



Thermal Insulation Application



For energy savings



*An exemplary application for color change
technology*

Thermal insulation application

USA thermal insulation segment view

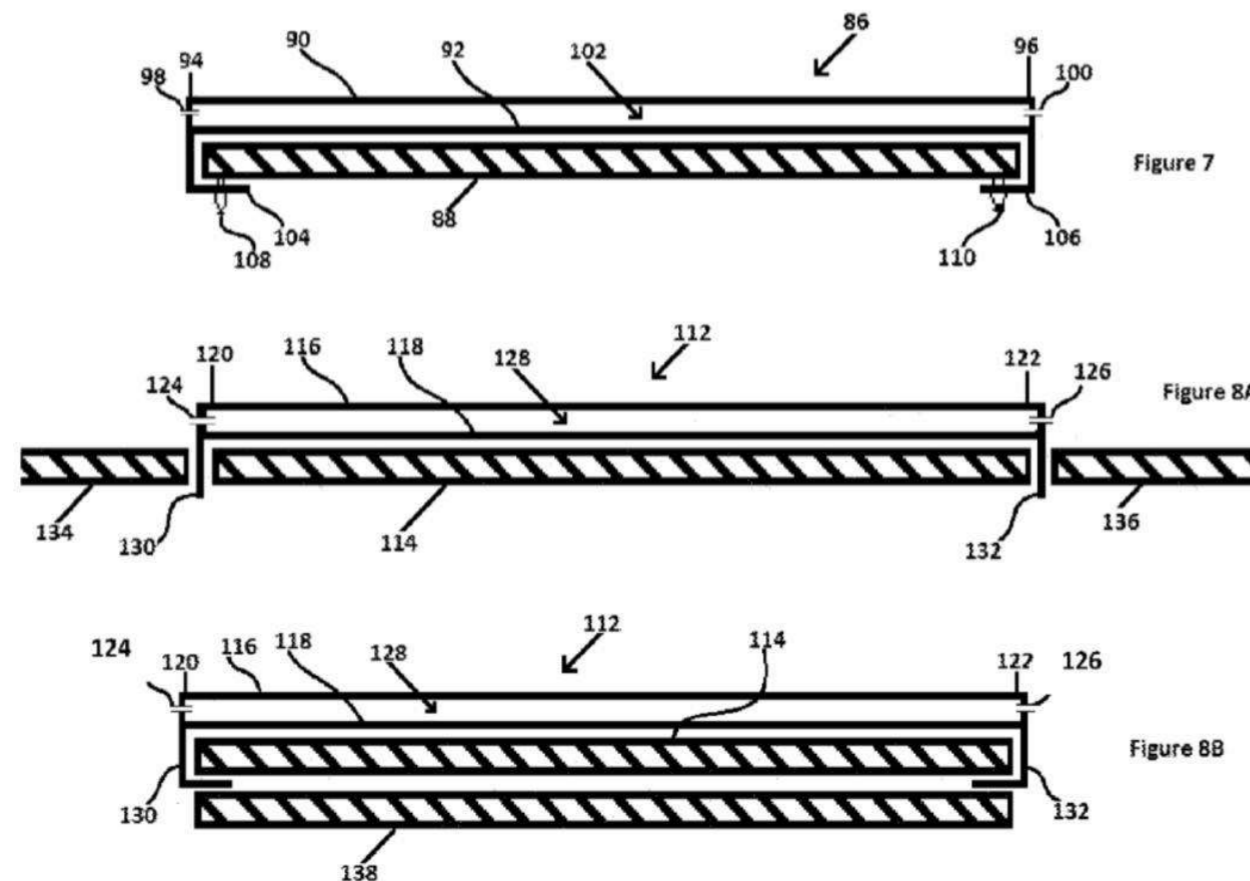


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Driving energy savings

Thermal insulation application

Exemplary application Thermal insulation

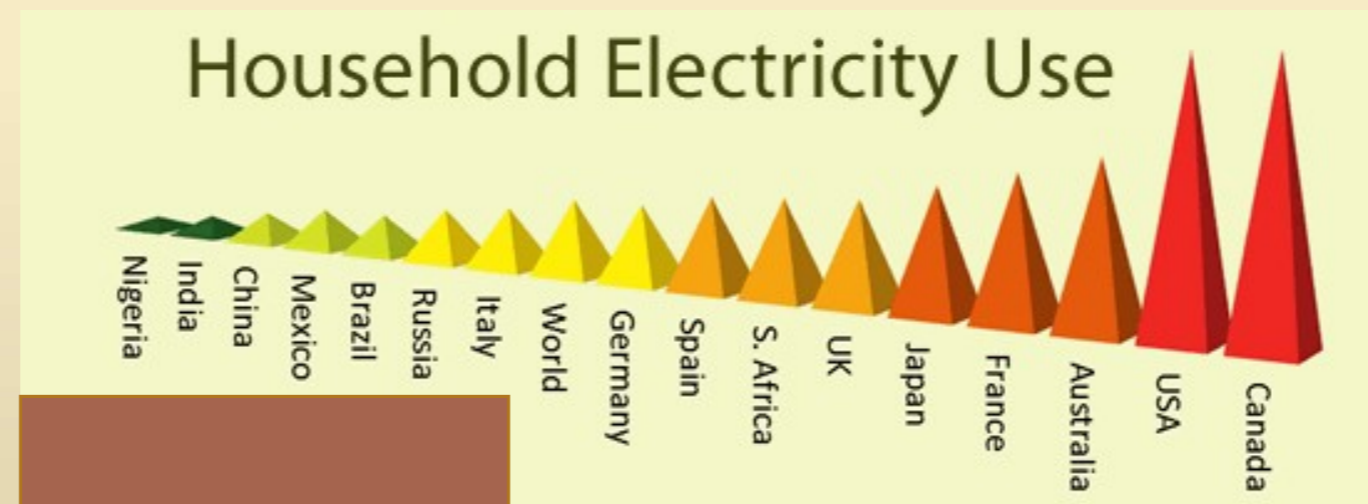


- Instead of color, insulation material in the form of fluid or solid could be injected / stuffed into the vest.
- An example of insulation material is Glass wool or similar.
- The substrate shown in the drawings could be the wall of any building (house or office).
- Drawings show a 2-layer vest embodiment.
- A case of double-decker vests is discussed in next slide.

Usage of double decker vests for buildings. Energy conservation by thermal insulation

- A double decker vest enables stuffing of thermal insulation material (e.g., glass wool or similar) in the lower enclosed space, while the outer enclosed space could be used for repeatable color changing.
 - The thermal insulation material acts as a heat trap inside the building (e.g., home or office), during winter conditions (e.g., countries with extreme winter conditions), thus reducing the continuous heating costs, to maintain habitable temperatures inside the building.
 - This would translate into huge energy savings / heating cost savings.
 - The thermal insulation further acts as a heat shield for the building (e.g., home or office), in case of summer conditions (e.g., countries with extreme summer conditions), thus reducing the continuous cooling costs (e.g., air conditioning), to maintain habitable temperatures inside the building.
 - This would translate into huge energy savings / cooling cost savings.
- Energy savings could be realized by having double decker vests created and installed for entire buildings (e.g., all walls of homes or offices).
 - While thermal insulation results in savings; the outer enclosed space of the vest with its own micro valves will be used for repeatable alteration of color for the exterior of the walls.
 - The same could also apply to the interior of the walls. The thermal insulation layer could be inside the wall along with the color changing feature.
- Benefits all along the year. The thermal insulation helps in all seasons, winters and summers to save energy costs.
- When needed the vests could be replaced, to change the insulation material.
- Energy conservation concepts are sought after and are in demand.

USA thermal insulation energy savings



Estimated Royalty revenue from insulation project - USA



- Converting existing homes to energy saving homes.
 - A rough approximation at 30,000\$ to completely insulate entire home with a conversion of 20 million homes in 20 years = 600 Billion \$ value.
 - At 12%, you are looking at 72 Billion \$ royalty income over 20 years.
- New home construction across USA can be averaged to about 5-6 million homes per year.
 - If 100% thermally insulated homes are made a construction standard, the demand for material, vests etc. will also become standard, at the same rate of construction.
 - The new home constructions will also owe royalty to exploit the concept during the IP tenure.

- By delivering thermal insulation to existing homes and new homes, the projected royalty revenue out of it is an approximate 72 Billion \$.
- The 20 million home conversion number still comes out to be conservative, given the new home construction rate in USA.
- The rigor of implementing IP law is very high in USA. You can really make the most as per USA Patent law, as compared to other countries.

Major related downstream businesses



- Polymer / plastic businesses
 - Includes material suppliers (e.g., plastics, additives, chemicals, etc.)
 - Thermal insulation material (such as glass wool) is relatively cheap, but will be a sizeable business.
- Vest manufacturing and supply
 - Custom make vests per house, per wall, varying dimensions, varying textures as per customer choice.
- Paints
 - Manufacture large volumes of paints (e.g., antifreeze paints), of various colors as it would take lots of paint to color all walls of an entire house.
- Installation – as DIY
 - THD can sell DIY kits, manuals, paints, pumps and gear to install vests and change colors.
- Installation – as professional service
 - Professional services will be needed for color changing most importantly. As gallons of color has to be pumped into the vests to cover the entire area/surface.
 - Professional services for vest installation will also be needed.

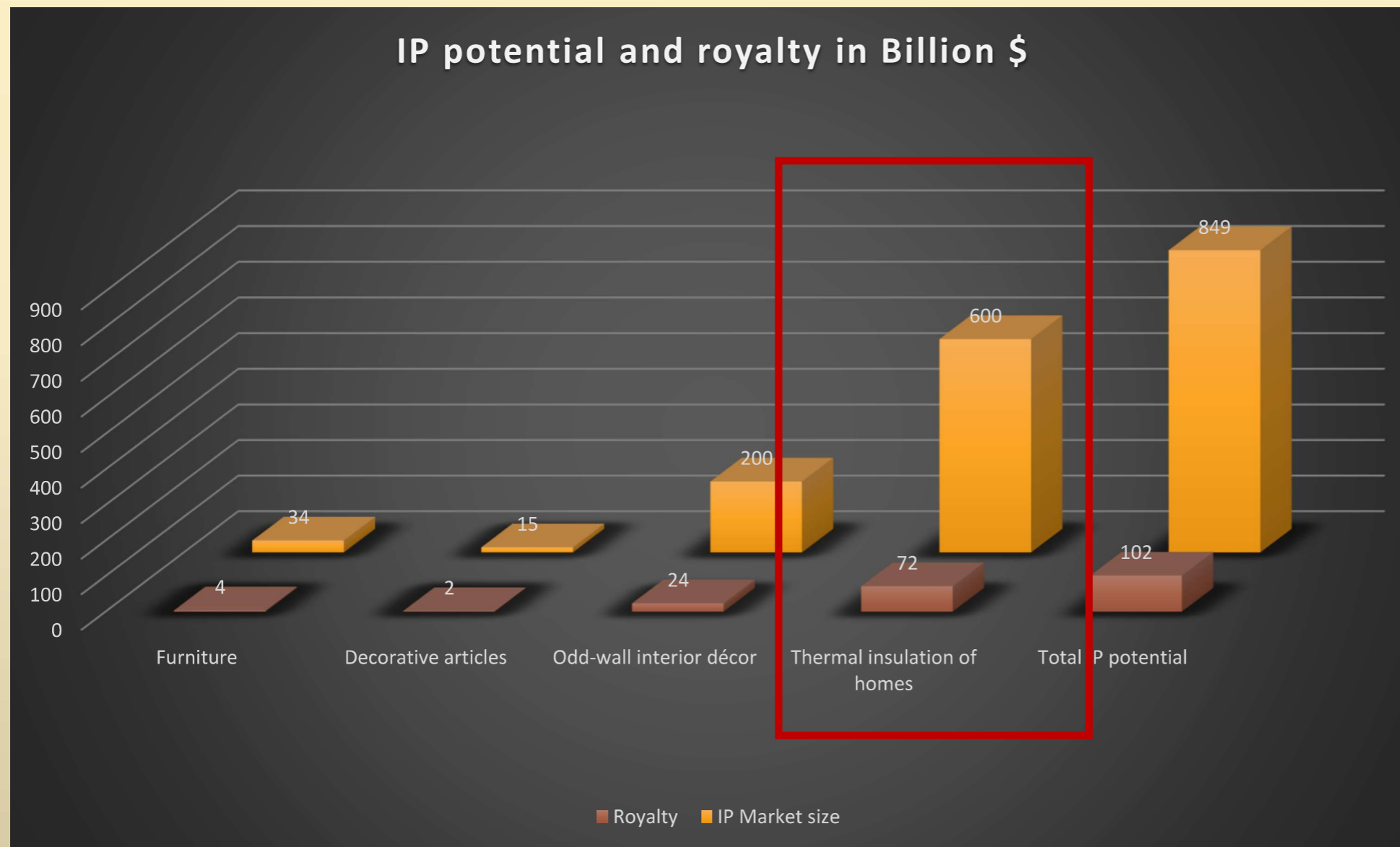
- Simply put, the valuation of these downstream businesses will be very high, whether you consider them for 20 years or 100 years.

- A general valuation could be that the downstream businesses can be estimated at few 100 Billion \$'s.

Downstream businesses for few segments - USA



IP potential and royalty in Billion \$



- The chart to the left shows a conservative estimate of projected royalties from few sectors including TI for USA.
- The IP concept (for USA only) for thermal insulation of homes, has a market potential of 600 Billion \$ in the 20 year period with royalties of 72 Billion \$ estimated at 12%.

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Estimated energy savings Heating and Cooling costs - USA



Energy source	Annual energy costs per home			USA homes % share	Total USA Energy cost*	Million \$ annual savings at % of thermal insulation efficiency, when all 116 million homes converted						
	Heating	Cooling	Yearly total			25%	30%	40%	50%	60%	70%	75%
Natural gas	680	620	1,300	50%	75,400	18,850	22,620	30,160	37,700	45,240	52,780	56,550
Electricity	910	790	1,700	40%	78,880	19,720	23,664	31,552	39,440	47,328	55,216	59,160
Other	1,800	1,300	3,100	10%	35,960	8,990	10,788	14,384	17,980	21,576	25,172	26,970

Other energy sources include heating oil, propane, wood

Buildings other than homes are excluded from this table. They could deliver at least 50% of savings from that of homes.

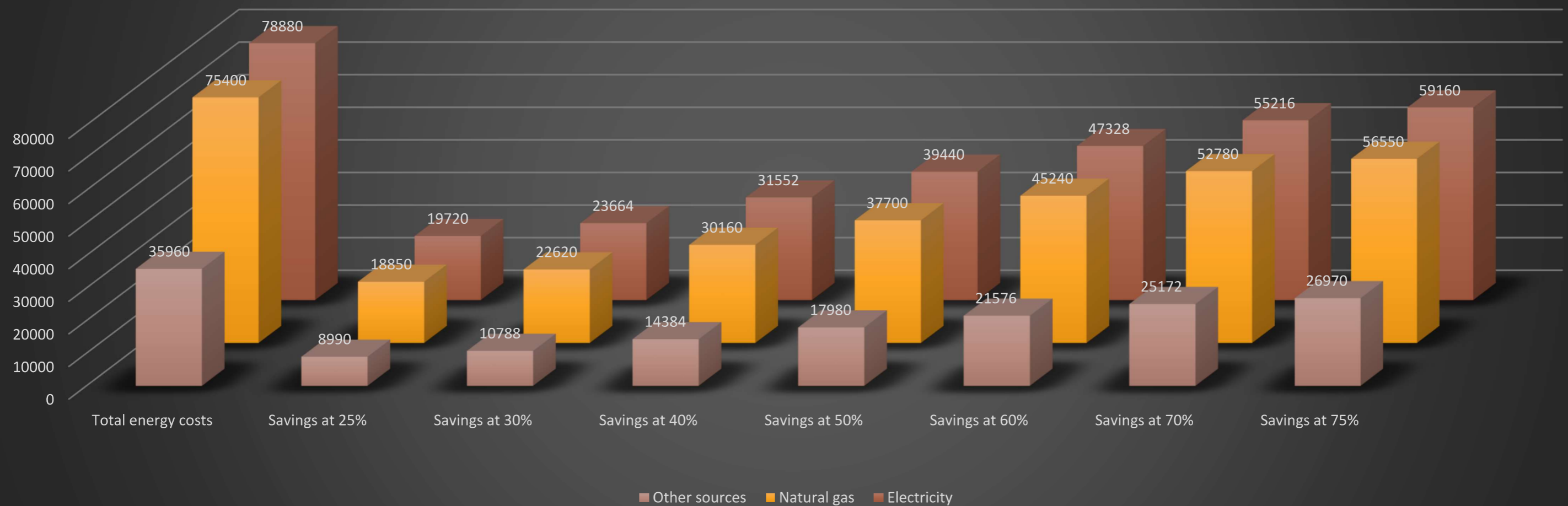
* Energy cost in Million \$ for heating / cooling homes in USA annually, at 116 million homes. Note that new homes are built at 5-6 million per year.

The savings at an assured 25% thermal insulation efficiency cannot be ignored. Stronger insulation efficiency means more savings. Shown up to 75%

Estimated energy savings At varying efficiencies of TI



Home energy costs and savings due to Thermal insulation at varying efficiencies (Million \$)



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Metrics for few segments - USA



IP	Business segment For 20 years	Estimated value Billion \$	Estimated royalty Billion \$
USA only	Furniture	34	4
USA only	Interior Decorative articles	15	2
USA only	Interior Décor – Odd Wall	200	24
USA only	Thermal insulation of homes	600	72
USA only	TI – Downstream businesses *	Few 100 (in 20 years)*	Not valued
USA only	Estimated energy savings *	300 (in 20 years)*	Not applicable
USA only	<p>* Indicates that these are perpetual businesses and savings. While 20 years is the IP timeframe, these benefits will continue for many decades after. Value of these benefits is extremely high. ** Simply put, we are discussing a Multi-trillion \$ value / business opportunity at the moment.</p>		

Projected energy savings During IP tenure - USA



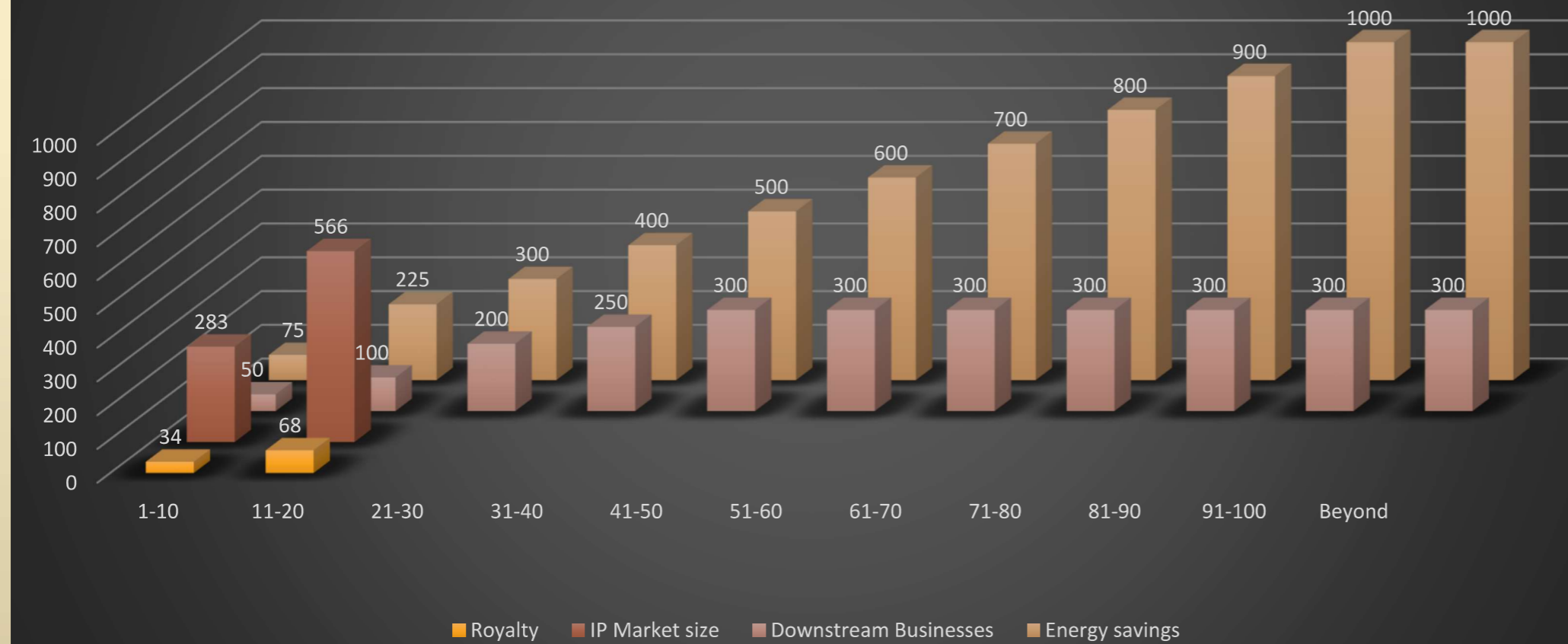
- With gradual conversion of existing buildings and making it construction sector standard, Billions of \$'s could be realized in savings. Here is a table with simple progressive savings in the IP tenure of 20 years.
- The gradual projection of numbers has been manually estimated by factoring in the 'New home' construction rate in USA (5-6 million per year) plus a healthy conversion rate of existing homes to TI homes.
- The projected energy savings due to energy conservation could be the most powerful marketing tool in USA. Just the energy savings over the IP tenure period of 20 years, would run into 300 Billion Dollars or more.

IP year	Savings (Billion \$)	IP year	Savings (Billion \$)	IP year	Savings (Billion \$)	IP year	Savings (Billion \$)
1	0.2	6	10	11	20	16	30
2	0.5	7	10	12	20	17	30
3	1	8	10	13	20	18	30
4	2	9	10	14	20	19	30
5	5	10	10	15	20	20	30

Put entire IP in perspective Multi-Trillion \$ opportunity



100 year view, in Billion \$
Continuation IP could be an opportunity



- The chart to the left puts this opportunity size in perspective for USA.
- As you see, the IP tenure 20 years (first 2 decades shown) is a small subset of the entire opportunity. A improvisation patent for target segments could extend this opportunity size.
- But the downstream businesses and energy savings are perpetual in nature and the projections are shown for 10 decades and beyond.
- As you see, the scale of energy savings cannot be ignored. So are the downstream businesses.

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Few other countries analysis For energy savings application



- Canada metrics: There are an estimated 13.3 Million households across Canada. Most of these households could use an energy saving solution. Due to the strong winter conditions, prevalent most of the year, across the entire country, savings could be significant. Current day average heating costs per household in Canada is on par with that of USA; about 600\$ per year per household. Straight away the solution delivers at least 25% savings in energy costs; which is a conservative estimate.
- Mexico metrics: There are an estimated 25 Million households in Mexico which could use cooling cost savings; due to the warm climate. Similarly other country estimates of energy savings could be worked out.
- Within USA, Alaska state could be a key opportunity area. For delivering heating cost savings.
 - Example, Alaska has an approximate 246,000 households.

Country IP	Opportunity areas	Other Countries
Canada ONLY	Winter heating cost savings	Countries closer to polar region, away from equator, will generally need heating cost saving solutions. All the other countries may or may not need cooling cost saving solutions. Several countries may need both.
Russia ONLY	Winter heating cost savings	
Mexico ONLY	Cooling cost savings	
Other similar countries	Opportunity in heating or cooling cost savings	

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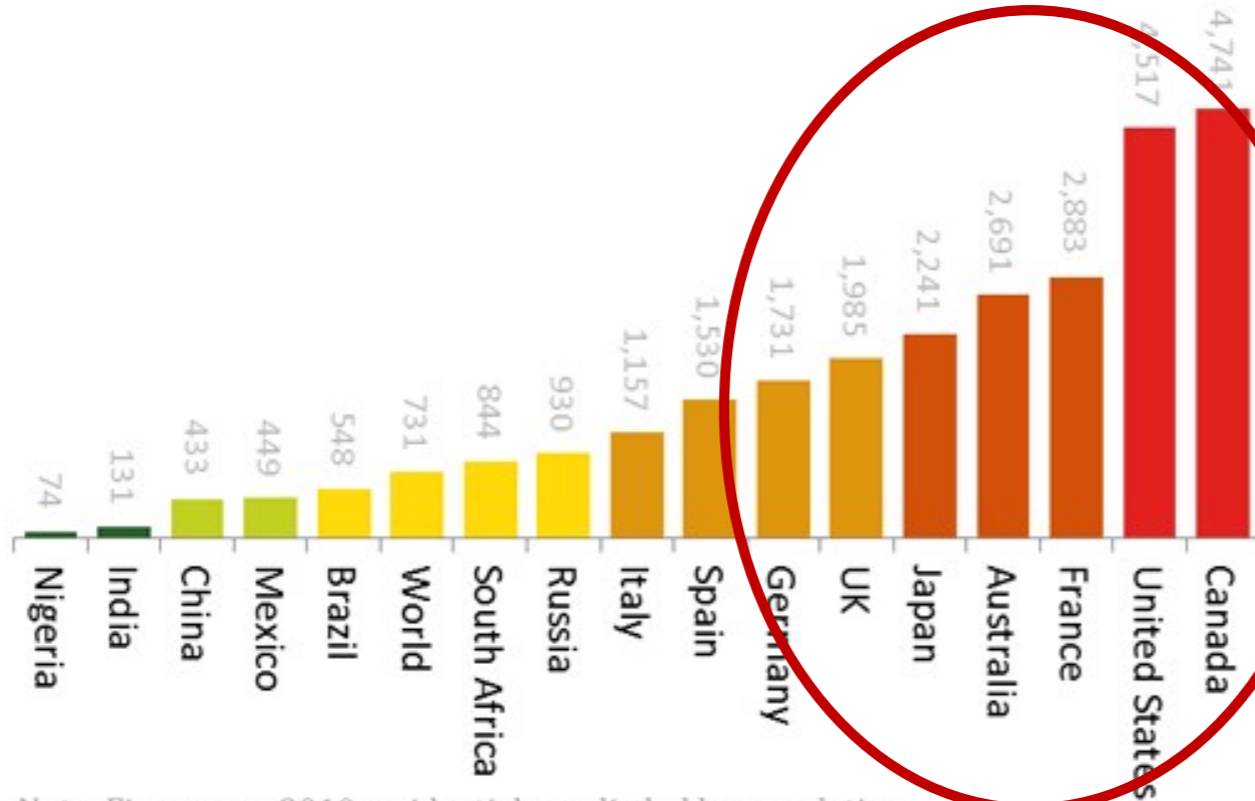
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Other opportunity countries For energy savings application

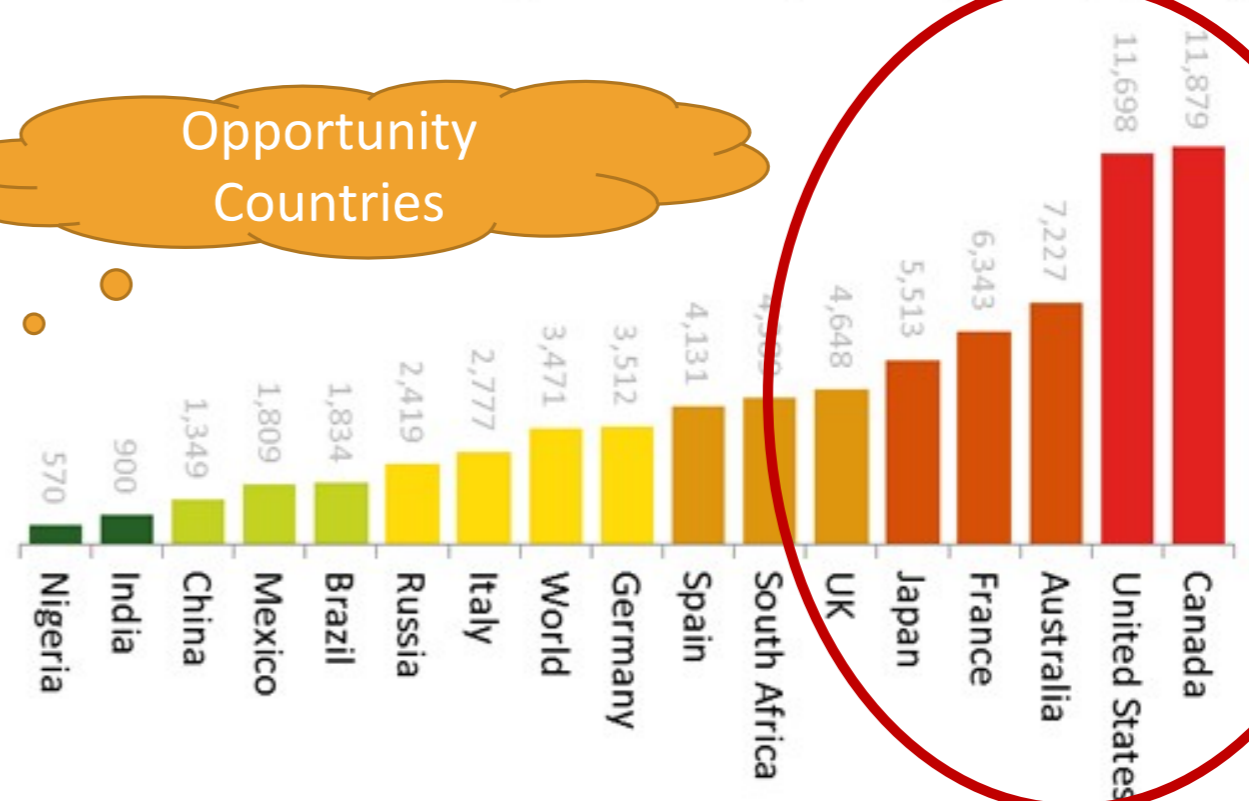


Residential Electricity Use Per Capita (kWh/year)



Note: Figures are 2010 residential use divided by population
Source: Enerdata via World Energy Council

Household Electricity Consumption (kWh/year)



Note: Figures are 2010 averages for electrified households
Source: Enerdata via World Energy Council

Countries with extreme weather



Extreme weather categories	Countries	Comments
HIGH extremities	Australia, Canada, Many Eurasian countries, Many European countries, New Zealand, USA.	Countries which could use Thermal insulation most of the year. Prolonged winters / summers. Close to north and south poles. Mostly wooden houses.
MEDIUM extremities	China, Japan, Korea.	Countries with seasonal extremities. Few months in a year.
LOW extremities	Brazil, India, Indonesia, Malaysia, Mexico, Nigeria, Philippines, Singapore, South Africa, Thailand.	Countries with 1-2 months extreme weather. Can get by without Thermal insulation. Mostly tropical climate countries. Mostly brick / stone houses.

Note - PCT application specific to Thermal insulation could be filed again in more countries. In fact, in all the PCT countries. Many other countries maybe of interest for Thermal insulation application.