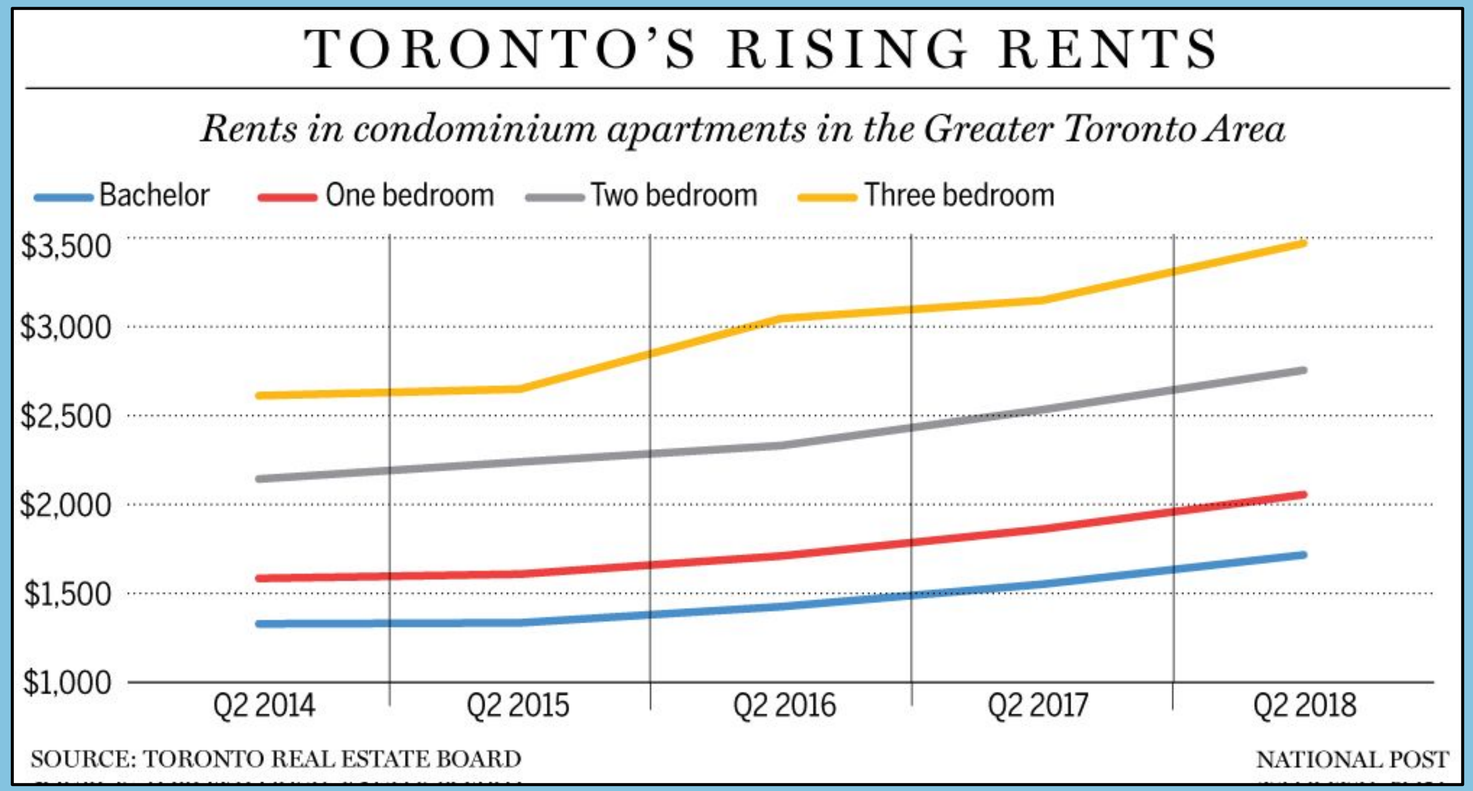
# Reducing Energy Costs with IoT and Passive Architecture

TKS + SIDEWALK LABS

# Housing prices are expensive **and climbing.**




The **average cost**

per annum to rent a **1 bedroom apartment** is **$25,904**

People **spend**

38% of their disposable income on rent

Costs **increase** by

**4%** every year. This means it would take only **18 years** for prices to double

**Too** much of our income is being spent on **housing** and this will only increase as time goes on . Therefore, the best way to cut housing prices is to reduce the costs of housing expenses

# What we’re **getting wrong.**



## Utilities are **not** well run today.

**THIS IS THE STATUS QUO.**

**HERE ARE FOUR AREAS WHERE IT COULD BE SO MUCH BETTER.**

### Waste
**30%** of electricity costs

Inefficiently run homes waste **30%** of their electricity budget as opposed to ideally run homes. This is compounded by the **3 - 4 year** lifetime of modern appliances, much shorter than in the past.

### Cost
**10%** of home expenses

Utilities can compose **10%** of families’ home expenses in Toronto. On top of this, shorter appliance lifetimes punish inefficient users - with a full set of appliances in Toronto costing $1500.

### Inefficient AC/Heating
**50%** of power

Heating and cooling homes contribute to **50%** of power costs in Toronto. This is exacerbated by detrimental effects of AC in cities; since they deposit hot air into streets, often near other AC units, they lose substantial efficiency.

### Human Error
**35%** of energy waste

Humans are **not perfect**. People leave taps, lights, and heating/cooling on when it’s not needed, over-wash and over-dry clothes and dishes, and homes are plagued by ‘vampire appliances’ which consume energy even when they’re off.

Adoption of smart thermostats and efficient lights helps with these issues, but there is so much more to be done.


# Energy Cost Analysis

## AC/Heaters Use Half of Your Energy

About half of energy usage in households are used up solely by your AC units and heater.

## Costs of Energy

Energy bills can constitute up to 10% of household expenses, and your AC and heating can constitute up to 50% of your bill.

## What we can do

To help eliminate these costs, we can use technologies like passive architecture, as well as networked IoT to minimize the work required to optimize energy conservation.

Energy might not be distributed the way you think.

# Recommendation: Passive Architecture Introduction

The architecture of a building is key to energy conservation. **Passive architecture** is a process of design that integrates with the regular architectural design of a building and **blends** it with technologies and the inherent properties of building materials.

Passive architecture ensures that the building is warm in the winter, and cold in the summer, creating a **comfortable** environment year-round, while using an **ultra-low** amount of energy and keeping the buildings **ecological footprint** small.

# Recommendation: Passive Architecture Analysis

- Since Toronto is north of the equator, the Sun’s rays will primarily hit the south side of buildings, followed by less intensive sunlight on the west and east sides. This means the north side is significantly colder than the other sides, especially in the winter.

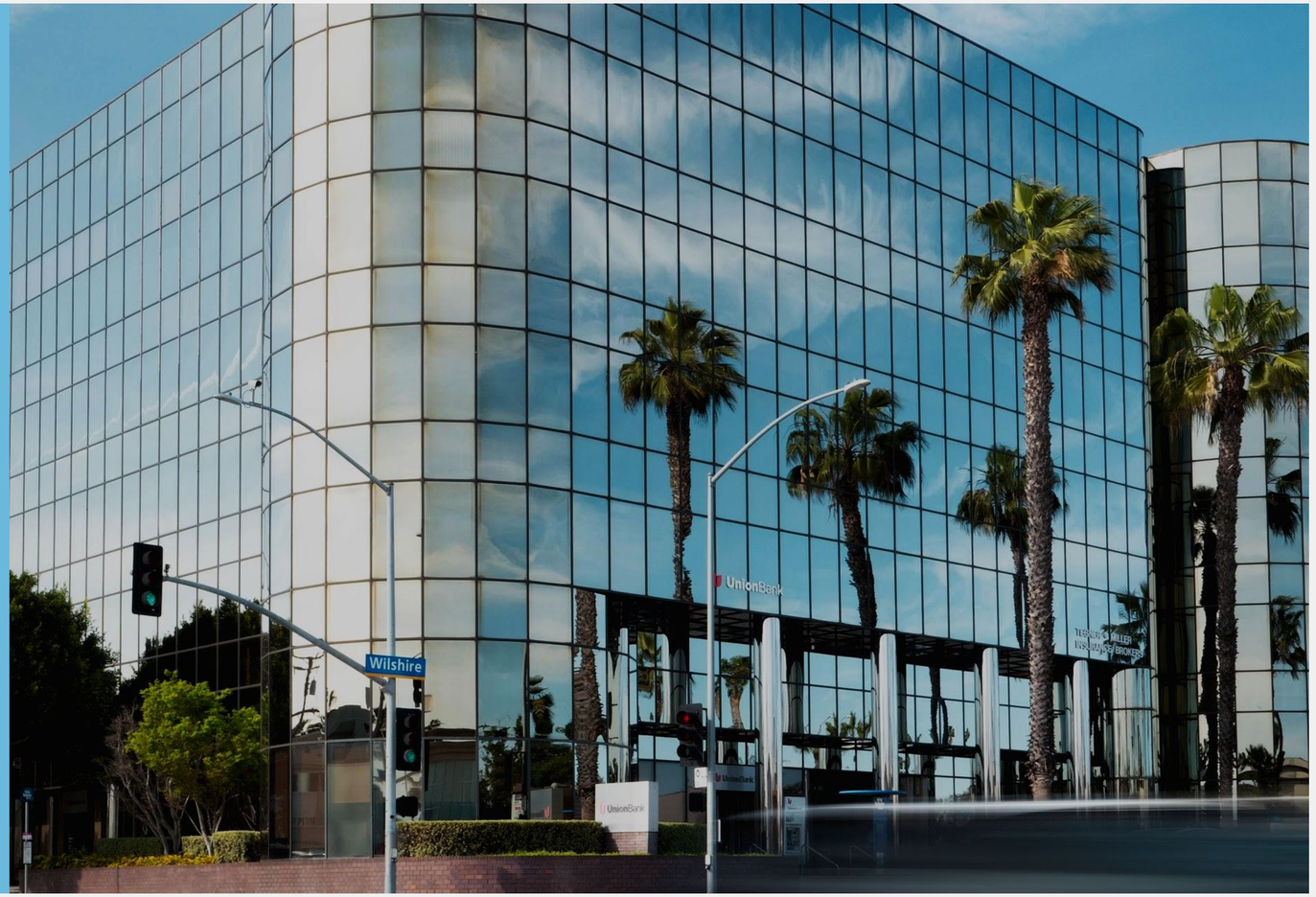
- The Earth’s subterranean temperature about 20-30 ft below the ground remains stable. At these depths the Earth is generally around 15 to 23 degrees Celsius and gets warmer and more stable with depth.

# Recommendation: Passive Architecture Heat Efficiency

Based on our **analysis**, we can design a building with strategically placed windows/solar panels, a green roof, and heat exchangers.

We can design this building in a way where the **windows** of the building are **strategically placed** on the south and west/east sides where the most sunlight is, to help maximize **energy and heat** efficiency with heat gain from the sun during winter.

We can also insulate the **north side** of the building to make sure heat doesn't escape through that side. The same windows can have **shades** that can be closed to keep **sun out** during the summer, and the insulation on the north side keeps the **warm air out**.



# Recommendation: Passive Architecture Windows

The windows on the building, **especially** on the northern side can be **triple glazed** to provide better insulation. Glazing a window is taking two panes of glass, and inserting **inert, insulating gas** in between them, which stops heat getting in and out. Triple glazed windows are the same thing but with three panes.

You can also use **solar windows** to generate electricity without cluttering the walls with regular solar panels This kind of glass is aesthetically the same as regular glass, but can collect solar energy like a regular panel. Currently these are not as efficient as regular solar panels, but they can become viable in the future.

Triple Glazed Insulation: 97% of energy
Installation: ~500$

# Recommendation: Passive Architecture Green Roofs

Our buildings can have **green roofs** which have a layer of soil and plants growing in them. In the summertime, the plants, along with the soil provide cover and **insulation against direct sunlight** which helps keep the building cool, and in winter, the soil and plants again act as an **extra layer of insulation to keep heat in** and cold air out.

Installation: 10-25$ per square foot
Heating and Cooling Savings: Up to 75%

# Recommendation: Passive Architecture Heat Exchanger

Heat exchangers can drastically improve the efficiency of energy usage.

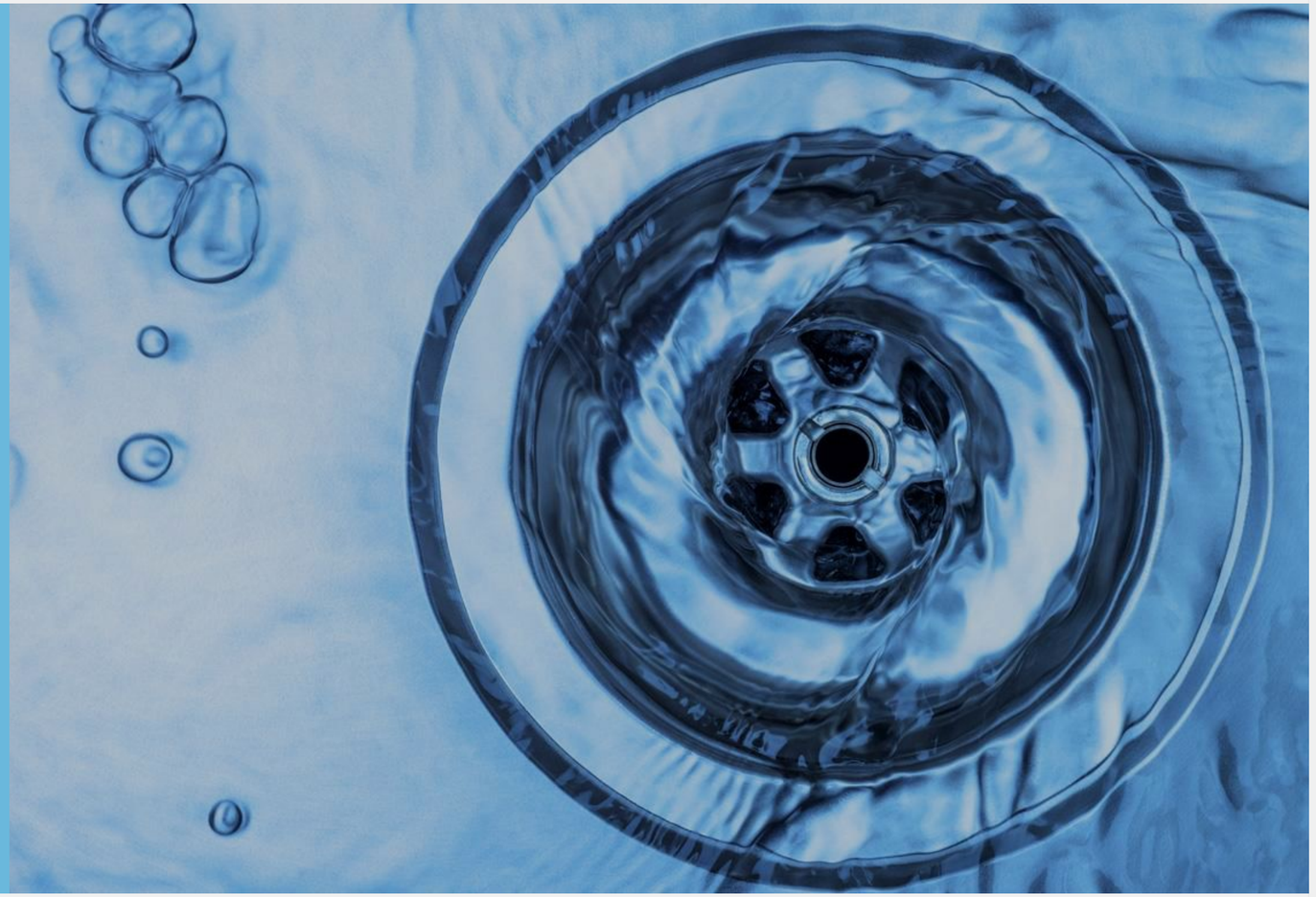
A **ground-coupled heat exchanger**, commonly known as earth pipes enable the transfer of **geothermal** energy to ventilation fluids. They are standard concrete/plastic **tubes** that run underground and moderate the temperature of incoming fluids before they enter the building. The temperature is **constant** deep underground, and acts as a heat source for the building in winter, and a heat sink in summer. As we are using Earth's natural geothermal energy, we leave a **low environmental footprint** and use virtually **no energy.**

AC Energy Usage: 50%; Earth Tubes: ~0%
AC Unit Install: 12,000$; Earth Tubes: 8000$

# Recommendation: Passive Architecture Heat Exchanger (continued)

Hot water coming in from taps like your sink, shower, laundry, etc. can have their heat exchanged too as they hold a lot of **thermal energy**. As wastewater goes down the drain, we can **collect heat** from the water with a heat sink and reuse it.

Entrance and exits to the buildings should be **a two-door airlock type** system and/or revolving doors as we can keep the temperature in common areas **constant**.



Installation: 300$
Home Energy Savings: 10%; Water Heating Savings: 40%

# Company Spotlight


Schneider Electric **specializes** in creating smart homes via IOT

# Recommendation: Schneider Electric

## Wiser Energy Monitoring System

This “Smart” system will enable to cut utility costs via more efficient consumption of utilities

## Accuracy

It beats all other smart systems since it effectively gathers data

## Usability

Users will be able to constanty see what utilities are  being efficiently used and vice versa

## Cost Efficacy

Electricity Costs are cut by approximately 40 percent

# Wiser Energy Home Monitoring System

**Transforms appliances**

into smart appliances through its smart networking and electrical panel. The system enables users to get consistent data on how their appliances are functioning

**Wiser Energy Home Monitoring System**


**Intelligent identification**

through collecting data from the respective appliances, passed through its state-of the-art device detection algorithms to classify appliances based on this data. This process takes 1-2 weeks but each appliance varies based on how frequently it is used.

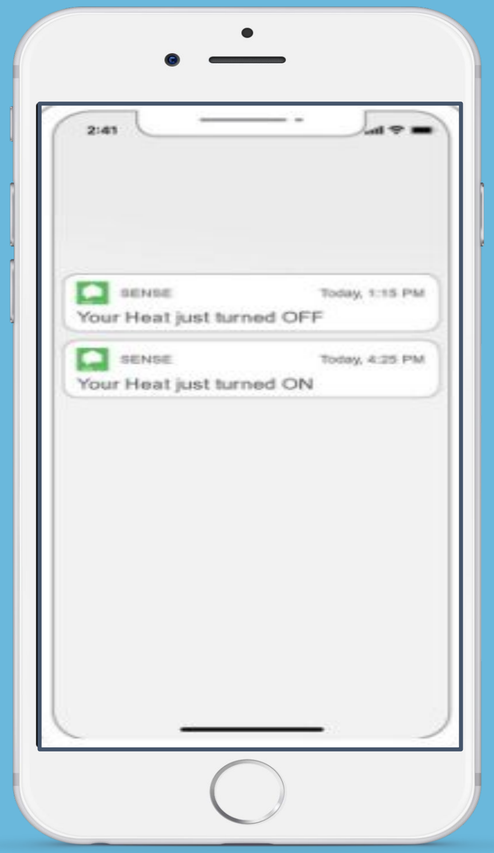
**Gathers voltage readings**

at least 1 million times per second, unlike other meters. Other smart meters gather  smaller number of readings per a couple of seconds.

**Reduces excess use**

Of specific appliances, thereby reducing excess utility usage, thereby contributing about a 4% savings in power.

# The Wiser App enables **usability and functionality** for users in and out of home




## Total Control

on every system at your home and its settings, level of activity, and energy usage to any levels of detail.

## Full Time Access

to appliances whether at home or outside, and regardless of whether those appliances are currently doing anything.

## Constant Updates

alerting the user of any changes in energy usage or configuration - or simply telling them when things go on and off.

The Wiser App can **estimate costs** and help users **hit energy goals.**


## Measurable

metrics, the ability to set consumption goals manually or automatically based on those metrics.

## Constant Feedback

on automatically measured metrics is reported to the user, along with suspected trends in energy usage and their relation to their energy goals.

## Insightful

Based on consumption patterns, the app can predict upcoming energy bills compared to previous bills and explain why.


These features collectively promote efficient consumption of utilities.

## Wiser Energy Monitoring System | Key metrics

### Costs

$499 per installation

### Installation

Takes **30 minutes** to install.

### Quantity Needed

Only **one** unit is needed for a **3** bedroom apartment.

### Durability

Lasts for a minimum of **4 years**

### Efficacy

Decreases electricity consumption up to **45%**


Demonstration of how to install the device and allow it to monitor energy usage

# Next Steps

Develop IOT models and passive cooling architecture that optimise the usage of power/ water to help reduce the overall consumption. To do this we need to gather temporal data on what appliances are being used when, for how long and notice trends etc.

01

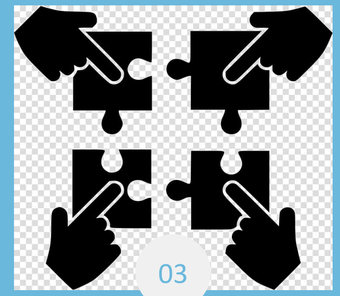
## Schneider Electric

Contacting Schneider Electric and understanding their different general projects will help you figure out which of your needs they can help you meet

02

## Identify Needs

After identifying your needs and how they can help you can tweak their existing models to specifically meet the criteria of your apartments



03

## Collaborate on Smart City

After deciding what specific model should be used Sidewalk labs and Schneider Electric should discuss plans that explain how the companies would collaborate on this project

# On a more personal note...

Dear Sidewalk Labs Team, we would like to thank you for giving us this amazing opportunity!

We learned so much about the problems with affordable housing today and we are truly grateful that you gave us a chance to contribute our solutions to this crisis. We hope we are able to make an impact on the smart city and that our ideas will help influence Quayside.

Feel free to reach out to us at TKS or on LinkedIn if you have any questions about our solution.

We hope to visit your city soon!


Ronit **Taleti** 

Evan **Chan** 

Safwan **Khan** 

Sammy **Nimour**