

A proposal to gain energy security, create wealth & jobs, with alternative source of eternal energy from gravitational force.

Rajaram Bojji F.I.E., F.N.A.E.
<http://rajaram.bojji.googlepages.com/bojjirajaram>
834 Spring Knoll Drive , Herndon, VA 20170
email: rajaram.bojji@gmail.com Ph. 703 835 9025

Abstract:

A simple pendulum demonstrates the efficacy of gravity force, in the matter of converting from potential to kinetic energy, and recover back from kinetic energy as potential energy with least loss. If we are able to split the mass in to vertically falling and rising component of many orders larger than a horizontally rolling mass, both the said components of mass mechanically coupled through a variable gear and cable to influence each other, we get a mechanism almost similar to a pendulum. The variable potential energy of the vertically moving masses reflects as variable kinetic energy of the rolling mass. The dynamic equilibrium of this mechanism is managed through distributed intelligence in microprocessors. Thus Gravity Power Towers are created incorporating all these elements. The Gravity Powered Elevated/Sub-way Rail transportation at speeds from 108 to 360 kmph provides 100% of energy from gravity and recover the same from 97.5% to 50% depending on the coasting length, and friction losses. The short fall in raising the masses back to original position is made up from electric motors inside the towers. Automated with little recurring energy costs, the gravity powered transportation will be a boon to humanity reducing global warming.

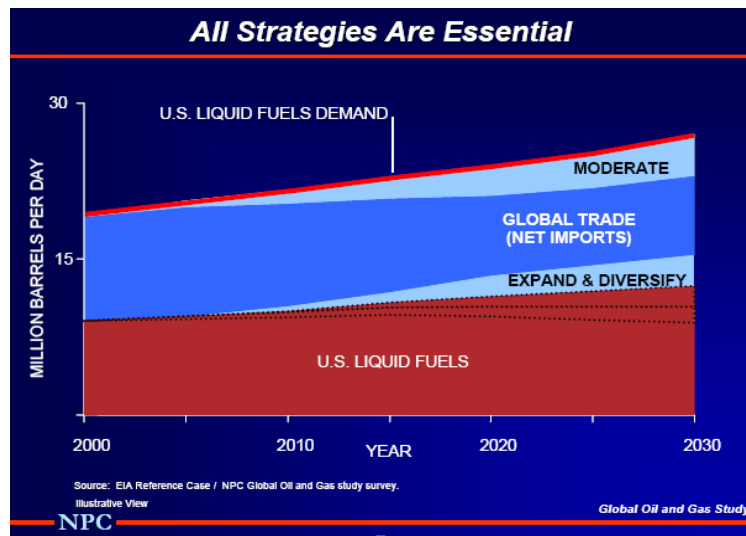
In USA, the transportation consumes 30% of total energy and the fossil fuels supply the entire requirement. If we are able to replace substantial quantum of this energy with gravitational force, energy security levels can be raised. By exporting this technology the USA can contribute in a significant manner to reduce carbon emissions and global warming. Gravity Powered Rail, roads can have significant impact. In this paper these impacts are discussed with estimates of investment needed for implementing the project and benefits expected.

An outline is presented for a \$ 450 b scheme to create 100,000 km of cargo transportation network in USA fully powered by gravitational force saving 97% of energy currently used, and generate 30% surplus after meeting all expenses, while generating a million jobs by 2011.

1 Introduction:

1.1 Energy is critical for any country's economy. In case of USA, out of annual consumption of more than 101 Qd.Btu, nearly 30 Qd.Btu is consumed by transportation. Over the next two decades, the projections by the NPC show that the world's consumption will rise from current 445 to 450 Quad. BTU to 678 Quad.BTU by 2030. The NPC concludes that we need energy from all sources and in foreseeable future one can never think of energy independence, but can only manage to have energy security.

1.2 The strategic approach did not factor in the new development of Gravity



Power Towers. The impact of this development on the energy scene is now analyzed.

1.3 The approximately 26 to 30 quadrillion BTU of energy used in transportation can be replaced by gravity power, and after taking into account the recovery factor, we need to provide 3% to 30% of energy for re-charging the Gravity Power Towers. If we take all cargo to move by Gravity Power, then we can adopt speed profile suitable for 3% level of energy consumption. But for passenger transportation, considerations of avoiding too many stops and cycles of acceleration and deceleration on a long distance haul, causes drop in recovery of energy to 70%, because we increase coasting length.

1.4 Extracts from a research paper by Bojji R -the results of the computer model are given (US Patent Application:12184151 dt.07/31/2008 :Case of Gravity Power Towers located at 450m , with zero coasting length and peak speed of 108 kmph, acceleration at 2m per sec. For a rolling unit of 50T and driving mass of 1000T. Level and straight track chosen.

Station to station distance	km	0.45
Time	sec	30
Average speed	kmph	54
T.Gravity Energy delivered	Kwh	6.97
Recovery of energy	%	97.667
Net Kwh/1000 tonne.km		6.575
Average speed/peak spd.	%	50

Table 1 Summary of results for transportation drawing energy from the Tower. The time taken is 30 seconds , average speed 54 kmph. The variable $n(j)$ during acceleration, t and $n(l)$ during deceleration, the tractive and braking force are plotted in the Figure 2.

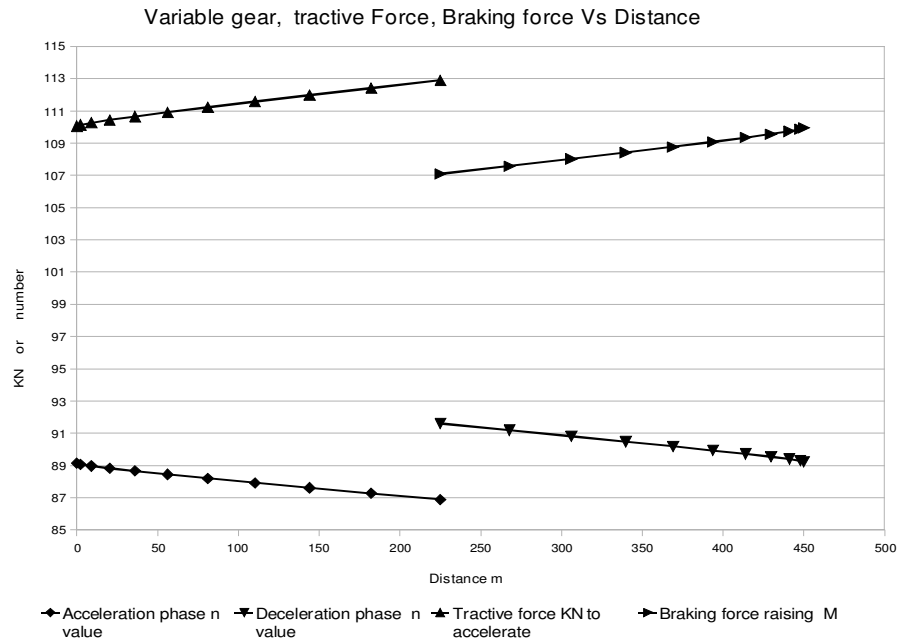


Figure: 2 Constant acceleration case with variable gear.

More importantly the energy recovered is 97.7 % approximately- which means

we need less than 2.3% of man made energy ; in other words we have opportunity to save more than 97 % of energy which we currently are using from fossil fuels! With this speed profile, Figure 3, urban transport with stops within 500m can be created, practically powered by free, eternal energy which is pollution free- that is gravitational force driven.

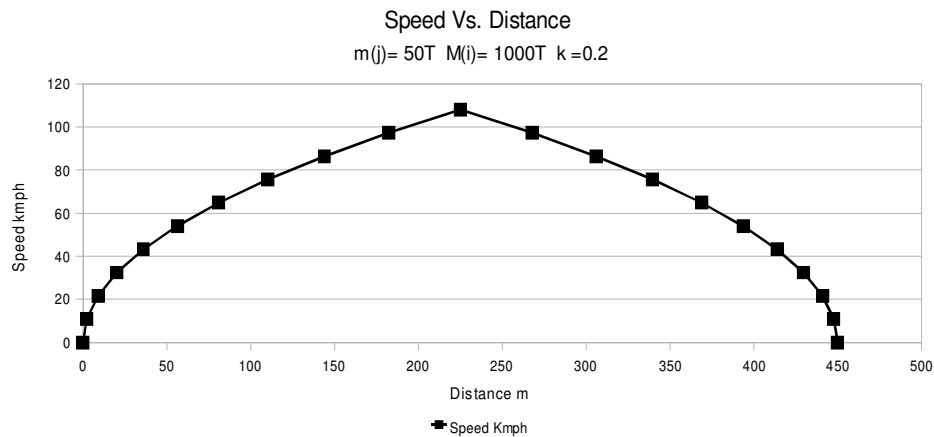
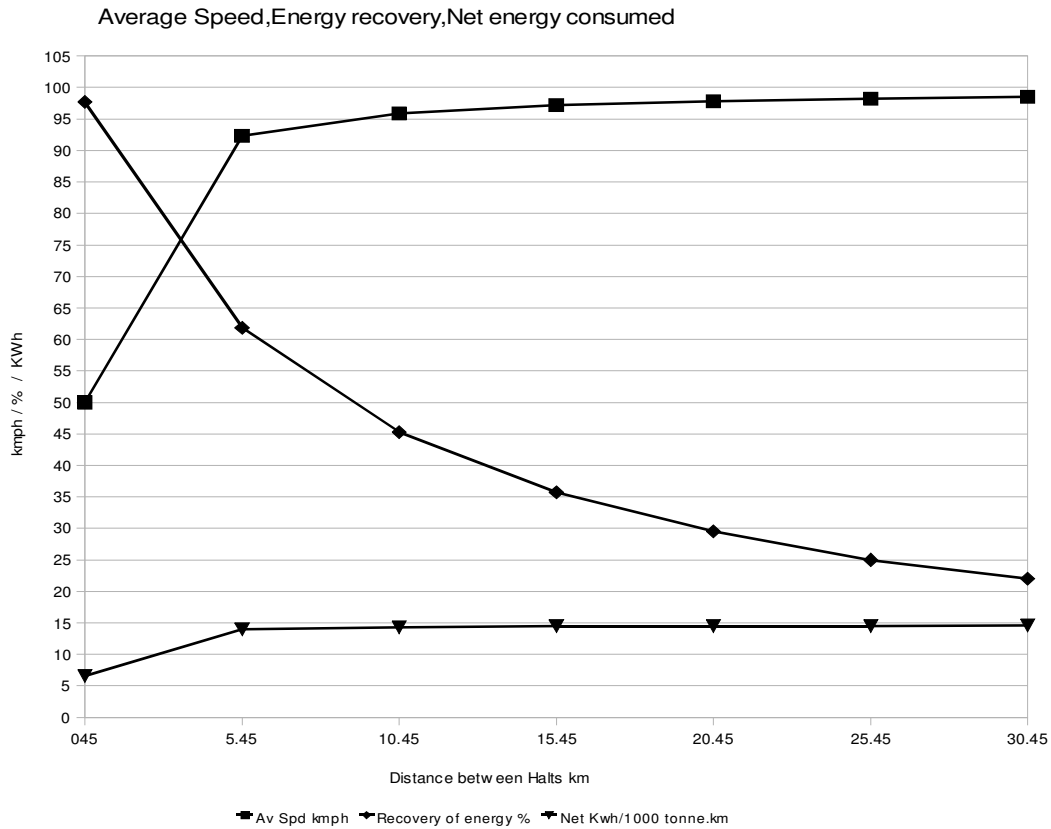


Figure 3 Speed profile for the 108 kmph short haul case.

It is beyond the scope of this paper to describe complete engineering details for implementing in field, but it is necessary to note that surprisingly for such a significant alternate source of energy to be availed, it is not as complicated or complex as it is in case of wind or solar power. Only variable gear transmissions readily available in industry, cable drums to roll up and down the vertically moving masses, endless thin steel cable transmission running around pulleys, sounding more like old world technologies, except for microprocessor based low power driven electronic intelligence to initiate or stop certain connecting gears form the components of the Gravity Power Towers. The rolling stock and railway track are substantially the existing ones, even simpler because there are no prime movers mounted on the stock, it is merely hauled by the cable. Hence the risk of technology complexity for quick realization is practically little.

For long distance travel without coasting length, such speed profile can cause concern of human comfort. In such a case accepting saving of 60-70% levels of saving, Fig. 4, we can work out high speed travel option with coasting

Figure 4. Effect of coasting length on energy recovery.



length. But for transport of goods this can be a boon. Billions of tonnes of cargo in containers can be transported across globe on surface, saving more than 97% of currently used energy.

2 Scope: National Highways 256000 km out of which

Inter-state highway 75300 km

Rail 240000 km

Airports-runways. 5000 paved (From Wikipedia)

2.1 Between rail and truck modes, almost 60% of cargo, which is 3000 b ton.miles, is carried which can now be carried by Gravity Powered rail saving 97% of energy from the fossil fuels.

2.2 Hence identifying 50,000 km of existing railway, and 50,000 km of inter-state highways, along which we construct the subway-rail fully gravity powered, we may plan to have a network of 100,000 km network of Gravity Powered Rail to transport.

3 The total cost for this infrastructure can be approximately estimated, as under.

3.1 Cost of implementation in USA- I phase.

Item	Numbers	Unit cost	Total cost millions
1. Gravity Power Tower with all components including cables 7 controls with intelligence built in with provision for traversers too.	50,000	1000000	50000
2. Modifications to existing railway- provision of side-bearing walls, running guidance for steel cables in middle track, per km basis as unit	50000	500000	25000
3. New Sub-way track all along highway median/shoulders per km basis as unit	50000	5000000	250000
=Rolling stock- @ 5 per km	500000	250000	125000
		Total	450000

So a total of \$ 450 b will be the investment, out of which the various states and Federal Government will commit about \$100 to 150 b, the rest coming from private parties. This project will be executed on public-private partnership basis.

3.2 The revenue streams of the various infrastructure development companies will be on the basis of charges for per unit of transport in terms of access charges

and the commercial operator encouraged to invest and run the rolling stock and collect freight carriage charges from the clients.

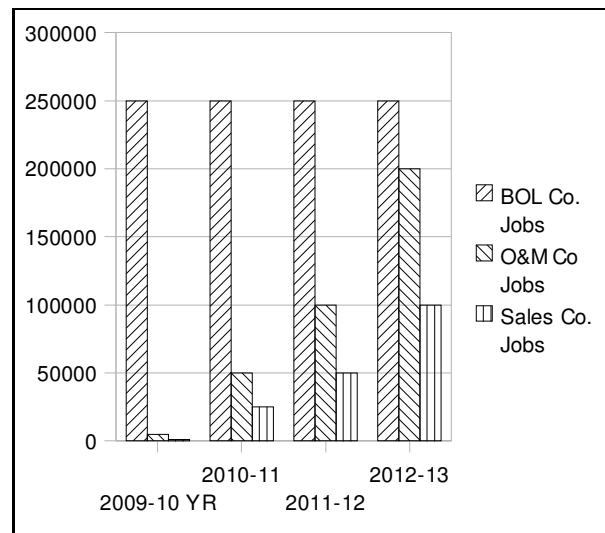
3.3 So we envisage:

3.3.1 Infrastructure design, engineering & construction company to be Build Own and lease the fixed assets including the Gravity Power Towers His lease charges will cover the debt servicing and redemption requirements with a percentage profit

3.3.2 Operate and maintenance companies, for maintaining and collection of access charges, which includes charges for providing the gravity energy too- he will pay the lease charges to the Build, Own and lease company

3.3.3 Commercial marketing and client relationship and service delivery company who gets paid by the users for transporting their cargo who will pay the costs as charged by Operate and Maintenance company.

3.4 Direct Jobs created are shown in a chart below. State wise we may envisage one of the types of companies, with the result we may have 40 to 50 of them based on work load and depending on the requirement.



3.5 In case of existing rail roads, the same staff will continue but there would be re-distribution of persons from one category of work to another. The locomotives will be drastically reduced limited to some shunting in yards.

3.6 While close to half a million get direct employment, the downstream effect of contractors engaging people to deliver the concrete structures, the steel and rail industry getting a fillip of continuous production are expected to create the other half a million jobs.

4 The description of the infrastructure created and expected benefits:

4.1 One finds a number of towers, elegant merging with local environs, quietly powering the transportation, located every half a kilometer, and cargo in containers or wagons moving one by one all by themselves automatically with operators there merely to watch not required for any pro-active role. The status of the energy in towers, recovery occurring automatically as well as any shortfall being made up from electrical motors built in to towers, which also automatically function, get watched in a control room displays monitored by supervisors for any unusual development.

4.2 With such a network of Gravity Power Driven system, of 100,000 km, it is assumed that out of 3000 b T.m of cargo, about 40 to 50% may get transported by 2011. That means about 2000 b tonne.km which has potential to earn at 8 cents per tonne.km, \$ 160 b . The cost of manpower is 250000 @ \$30,000 yields \$ 7.5 b . The energy costs at 6.6.kwh per 1000 t.km and at \$24 per Mwh, works out to less than \$0.5b which is naturally less, because 97% of energy is supplied by free gravity. Providing for maintenance and depreciation 10%, and providing for debt servicing at 10%, we get surplus in excess of \$ 150b. It may be noted that only staff 250,000 are charged to maintenance operation and marketing, while the other 250,000 are project account. They continue developing further network extension work. The federal and state governments may collect this surplus and hand over their shares to the companies if they so desire, after collecting interest also at 10% per annum.

4.3 With this kind of revenue stream, the equity of the companies get higher market valuation to reflect future cash flows, making it easy to finance the expansion of the network.

4.4 The export market all over the world is waiting to be availed of.

- 5 The US government may take a view over years to even reduce the unit rates to be charged, to make goods cheaper in market once the capital is recovered by the operators. Accordingly the concession agreement could be structured. The energy is eternal and does not suffer from any risk of rising cost of generation, which makes the system uniquely positioned to control rise in prices of commodities and goods. The impact of this feature can be very substantial for common man and economy.
- 6 The use of fossil fuels in cargo transport both by road and rail can be eliminated which is substantial, and so the import bill for more than estimated 6 to 7 million barrels per day can be saved.
- 7 The carbon credits can fund and bring down further the cost of financing the future projects. When completed, we prevent 3.5b tonnes of carbon emissions per annum.
- 8 Only cargo transportation is covered in this note. Urban and intercity transport of people at 360 kmph is separately covered in another note, using gravitational force.
- 9 Way forward:
 - 9.1 To realize the benefit, it is not research what is required, but execution of a pilot project on a war footing where concurrent engineering and design can be completed, standards laid down and commercial project initiated within one year. I can confidently promise the delivery even if only technologies available in India are used; with the available US variable gear transmission, it is even simpler. Only microprocessor based intelligent systems, a combined group of US, Indian and German experts will be used for assuring CENELEC standards.
 - 9.2 The pilot project is only one mile or km long railway with three Gravity Power Towers and 4 rolling units, with a total investment of \$ 25m; the amount spent more for developing the design documentation and verification of the software and field testing on prototypes, assuming we use the existing rail track. The details have to be worked out, but these numbers are based on experience of similar work done in India, by the inventor, in a more complex development of technology, than the current case.