Gravity Powered Transportation system

Er. Rajaram Bojji M.Tech., F.I.E., FNAE

Abstract

A mass with potential to travel vertically down under gravity has stored potential energy, which can be called the driving mass when it is allowed to move down under gravity. Through a gear system and high speed traveling power cable we can harness this energy to deliver enough force to another mass a fraction of the driving mass at a fraction of the acceleration due to gravity, to reach a desired velocity. The driving mass which would have gained some kinetic energy in the process of falling down, is now made to transfer the same to a flywheel storage. This is the phase of transporting a mass when maximum demand is made on power and gravity can deliver this. The coasting portion of the mass rolling needs lower levels of energy, which can be drawn from a few flywheel storage units mounted on the rolling mass, the flywheel storage units also charged by the driving mass while accelerating the mass rolling. The module containing the driving mass, gear system, a built in flywheel storage unit and a dedicated electrical motor is called Gravity Power Module. When the rolling mass has to be a brought to halt, the Power Mass Module engages through its gear system the rolling mass, its kinetic energy getting converted in to increased potential energy of the driving mass, in effect raising the same against gravity. Any loss due hysteresis in the system is made up by the electrical motor. A set of such power mass modules operate in a gravity tower and a group of such gravity towers located at appropriate distances connected by transport mode like rail or road forms a gravity powered transportation systems. Calculations show that we can save almost more than 70% of electrical energy requirements and also totally avoid fossil fuel vehicles on the roads.

1 Introduction.

1.1 Gravity, the fourth fundamental force so prevalent, remained an enigma and treated more as a force to be resisted and managed on the planet. Fossil fuels and electro-magnetic energy are our current choices. If we are able to harness omnipresent gravity force for our needs in a proactive manner, a new chapter opens for human civilization improving quality of environment reducing carbon emissions as well as provide an unlimited free source of energy.

1.2 We do consume substantial quantum of energy in transportation. Maximum rate of work is observed during accelerating a mass from rest to a cruising speed. Power needs are quite high in this phase. Every mass rolling at a speed finally has to be brought to halt, and most of the time the kinetic energy is wasted as heat in braking the rolling mass to a halt. Efforts for regeneration in electrical driven systems using asynchronous motors yielded partially successful results in energy recovery limited to less than 20 to 30%; which also involves substantial capital intensive infrastructure.

1.3 Recognizing the linearly oscillating system formed by transportation of masses, in this paper a means is described to convert potential energy of masses with capability of moving up and down, into kinetic energy of horizontally rolling mass, and then convert back the kinetic energy in to potential energy of the vertically moving mass, thus recovering most of the energy, except for loss of energy in hysteresis. Gravity becomes the prime mover in transportation, which can redefine quality of our life on the planet.

2 The Principle:

2.1 Let M be the mass as in Fig.1 which is at a position h_1 at time t_1 and connected through a gear and cable system having a gear ratio of 1: n , to mass “m” on wheels rolling in a generally horizontal direction, which is same as perpendicular to the direction of motion of mass M; n being the gear ratio

at time t_1 such that mass "m" moves n_1 times what the M moves vertically. This can be represented by the relation ship:

M.g /n= m.a .....[1]

F/n=f where F= M.g and f= m.a

where g is the acceleration due to gravity and a is the acceleration with which the mass m would move, at the time t1 if we allow the M to vertically move down.

2.2 Generally the value of "a" is only a fraction of g and let it be "k" . By making "m" a fraction of M, say " p" , we substitute in the equation [1],

M.g/n=p.M.k.g or

n.p.k=1 ----------[2]

2.3 Case of moving a mass from rest: Now let us allow the M to move down to position h2 , a distance of (h1-h2=h), under gravity , which will make the mass rolling to move a distance of n.h from its position of rest; in time "t" to reach a velocity of "v". Then we can write:

t = v/a assuming the same uniform "a" is applied throughout.

$M.gh= 0.5mv^2 + 0.5M(v/n)^2 + Q$ -------[3]

We may put dM.h=Q and increase M by dM, and the revised M if used, equation can be written neglecting the term Q.

where Q is the energy lost in friction losses in gears rolling friction etc.

The gravity power driving the mass m at "v" is equal to m.a.v

At this stage the driving power is disengaged, assuming we have reached the desired speed v for the mass rolling; the kinetic energy of the M is now recovered into a flywheel storage unit, bringing the mass to a rest.

2.4 Case of maintaining the cruising speed of a mass rolling: As the rolling mass is moving at a speed v, to maintain the speed, it has to over come rolling resistance and resistance due to air and grade resistance , which occurs as an opposing force and if not overcome, causes a deceleration of Q/m , where fr is the resisting force. Further it is at speed v. So a power equal to m. (Q\m). v has to be provided.

F.(v/n) = m. (Q\m). v.....[4]

F being M.g where if M is kept constant, then we have to control n, the gear ratio, to satisfy this relationship. But we do need to note that the M has to be moving at v/n speed. But suppose the M was at rest, and needs to move at this speed, then we have to allow the M to move down under gravity, until it reaches this speed.

2.5 Case of stopping a rolling mass-recovery of energy: The rolling mass required to stop will get engaged to the power-cable gear system to the mass M; due care taken to match relative speeds and assuring gradual imposition of deceleration through progressively adjusting the “n” value, which will cause the M to rise up converting the kinetic energy of the rolling mass as a potential energy gain to self, thus bringing the rolling mass to a halt. Obviously the M will not regain the original “h” value, but a little less, which represents the friction losses, hysteresis of the system. Let it be h_r, that is the recovered height. So we can write

$0.5m.v^2=Mg.h_r$ .....[5]

it is to be noted that had there been coasting without further input of power, the value of “v” in the equation [5] could be less accounting for the loss of momentum.

2.6 So the energy input required by an external source other than gravity, to bring back the M to its fully charged potential energy level, is $Mg(h- h_r)$.

Generally the time over which this is required to be recovered is much more than the time that the M took to launch the mass m , and in a linearly oscillating system, the cycle time for the subsequent mass to be launched decides the time. That is the frequency of the service or the headway between two rolling masses will allow us to decide the power needed for the electrical motor to raise the mass back to position.

2.7 The losses can be estimated as:Rolling resistance is generally expressed as

$Q = c+d.v+e.v^2$ where c,d and e are constants for the rolling mass, the value of constants determined through field experiments. Similarly for all the gear systems, and the high speed cable system supported on special rollers too will have a similar equation linked to the speed.

2.8 From experience in railway systems with roller bearings these losses amount to about 10 to 15% of the energy used. So even if we assume level route without gradients and assuming that the flywheel storage which captures unused energy we may place the value of h_r/h at 0.8 .That is almost 80% of energy can be recovered in a linearly oscillating transportation system. Typically urban transport very closely satisfies this condition.

2.9 In all the above relationships M may be taken as a set of masses of a number of Power mass modules grouped into a gravity Power Tower and the embedded intelligence coordinates the various activities based on inputs received from transducers located at appropriate locations providing information about speeds, distances and accelerations on a continuous basis of the rolling mass, the high speed traveling cable – all described in detail in [Ref 1]

3 Practical case of rail based system- based on gravity power:

3.1 Let m=50 T; M= 250 T ; a=0.2g then we get p= 0.2 and k=0.2 ; so n=1/pk=25; for proposed Gravity Powered case and let 400KW be the

maximum electrical power available to the 50T rolling stock as in conventional case which means each of the four driving axles is provided with 100KW asynchronous three phase AC motor, having capability to regenerate energy in braking amounting to 30%. The comparative charts for the speed profiles achieved, the maximum speed, and after energy recovery, how much is the net electrical energy consumed are presented in [Fig. 2 to 5]

3.2 Higher speeds , saving 70% of electrical energy is made possible with Gravity Powered transport systems.

4 Scope covered in this paper: Innovative engineering aspects of the systems are described in detail in US Patent application number 12184151 filed on 31st July 2008. The aspects of high speed traveling power transmission cable, the construction of gravity powered rail both underground and elevated, gravity powered roadways to run cars without oil guzzling engines as well as launching and receiving aircraft at runways with gravity power are described. The scope of this paper is to explain and demonstrate the principles as to how gravity force , hither to neglected, can play a very important role to improve our energy security.

5 Conclusion: Nature has gifted us the omnipresent gravity which we treated as a hindrance till date. It is now possible to to put gravity to pro-actively power all forms of surface transportation, saving 70% of electrical energy and contributing to improving quality of human life at reducing costs, because gravity is non-polluting and cannot be exhausted!!!

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Reference: [1] “Gravity Powered Rail, Road and Runway transportation systems” US Patent Application no:12184151 filed on 31st July 2008.

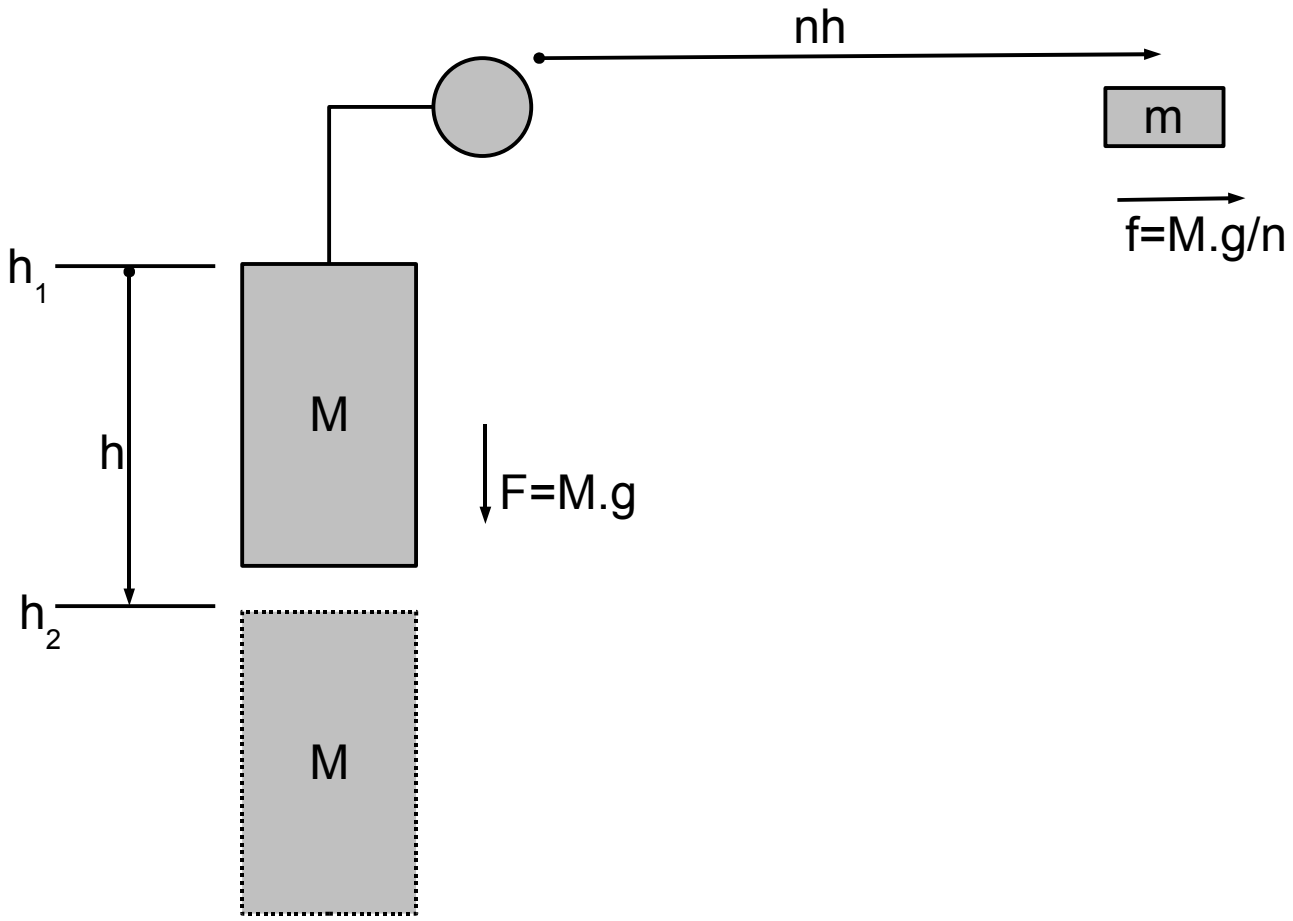

Fig:1

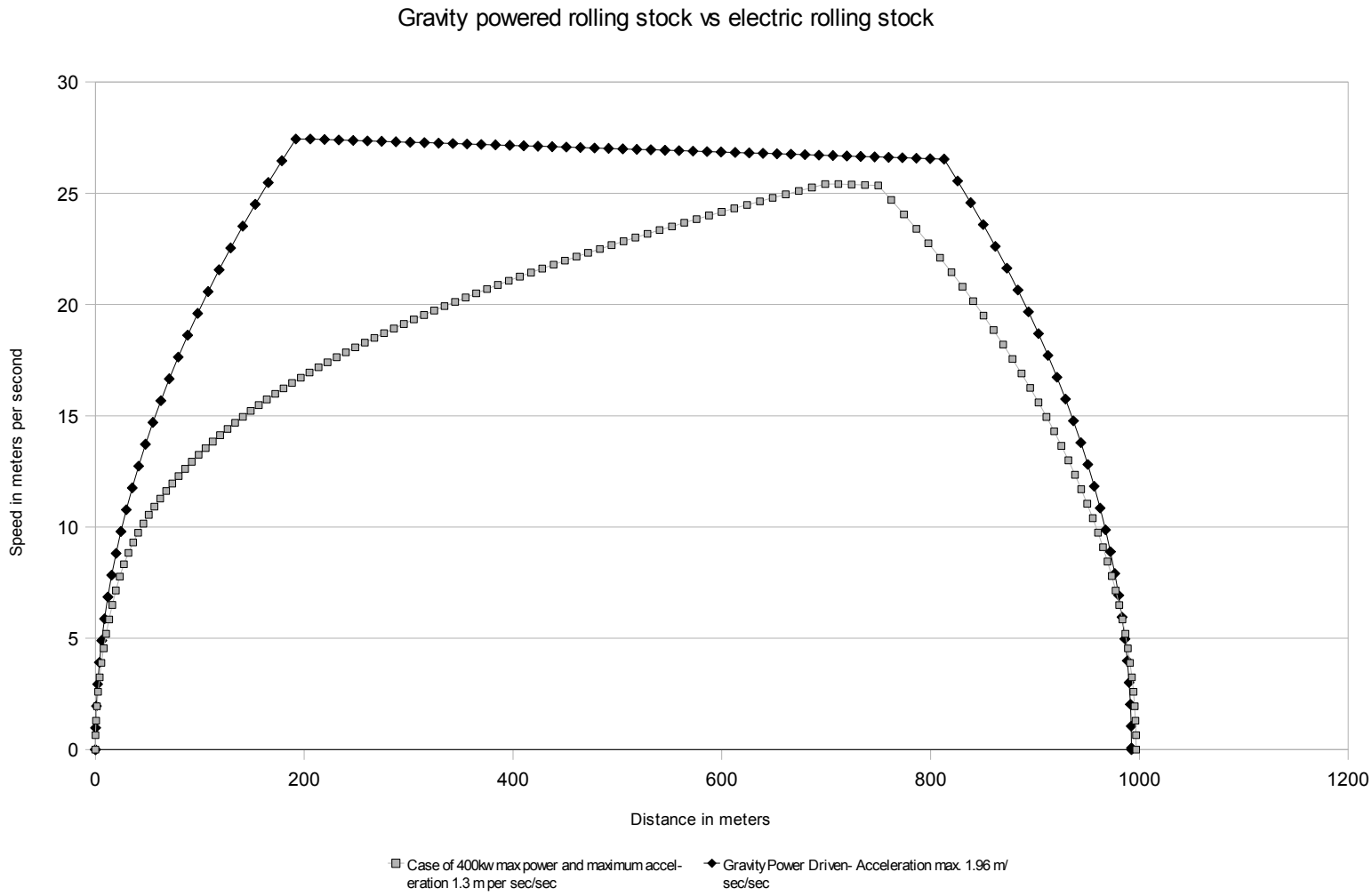

Fig: 2 Gravity Powered system reaches higher speeds faster as can be seen takes lesser time to cover the same distance.

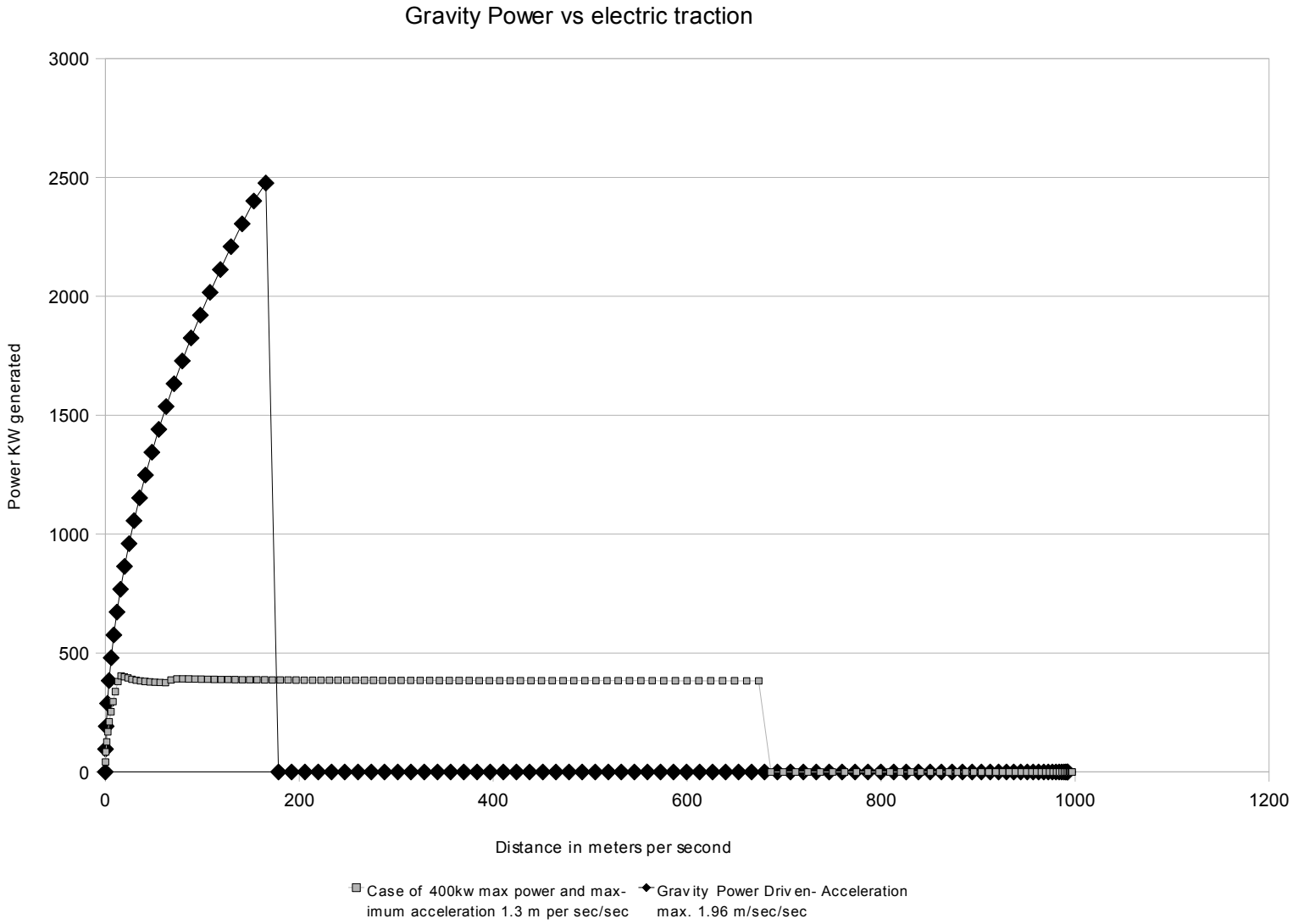

Fig: 3 Gravity Powered system generates very high levels of power and accelerates much faster than electrically driven system.

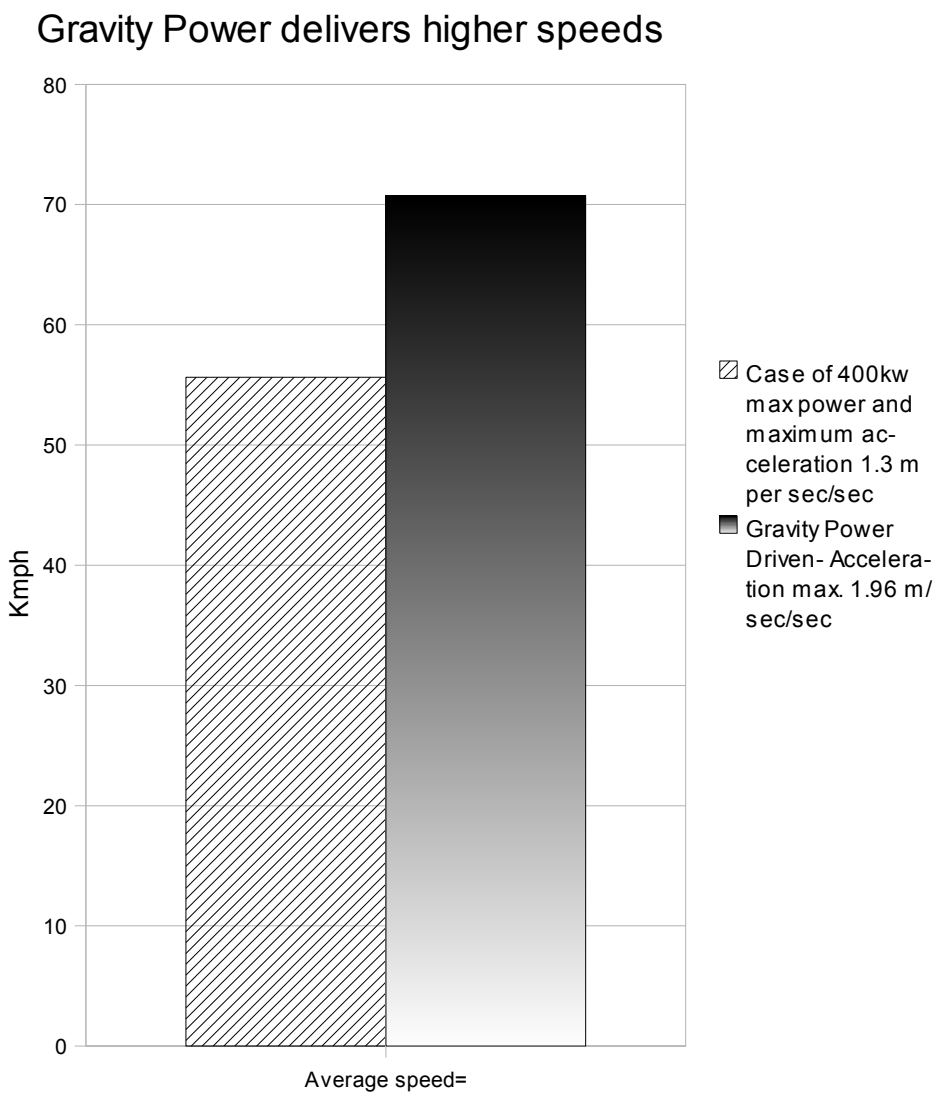

Fig: 4 Gravity Powered system achieves much higher average speeds compared to electrically driven system.

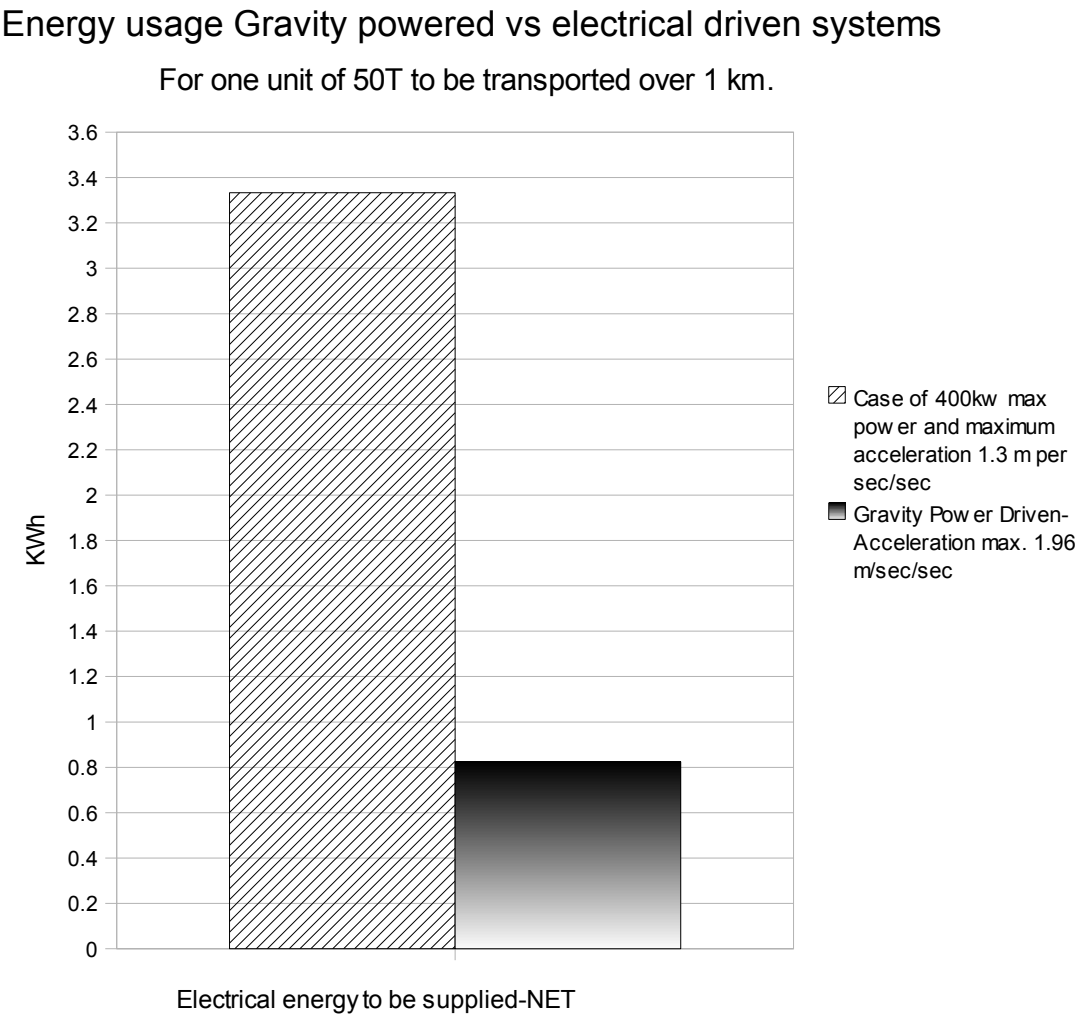

Fig: 5 The Gravity Powered transportation saves more than 70% of electrical energy.