air turbine ranges from 72.5% to 99% for injection pressure 2.8- 4.2 bar.

CONTD… 7.0 CONCLUSIONS

The above investigation also shows that:

This data could be useful for designing the air engine for light vehicles / motorbikes.

The technology of Air Engine is implemented widely in developing countries where major contributors of CO_2 are two wheelers in 70-80 % population of vehicles, this can curb the emission 50-60%.

Thus the Technology can be used as alternative to fossil fuel, contribute to energy sustainability and can also check the global warming and climate change largely.

Motorbike run on Air Engine

Some of the News

New design for motorcycle engines powered by compressed air

NY, USA June 22, 2010

Most motorcycles in the world today use engines that burn gasoline, contributing to greenhouse gasses and adding air pollution to the surrounding area. Now two scientists in India have conceptually designed a new, cleaner motorcycle engine that uses compressed air to turn a small air turbine, generating enough power to run a motorcycle for up to 40 minutes.

Their design, described in a recent issue of the *Journal of Renewable and Sustainable Energy, could be combined with a compressed air cylinder as a replacement for traditional internal combustion engines. In areas where motorcycles are a major source of public transportation, such a technology could cut emissions substantially if widely implemented.*

According to Bharat Raj Singh, one of the two authors on the paper and a researcher at the SMS Institute of Technology in Lucknow, India, some 50 to 60 percent of present emissions in some areas could be reduced with the new technology, though a number of technical challenges remain. Designing a compact but high-capacity air tank to store sufficient "fuel" for long rides is a major hurdle. Existing tanks would require someone to stop about every 30 km (19 mi) to swap tanks.

More information: The article, "Study of the influence of vane angle on shaft output of a multi-vane air turbine" by Bharat Raj Singh and Onkar Singh was published May 6, 2010 in the Journal of Renewable and Sustainable Energy. See: http://jrse.aip. org & http:///jrse.aip.org/resourse/1/jrsebh /v2/i3/p033101_s1

Provided by American Institute of Physics

"New design for motorcycle engines powered by compressed air." PHYSorg.com. 22 Jun 2010. http://www.physorg.com/news196427687.html

Page 1/1

Some of the News

THE HINDU

S & T » Technology
June 24, 2010

Motorcycles powered by compressed air

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Replacement

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In areas where motorcycles are a major source of public transportation, in developing countries like India, such a technology could cut emissions substantially if widely implemented.

According to Bharat Raj Singh, one of the two authors on the paper and a researcher at the SMS Institute of Technology in Lucknow, some 50 to 60 per cent of present emissions in some areas could be reduced with the new technology, though a number of technical challenges remain.

The major hurdle

Designing a compact but high-capacity compressed air tank to store sufficient "fuel" for long rides is a major hurdle.

Existing tanks would require someone to stop about every 30 kilometres (19 miles) to swap tanks. — **Our Bureau**

Some of the News

SPACE DAILY
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New Design For Motorcycle Engines Powered By Compressed Air

by Staff Writers
College Park MD (SPX) Jun 25, 2010

Most motorcycles in the world today use engines that burn gasoline, contributing to greenhouse gasses and adding air pollution to the surrounding areas. Now two scientists in India have conceptually designed a new, cleaner motorcycle engine that uses compressed air to turn a small air turbine, generating enough power to run a motorcycle for up to 40 minutes.

Their design, described in a recent issue of the Journal of Renewable and Sustainable Energy, could be combined with a compressed air cylinder as a replacement for traditional internal combustion engines.

In areas where motorcycles are a major source of public transportation, such a technology could cut emissions substantially if widely implemented.

According to Bharat Raj Singh, one of the two authors on the paper and a researcher at the SMS Institute of Technology in Lucknow, India, some 50 to 60 percent of present emissions in some areas could be reduced with the new technology, though a number of technical challenges remain.

Designing a compact but high-capacity air tank to store sufficient "fuel" for long rides is a major hurdle. Existing tanks would require someone to stop about every 30 km (19 mi) to swap tanks.

THE FUTURE OF AIR

Air Powered Motorcycles Coming Sooner Than You Think

By Dan Evon

Alternative fuels have been all the craze ever since we started burning a hole in our Ozone layer.

We've seen electric motorcycles, bio-diesel bikes, and prototypes for bikes that run on everything from wind to thunder...yes thunder. But now, a group in India says that they have a new solution to pollution. Air power.

Two scientists in India have designed an engine that uses compressed air to turn a small air turbine. Bharat Raj Singh, one of the scientists, says that his new engine could generate enough power to run a motorcycle for up to 40 minutes at a whopping 11 mph.

Pretty impressive right? No? Well take this into consideration. An air powered motorcycle would have virtually no negative impact on the environment, would have an endless supply of fuel, and would be as cheap as dirt, or air. But there are still a lot of hurdles in the way of an eco-friendly air powered motorcycle.

Right now, the benefits of running a bike on air are canceled out by the energy that is required to compress the air. Singh is currently working on a natural way to compress air so that running the bike wouldn't require the use of any fossil fuels. Also, storing the compressed air can be a problem. The tanks have to be extremely strong, and they have to hold enough air so that you don't run out of breath in just a few miles.

But Singh and his team are on the right track, and in a highly populated and polluted place like India, these bikes could really make a difference. Singh says that emissions could be cut by 60% if his bikes become widely used.

Singh, however, is not the only air power pioneer. Edwin Yi Yuan has designed a concept air-fueled bike named the Green Speed Air Powered Motorcycle. Yuan's bike was designed to break the speed record for an air-powered bike, which right now is at about 18 mph.

The Green Speed machine uses an engine designed by Angelo di Pietro, which revs up to 1000 RPM's, allowing the bike to only need

one gear. Yuan says that once the bike is mass-produced, it will use solar energy to fill the air tanks.

The Green Speed Machine and India's solution to pollution are great, but if you want to see a real Air-powered motorcycle, you have to visit Jem Stansfield, who built his bike in his garage. Yes, Stansfield has a degree in Aeronautics, and has many inventions to his name, but he still made the bike in his garage. Stansfield's bike gets 7 miles before it needs to be refilled, which according to Stansfield, takes just a few seconds. He can reach 18 mph on his bike, but still faces the problem of using electricity or other fuels to compress the air in his tanks.

It isn't likely that you will see a new air-powered Harley Sportster, or a Goldwing floating on air, but air-powered motorcycles are coming, and they will be here sooner than you think.

Carbon Capture Report

Institute Of Technology: Organization DB Profile: All People

Showing Entries 1-30 of 1037

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Questions

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REFERENCES

[1] Hubbert M.K., 1956, Nuclear energy and the fossil fuels; Amer. Petrol. Inst. Drilling and Production Practice, *Proc. Spring Meeting,* San Antonio, Texas. 7-25 [#187].

[2] Aleklett K. and Campbell C.J., 2003, The Peak and Decline of World Oil and Gas Production- Minerals and Energy, *Raw Materials Report*, Volume 18, Number 1, 2003, pp. 5-20(16).

[3] Singh B.R. and Singh Onkar, 2007, Use of Non-Conventional Energy for Sustainability to Fossil Fuel, *National Conference on Recent Trend on Mechanical Engineering, RAME-2007,* held on 28-29th March'2007 at Baba Sahab Dr. Bhim Rao Ambedkar College of Agricultural Engineering and Technology, Etawah-Proceedings pp 130-136.

[4] Singh B.R. and Singh Onkar, 2007, Uses of Wind Power as a Non-Conventional / Renewable Energy for Sustainability, *National Conference on State of Art Technology in Mechanical Engineering, STEM-2007,* held on October 29-31, 2007 at College of Technology, G.B. Pant University, Pant Nagar, UP-Proceedings pp 503-515.

Contd... REFERENCES

[5] Honton E. J., 2004, Hydrogen Fuel Cell Car, presented at *15th Annual US Conference and Hydrogen Expo*, April'2004, USA.

[6] Rose Robert and William J. Vincent, 2004, Fuel Cell Vehicle World Survey 2003, *Breakthrough Technologies Institute,* February' 2004, Washington, D.C.

[7] Singh B.R. and Singh Onkar, 2006, Necessity and Potential for Bio-Diesel Use in India, *International Conference on Bio-Fuel Vision-2015,* October'13th -15th, 2006 at Bikaner, India- Proceedings pp 71-89.

[8] Singh B.R. and Singh Onkar, 2006, Study of Compressed Air as an alternative to fossil fuel for Automobile Engines, *International Conference on Challenges and Strategies for Sustainable Energy and Environment*- held on 10-11th June'2006 at UPTU, Lucknow, UP-Proceedings pp 179-191.

[9] Singh B.R. and Singh Onkar, 2008, A Study on Sustainable Energy Sources and its Conversion Systems towards Development of an Efficient Zero Pollution Novel Turbine to be used as Prime-mover to the Light Vehicle, *2008 ASME International Mechanical Engineering Congress and Exposition*, held on October 31-November 6, 2008 at Boston, Massachusetts, USA- Paper No. IMECE -2008 -66803.

Contd... REFERENCES

[10] Negre Guy and Negre Cyril, 2004, Compressed Air - The Most Sustainable Energy Carrier for Community Vehicles, Speech in front of assembly at Kultur gathered for *Fuel Cells World*, Tuesday 29th June ’2004.

[11] Saint Hilaire G., Saint Hilaire R. and Saint Hilaire, Y., 2005, Quasiturbine zero pollution car using gasoline. *Festival at Le Lundi, Montreal Gazette,* 26 September 2005**.**

[12] Singh B.R. and Singh Onkar, 2008, Development of a vaned type novel Air Turbine, *International Journal of Mechanical Engineering Science,* Proc. IMechE Vol. 222 Part C, pp 1419-1426.

[13] Knowlen C., Bruckner A. P., Mattick A.T. and Hertzberg A., 1998, High Efficiency Energy Conversion Systems for Liquid Nitrogen Automobiles, *Society of Automotive Engineers, Inc., AIAA* 98-1898.

[14] Fuglsang P., Bak C. and Gunna M., 2004, Design and verification of the Ris0-B1 Airfoil-family for Wind Turbines, *Journal of Solar Energy Engg.,* ASME- Nov’2004, Vol.126 pp 1002-1008.

Contd... REFERENCES

[15] Gorla R. and Reddy, S., 2005, Probabilistic Heat Transfer and Structural Analysis of Turbine Blade, *IJTJE*, Vol. 22, pp 1- 11.

[16] Selig Michel S. and Bryan D. McGranahan, 2004, Wind Tunnel Aerodynamics Tests of Six Airfoils for use on Small Wind Turbines, *Journal of Solar Energy Engg.*, ASME-Nov'2004, Vol.126, pp 986-1000.

[17] Schreck S. and Robinson M., 2004, Tip Speed Ratio Influences on Rationally Augmented Boundary Layer Topology and Aerodynamic Force Generation, *Journal of Solar Energy Engg.*, ASME-Nov' 2004-Vol.126, pp 1025-1033.

[18] Singh B.R. and Singh Onkar, 2008, A concept for Development of a Vaned Type Novel Air Turbine, *12th International Symposium on Transport Phenomena and Dynamics of Rotating Machinery* - held on February 17-22, 2008 at Honolulu, Hawaii - Paper No. ISROMAC-12-20046.

Contd... REFERENCES

[20] Singh B.R. and Singh Onkar, 2008, Energy Storage System to meet Challenges of 21st Century- an Overview, *All India Seminar on Energy Management in Perceptive of Indian Scenario*-held on October 17-19, 2008 at Institution of Engineer (India), State Centre, Engineer's Bhawan, Lucknow-Proceedings Chapter15, pp 157-167.

[21] Singh B.R. and Singh Onkar, 2008**,** A Study to Optimize the Output of Vaned Type Novel Air Turbine, *4th International Conference on Energy Research and Development*, held on 17-19 November, 2008 at State of Kuwait, Kuwait- Paper No. ICERD - 4 -1353.

[22] Singh B.R. and Singh Onkar, 2008, Parametric Evaluation of Vane Angle on performance of Novel Air Turbine, *Journal of Science, Engineering and Management*, SITM , December, 2008,Vol. 2, pp 7-18.

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