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GREEN ENERGY

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Abstract:
Energy is basically what makes stuff do stuff, right? And green energy is like that cool kid on the block that doesn't mess up the environment. It's all about getting power from nature in a way that doesn't mess with Mother Earth too much. This paper's gonna dive into how green energy is gonna save the day in the future and all the neat things we're already doing with it, like making electricity and keeping our water toasty or cool.
So, green energy is the kind of energy that comes from stuff that's always around and doesn't get used up, like sunshine, wind, geysers, and stuff growing. It's like that friend who never runs out of juice for your phone because they're just that prepared. And it's super good for the planet 'cause it doesn't belch out all those dirty gases that make the climate go haywire.
Keywords: green energy, solar

1. Introduction

Back in 2006, some smart cookies in November started talking about this thing called the Renewable Energy Standard Offer Program, or RESOP for short. Basically, it was like telling folks, "Hey, we'll pay you a good chunk if you make energy from these green sources for the next 20 years." Then in 2009, the Ontario Green Energy Act showed up, trying to make the world a greener place with more of this clean, endless power.

The energy world's got two teams: Team Renewable and Team Non-renewable. Team Renewable are the all-stars like sun, wind, water, and some heat from deep down. They're like the gifts that keep on giving 'cus you can use 'em over and over again. And they're not just clean, they're basically the poster children for the "save the earth" club.

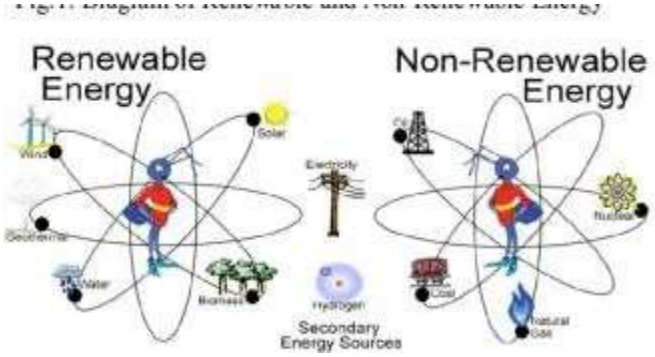
On the flip side, we've got Team Non-renewable. These are the old reliables like oil, coal, and gas. Sure, they're easy to grab and burn, but they're not gonna stick around forever. Plus, they're not exactly the healthiest for the planet or us humans. They're like that cheap burger that fills you up now but you'll regret later.

The good thing about green energy is it's like winning the lottery for Mother Nature. It's everywhere, it's free, and it doesn't leave a mess behind. You can get it from the sun's rays, the wind blowing, the tides moving, or even from hot stuff under the earth's surface. It's like nature's all-you-can-eat buffet and we're just starting to really dig in.

Now, the not-so-green energy, like oil and coal, are kind of like using up your grandpa's inheritance. Sure, it's handy now, but what's gonna happen when it's all gone? Plus, they're basically the main

reason we've got this whole climate change drama happening. So, we're looking to make a switch to the green team for a cleaner, safer future.

In this paper, we're gonna talk about why green energy's the future's bestie and all the cool tricks we're learning to use it better. Like turning sunlight into electricity or using wind to do stuff like, you know, not just blowing your hair around. It's pretty neat!



2. GREEN ENERGY

Green energy comes from natural sources such as sunlight, wind, rain, tides, plants, algae and geothermal heat. These energy resources are renewable, meaning they're naturally replenished. The different types of renewable energy technologies

include: Solar energy, Marine energy, Wind energy, Hydropower, Bio-energy, Geothermal energy etc

There are a bunch of different ways we can get energy that's good for the planet, like using the sun, wind, and stuff that grows, which we call "renewable" energy. These cool techs help us save energy, guess how much we can make from them, and get that sweet, clean power to our homes and offices without messing up the Earth.

So, let's talk about why we need this green energy stuff. Basically, our old buddy fossil fuels are like that friend who keeps leaving their trash everywhere and making the place hotter. They're causing big problems like global warming and messing up our nature. That's why we're trying to switch to green energy, which is like a superhero for the environment, making sure we have power without the dirty side effects. It's like having a clean, never-ending energy party!

Now, why do we really need it? Well, if we keep going the way we are, we're gonna see some serious drama with our crops, storms getting crazier, animals and plants losing their homes, and water getting harder to find. And the sad part is, if we break it, we can't just buy a new one - our planet's ecosystem is super sensitive. So, green energy is like our ticket to a better future where we all live happily ever after with our polar bear pals.

But how do we use this green power in our daily lives? Oh boy, there are so many fun ways! We've got solar panels that let us catch sun rays to power our TVs and toasters. If you live in a windy place, you can whip up some electricity with wind turbines - talk about harnessing the power of the breeze! Then there's biomass, which is like turning leftovers into energy, and geothermal heat that's just chilling under our feet, waiting to be used. And let's not forget the ocean waves and tides that can make our lights flicker without burning a single fossil fuel.

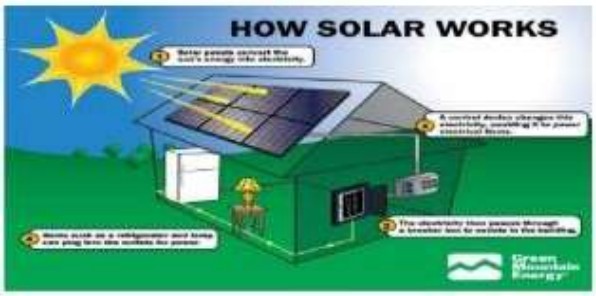
Solar energy is the king of them all, though. It's like the sun is throwing us a never-ending energy rave, and all we have to do is set up some solar panels to join in. And the best part? It doesn't add to our carbon dioxide hangover or make the globe any hotter. So, let's get on board with green energy and save our home, sweet home

3. TYPES OF GREEN ENERGIES

1.SOLAR POWER

Hey, so the sun's like this massive battery, right? It keeps pumping out energy for all the critters living on our planet. And get this – it's got enough juice to
last us like 10,000 times more than what we're using now in the 21st century. It's all clean and green, the best kind of power out there! We can harness it in different ways, like hydro and wind, which are basically the sun's cool sidekicks. It's like the ultimate renewable buddy that doesn't mess with our planet's vibe by adding to that pesky carbon dioxide. And, bonus, it's not heating up the place like a sauna, so no global warming drama either. How sweet is that?
It can be turned into handy energy with the help of a couple of cool ways that fall into two main groups:

(i) Solar Photovoltaic (PV): This is basically when we take sun energy and change it into electricity with these neat little things called photovoltaic cells. They've been around since 1975, which is when someone had the bright idea to make solar cells that work pretty well. These cells are like sun sponges; they soak up light and turn it into power. We put a bunch of them together in what we call PV modules so we can use that energy for all sorts of stuff.
These PV modules are part of a bigger solar system, and while the cells themselves might seem like the main deal, it's the other bits and bobs that really make sure everything runs smoothly and safe. These other parts are known as the "balance of the system" and they're what keep the whole shebang reliable and efficient.
So, when sunlight hits these modules, it turns into direct current (DC), which is like the raw energy you get from a battery. But most of our gadgets and the power grid run on alternating current (AC), which is what we get from the wall sockets. So, we use this gizmo called an inverter to switch that DC into AC, and then tweak it to play nice with the grid or whatever we're trying to power.
So, in a nutshell, we've got solar panels catching the sun's rays, turning them into DC juice, and then an inverter that changes it into AC power that we can all use. Ain't that nifty?

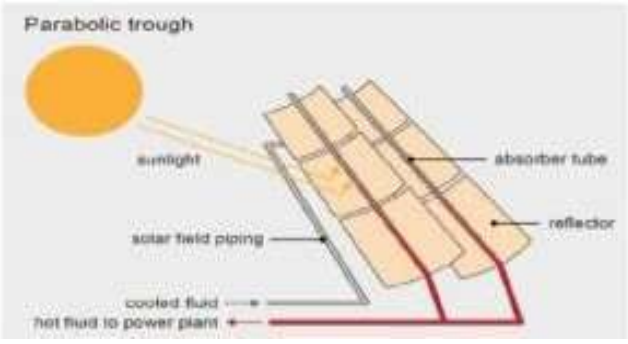


(ii). Solar Thermal: Basically, solar thermal is all about using the sun's heat energy. It starts with these solar "collectors" that soak up the sun's rays to give us solar space heating or hot water, which is pretty neat for our homes or small-scale needs. But, when we want to go big, like really big, we use these fancy parabolic mirrors to focus all that sunlight into a tiny spot, making it super hot. This intense heat can do a couple of cool things: it can be used straight up for some serious heating jobs or to create electricity.

Imagine a solar thermal power plant, right? It's like taking a magnifying glass to the sun's rays, but on a huge scale. We aim all that heat at a small area to make it super toasty. Then, we let water get all steamy from that heat and watch it zoom down to hit a turbine, which is connected to a generator. And just like that, the steam spins the turbine, the generator goes to work, and voilà, we've got electricity!
Some of these solar power plants are like the Swiss Army knives of energy, a bit of a hybrid deal. They can even store some of that heat to use later when the sun's taking a nap. Common ones you might see are:
Concentrated Solar Power (CSP): These are like the sun's very own power plants, with those big mirrors reflecting light to a central point to make steam and electricity.
Solar Water Heating: Think of it as a giant solar teapot for your home, warming up water without using a drop of gas or electricity.
Solar Space Heating: This keeps your place nice and cozy using the sun's warmth. No more freezing toes on cold winter mornings!
So, solar thermal is the sun's way of giving us a warm hug and some extra juice for our gadgets. It's a clever mix of sun and tech that's good for the planet and keeps our wallets happy.

(ii)a. Parabolic Trough Stuff

Okay, so imagine you've got this big ol' mirror that's shaped like a Pringles chip, right? That's a parabolic trough system!
It's like a sunlight-catching funnel that's all about getting sunrays to hit a tube filled with something like oil or water.
This tube gets super hot, and the heat makes the liquid inside turn into steam. And what do we do with steam? We make it work like a charm, pushing it through some heat exchangers to spin these turbines that are attached to generators. And boom, we've got ourselves some electricity! This tech is like the cool uncle of solar power plants - been around a while, knows all the tricks. It's usually set up in a line pointing north- south, and it turns with the sun like it's doing the wave at a stadium. They come in sizes that can power a bunch of houses, like 44,000 of 'em, and it's pretty much the king of solar thermal electric tech.



(ii) b. Solar Tower Things

Now, solar towers are like the fancier cousin of the parabolic trough. They've got three main bits: heliostats, a tower, and a receiver that's like the VIP section at the top. These heliostats are like sunflowers on steroids, reflecting sunlight to the central receiver. They can swivel in any direction, like they're playing Twister with the sun, to keep that solar love coming. And thanks to some nifty computer programming, they always know where the sun is. The first big one of these bad boys was built by Abengoa Solar, a Spanish company, and they

named it PS10. It's been chilling and powering up in Seville since 2007. It's all part of the Solucar Platform, which is like a giant solar theme park. These towers are like the new kid on the block in the solar thermal electric world, but they're definitely here to stay and strut their stuff.

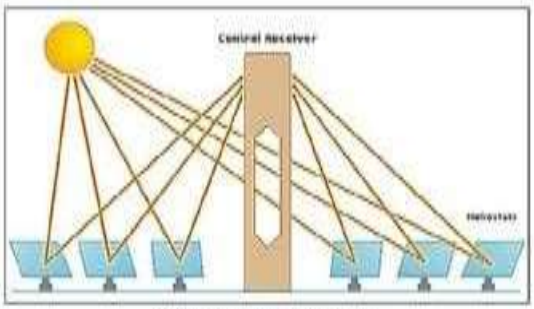


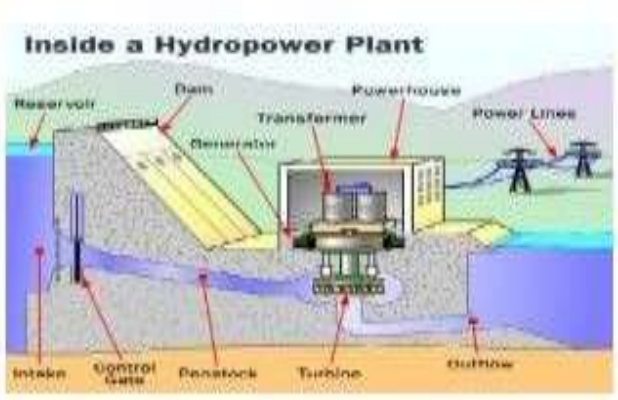
Fig.6: Solar Tower System

2. HYDRO POWER

So, hydro energy is like the cool kid on the block because it keeps coming back, thanks to the sun's power over the earth's water cycle. This is all about getting energy from the water's cycle of falling and moving fast, which we can use to make electricity. And get this, hydroelectric power is already a big deal, giving us about 19% of the world's electricity, which is like saying it's not just a side dish, it's part of the main meal deal [5].

Now, let's break it down into sizes:

- Large-scale projects are like the heavyweights, pumping out hundreds of mega watts with the help of those giant dams we see in pictures. These bad boys are the main source of hydroelectric power today.
- Then there's the small-scale stuff, which is like the little siblings. They have smaller dams and don't mess with nature as much, so they're kind of the underdogs with less power but a lot of heart.
- And finally, micro scale schemes are the baby versions, churning out power in kilowatts. These little guys are perfect for small towns and even your own crib, keeping the lights on without the need for those big, show-off dams.



3. GEOTHERMAL POWER

So, geothermal is like, energy from the Earth, right? It's all about that heat that comes from deep down, from stuff breaking down and going all radioactive, like uranium and potassium. It's a totally green

deal, never runs out, and it's super cool for our planet. The first time we figured out how to use this hot stuff for electricity was in a place called Larderello. Now, magma is basically molten rock, and it's super hot because of those radioactive elements doing their thing under the Earth's surface.
Apparently, scientists at this place called NREL, the US National Renewable Energy Laboratory, discovered that there's a type of rock that's hot and dry and can give us a whopping 4 million MW of power. That's more juice than the whole US needs right now for all its lights, gadgets, and Netflix binges! Crazy, huh? And when we're talking about how much we can get from it and how reliable it is, geothermal is like the unsung hero. It's like the steady friend you can always count on, no matter if it's sunny or windy outside.

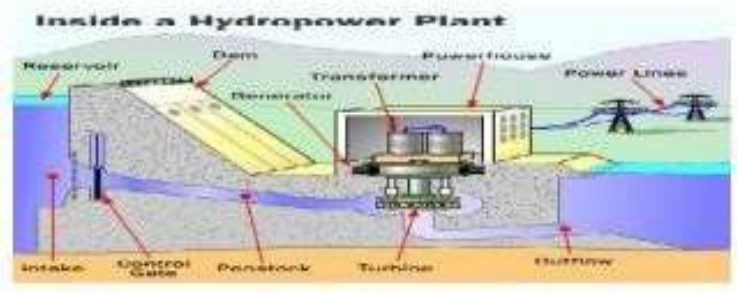


Fig.8: Hydropower Plant Parts

4. GEOTHERMAL ENERGY

So, "geo" is like shorthand for "earth" and "thermal" is all about "heat," right? So geothermal is basically energy that comes from our planet's own heat, which is pretty cool.
It's like a never-ending hot tub, but instead of bubbles, we get electricity! It's totally renewable and eco-friendly, which is a win-win for everyone.
The first time humans tapped into this hot stuff was in a place called Larderello. Now, the earth's crust is like a big ol' cookie with a hot, gooey center made of magma, which is basically earth's version of lava. This magma is a result of some serious radioactive decay action happening with materials like uranium and potassium way down below.
But get this - the US National Renewable Energy Lab (NREL for short) says there's a whole bunch of heat in rocks that aren't even all that hot. These hot dry rocks could give us enough juice for about 4 million MW of power plants. That's more electricity than the whole US uses right now, can you believe it?
When it comes to size and keeping the lights on without breaking a sweat, geothermal's got it in the bag. It's like comparing a steady flame on a gas stove to a bonfire that keeps going and going. So, whether we're talking about a big geothermal plant or a little one, it's all about harnessing that earthy heat for some seriously sustainable energy.

(i). Geothermal Stuff:

So, geothermal resources come in four main flavors: hydrothermal, geopressured, hot dry rock, and magma. But, only the hydrothermal kind is what we're using for real stuff right now. The other ones are still in the cool science lab, not quite ready for prime time yet. Now, these hydrothermal resources are like a little hot water party happening underground. You've got your magma chilling there as the heat source, a rocky pool called an aquifer that holds the water, and then there's this cap rock that's like

the lid on a pressure cooker. To get at the energy, we drill into the aquifer and pull out the hot water and steam.

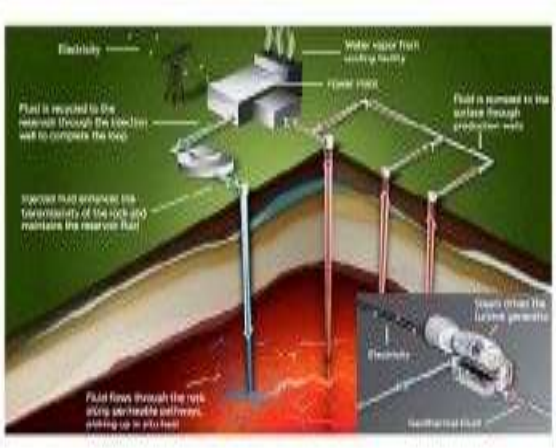
(ii). How We Play with Geothermal Energy:

This geothermal goodness can do all sorts of things for us, like make electricity or just keep our homes toasty and our showers steaming hot. We also use it to keep plants happy in greenhouses, fishies warm in their farms, and help with industrial stuff.

When it comes to geothermal tech, we've got two main setups: the ones that produce stuff and the ones that handle the leftovers. First, we shoot hot water and steam up to the surface through some deep holes. Then, the mechanical system swoops in with its pipes, heat exchangers, pumps, and controls to get that energy to where we need it. Once we're done using the heat, we've got the disposal system that's like the janitor, cleaning up and storing the cooled-off fluid in ponds or back down in the earth through injection wells.

(ii) a. Dry Steam Tech:

Now, if you're in an area with dry steam, it's like hitting the geothermal jackpot! These power plants are tailor- made for those spots because they just use the steam directly. It's all about that heat transfer and pressure drop to spin the turbines and make electricity without too much fuss. These systems are the cool kids of the geothermal block, working Commercially available options range from 35 to 120 MW.



Now, let's chat about Flash Steam Technology. This is what happens when you've got a liquid hydrothermal resource. You take that fluid and shoot it into a flash tank, which is like a cooler, less pressure-y hangout spot for fluids. The sudden change makes the fluid go all gaseous into steam. Then, voilà! You send that steam to a turbine that's hooked up to a generator, and bam, you're making electricity.

Most of the time, not all the fluid gets flashed into steam, so it gets put back into the ground or used for some other heat-loving job. But if it's hot enough, it goes to a second tank for another round of flashing into steam for more electricity. It's like giving it a second chance to shine!

Moving on to Binary Cycle Power Plants. These are the cool kids on the block for when your geothermal resources aren't hot enough for a steamy rendezvous or have too many chemical party crashers. What you do is, you run the fluid through a heat exchanger, and then there's this secondary fluid that's got a lower boiling point, like isobutane or pentane. They get all steamy and head to the turbine to churn out electricity. After the party, the fluid gets put back in the ground.

So, what's the deal with Wind Energy? It's like the free spirit of energy sources, just floating in the breeze. You harness it with wind turbines, which are basically giant fans that turn with the wind to

make electricity. And guess what? It's clean, no pollution or nasty greenhouse gases. The windy world's power capacity is growing faster than a teenager, hitting 369.553 MW by the end of 2014 and covering about 4% of our electricity needs. These turbines come in all sizes, from the little guys powering traffic lights to the big shots that keep our homes lit up. And the cool part? They work in low wind too.

And then there's Vibration Energy, the unsung hero of the energy world. Imagine, we can use the jitters from a big crowd, a busy street, or even a swaying building to make power. Or the hum from your washing machine when it's out of balance. That's right, we can capture all that shaking and turn it into electricity for our gadgets. We've got two main types of vibration to jam with: free vibration, like a tuning fork doing its thing, and forced vibration, like your phone buzzing on the table.

For the techy part, we use transducers. Think of them as energy translators. They turn the mechanical jiggles into electricity. We've got piezoelectric materials, which are like the cool crystals that light up when you squeeze 'em, and electromagnetic transducers, which are like the springs in your car that turn the bumps on the road into a smoother ride and also happen to make some electricity.

So, that's the lowdown on geothermal and wind energy, and a little taste of the wild world of vibrations turning into power. Ain't science grand?

4. ADVANTAGES OF USING GREEN ENERGY STUFF

1. SOLAR POWER, THE SUN'S GIFT

- It's like the coolest thing ever, totally clean and doesn't mess with the air or our health. It's like Mother Nature's free battery.
- You know those little gadgets you use that don't eat much energy? Yeah, solar can keep 'em going without breaking a sweat.

2. HYDRO POWER, THE FORCE OF THE WATERS

- This one's pretty neat too. It's clean energy without any dirty leftovers. It's like the ultimate energy- producing waterfall.
- It's like having a homegrown energy party, where each state can make their own juice without asking the neighbors for fuel.
- Plus, it's reliable, doesn't cost a fortune, and there's enough to go around so everyone can keep their lights on and fridges humming.

So, green energy is basically the VIP of the future, keeping our planet fresh and our wallets happy. Let's keep it real and roll with the sun and water vibes!

1. HYDROPOWER

Apart from being a green energy source, hydropower has a bunch of other cool perks. For one, it helps manage floods and keeps crops happy through irrigation. Plus, the reservoirs created by hydropower plants are like giant water banks that store rainwater, which can be tapped into for drinking or watering fields.

2. SOLAR PANELS

Solar panels are like nature's little powerhouses. They soak up the sun's rays and turn them into electricity. This means no messy pollution or greenhouse gases. And the best part? They're quiet as a mouse, so you won't hear them working away on your rooftop.

3. WIND ENERGY

Wind power is another clean kid on the block. These giant spinning fans, known as wind turbines, catch the breeze and turn it into electricity without dirtying the air. They don't cause acid rain or add to the greenhouse gases that are warming up our planet. And guess what? The land around them is still

a perfect spot for farming or any other use. They're like the friendly neighbors of the energy world, helping out without taking up too much space.

4. GEOTHERMAL ENERGY

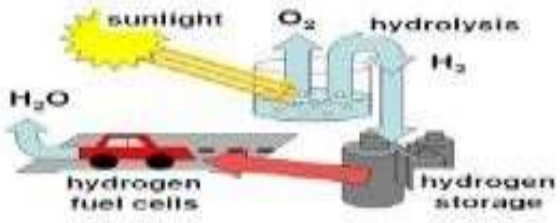
Now, geothermal energy is like using the Earth's own heat to keep your home cozy and your water hot. It's cheap, reliable, and doesn't mess with the environment. It's like having a bottomless wallet for your energy needs that won't run out and won't leave a mess for future generations to clean up. Plus, it's a great way to keep our planet from getting too hot under the collar. It's a win-win!

So, there you have it, folks. These four renewable energy sources are like superheroes, each with their own unique powers to combat climate change and make our lives better. They're the unsung heroes of our modern world, working tirelessly behind the scenes to keep the lights on and the Earth healthy.

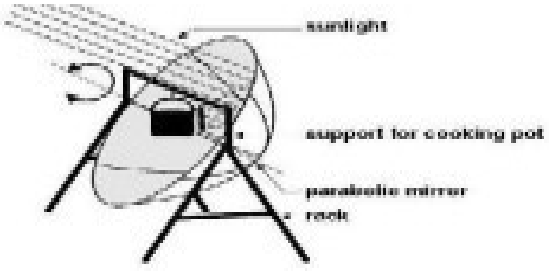
5. APPLICATIONS OF GREEN ENERGY

1. Use in calculators, road signs, satellites, etc. as solar energy.
2. Passive space heating by solar energy.
3. Warm up and keeping the food fresh by solar energy

4. for hydrogen fuel production.



5. Parabolic concentrating solar cookers.



and Narrow Blockchain's like that buddy that keeps all your secrets safe. It'll help digital twins manage data in a way that's secure and transparent, which is great for stuff like public transport deals and making sure your trash gets picked up without any funny business.

4. Mind-Blowing 3D Visuals with AR & VR Ever wanted to see what a new building might look like before it's built? AR and VR are going to be buddies with digital twins, letting planners and regular

Joe's like us see the city in a whole new way. It's like having a virtual sandbox for playing out city projects!

5. Streamlining urban planning with quantum computing

Quantum computers are the heavy lifters of the digital world, and they're going to help digital twins deal with a ton of data. This allows us to design cities with the tiniest of details, like positioning each tree so that it provides the most shade.

6. Digital Twins as a Service for the Little Guys Cities don't have to go big or go home with their digital twins anymore. They can just subscribe to them like they do Netflix! Tech companies will offer these handy digital city models so smaller places can get in on the action without breaking the bank.

7.Digital Twins That Are Green Digital twins are gaining popularity as a means of going green in the future. They're

going to help cities save energy, use water wisely, and grow in a way that doesn't mess with the planet. It's like having a

personal environmental advisor for the city.

8.Digital Twins Getting to Know Their Citizens Cities are starting to put people first, using digital twins to understand what we all want and need. By mixing in some human behavior analysis, they can make sure the city's working for us, not the other way around.

9.Digital Twin Cities Collaborating on the Map Cities are going to start sharing their digital twin intel, which is like

having a super-smart neighborhood watch. This'll help with big events, like disaster management, and keep things running smoothly across borders.

10.Processing lightning-fast data with edge computing Edge computing will increase the speed of digital twins. It's like

having a mini data center on every street corner, helping to make everything from traffic lights to emergency services quicker on their feet.

5. CONCLUSION

The planning, running, and making cities better with digital twin tech is pretty cool. It's like, imagine having a real-time copy of the whole city right at your fingertips? Crazy, right? This tech is like a cheat code for urban planners, so they can peek at how stuff's going on and make waaay better choices. It's a game-changer for sure because it lets cities run smoother, be kinder to the planet, and make decisions based on what's actually happening. They help cities manage their toys, I mean, resources, better, keep the lights on, and stop traffic jams before you even get out of bed. As we get more futuristic with 5G and blockchain, these digital twins are gonna be even more important for our smart cities. They're gonna help us build cities that are cleaner, work better, and are all about the people living in them. As we keep developing tech, these digital twins will be the big cheese in shaping our cities into places that can handle whatever the future throws at them, and still keep us all happy. So, if cities start using this digital twin thing more, they'll be ready for anything and keep getting better for everyone who lives there.

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