

# Alternative Fuels

Case study  
Batch 1

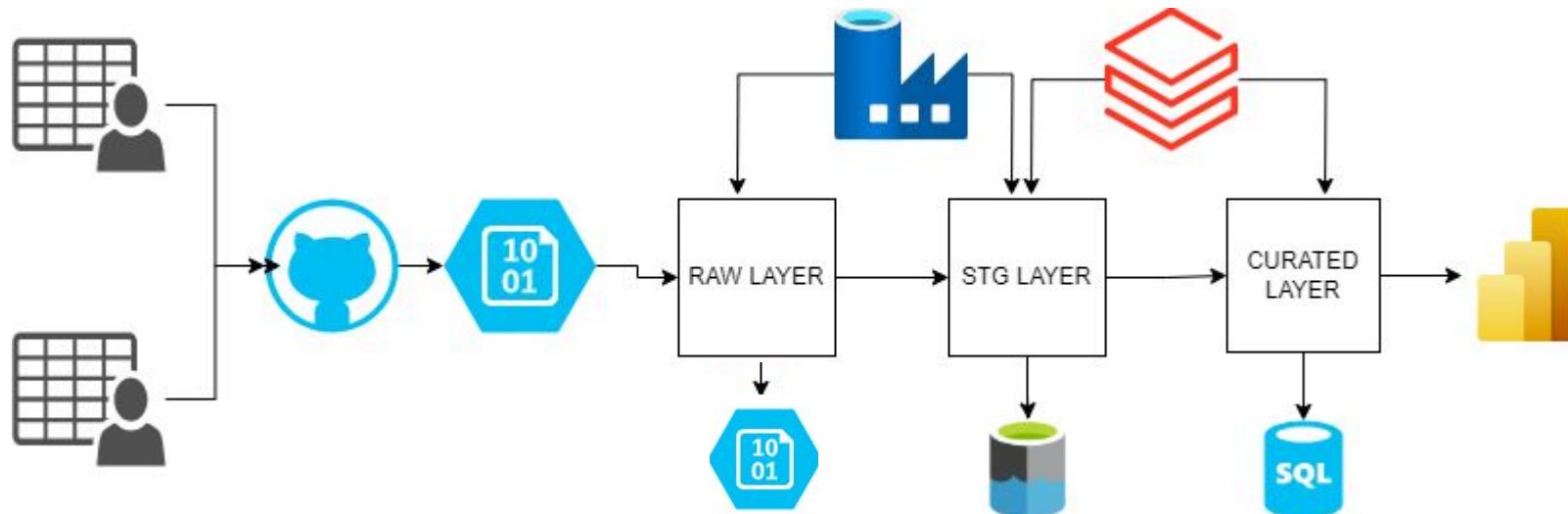
Team Members:

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Aum Rajadnye	INARTQ
Deepthi Peter	INDPF8

# Problem Statement

- Objective - Develop a data engineering application using Azure cloud services and the Spark framework to analyze the usage of alternate fuels and the factors influencing customers' fuel choices.
- The dataset used for this project is published by the US and Canada Transportation and consists of millions of observations and over 30 variables.
- The focus of the analysis is on low carbon fuels (LCF), such as sustainable aviation fuel (SAF), biodiesel, bioethanol, and renewable compressed natural gas (R-CNG), which aim to reduce carbon emissions from transportation.

# Architecture



# Raw Layer

Microsoft Azure Search resources, services, and docs (G+) Shellunext\_1693422718... UNEXT (NPUNEXT.ONMICROSOFT.COM)

Home > skribblecasestudy | Containers >

**parent** Container

Search Upload Add Directory Refresh Rename Delete Change tier Acquire lease Break lease Give feedback

**Authentication method:** Access key ([Switch to Azure AD User Account](#))  
**Location:** parent / raw

Search blobs by prefix (case-sensitive) Show deleted objects

Name	Modified	Access tier	Archive status	Blob type	Size
...					
alt_fuel_stations.csv	10/6/2023, 9:40:55 AM	Hot (Inferred)		Block blob	24.64 MB
light_duty_vehicles.csv	10/6/2023, 9:40:06 AM	Hot (Inferred)		Block blob	565.18

# Staging Layer

The screenshot shows the Microsoft Azure Storage Explorer interface. At the top, there's a navigation bar with the Microsoft Azure logo, a search bar, and various icons for account management and notifications. The main title is "parent" under the "Containers" section. On the left, a sidebar lists navigation options like "Overview", "Diagnose and solve problems", "Access Control (IAM)", and "Settings" (which includes "Shared access tokens", "Manage ACL", "Access policy", "Properties", and "Metadata"). The "Overview" tab is selected. In the center, there's a table displaying blobs in the container:

Name	Modified	Access tier	Archive status	Blob type	Size
[...]					
altfuelstations	10/6/2023, 10:08:41 AM	Hot (Inferred)		Block blob	4.14 Mi
lightdutyvehicle	10/6/2023, 10:08:38 AM	Hot (Inferred)		Block blob	97.08 K

# Curated Layer

The screenshot shows the Microsoft Azure Storage account overview page for the container 'parent' under the storage account 'skribblecasestudy'. The left sidebar includes links for Overview, Diagnose and solve problems, Access Control (IAM), Settings (Shared access tokens, Manage ACL, Access policy, Properties, Metadata), and a search bar. The main content area displays the authentication method as 'Access key' and the location as 'parent / curated'. It features a search bar for blobs by prefix and a toggle for 'Show deleted objects'. A table lists blob details such as Name, Modified, Access tier, Archive status, Blob type, and Size. The table contains the following data:

Name	Modified	Access tier	Archive status	Blob type	Size
[..]					
_delta_log	10/6/2023, 10:25:22 AM	Hot (Inferred)		Block blob	1.04 Mi
part-00001-a6a15c47-b4c7-476a-9df4-5bdcb240119b-c0...	10/6/2023, 10:25:22 AM	Hot (Inferred)		Block blob	979.17
part-00002-05fd2ec1-7e23-4552-9456-bd20b6d473f0-c0...	10/6/2023, 10:25:23 AM	Hot (Inferred)		Block blob	1.03 Mi
part-00003-9fe17f38-cc1e-40d6-a311-a219624a9fc6-c00...	10/6/2023, 10:25:22 AM	Hot (Inferred)		Block blob	504.33

# Dashboards

Skribble - Power BI Desktop

File Home Insert Modeling View Help

Paste Cut Copy Format painter

Get data from workbook hub Data SQL Server Enter data Recent sources Transform data Queri

Collapse or expand the filter pane while editing. This also determines how report readers see it

Count of category by fuel

The chart shows a sharp decline in the count of categories as fuel type moves from 'Vapor/Check' down to 'Methanol'. The y-axis ranges from 0 to 1,000.

Category	Acura	Audi	Bentley Motors	BMW	Buck	BYD Motors	Cadillac	Chevrolet	Chrysler
Sedan/Wagon	28	533	144	3119	214	219	256	2838	45
SUV				1443		383		391	965
Van						13		216	5
Pickup								10	50
Passenger Van/Shuttle Bus									22
Vocational/Cab Chassis									
Total	28	1976	144	3502	227	219	657	5301	105

Sum of alternative\_fuel\_economy\_highway by fuel

The pie chart illustrates the distribution of fuel types based on their alternative fuel economy on the highway. Diesel fuel (B20) is the most abundant at 58.69%, followed by Propane at 15%.

Fuel	Percentage
Electric	2%
Ethanol	6%
Hybrid Electric	1%
CNG - Compressed Natural Gas	1%
Hydrogen Fuel Cell	1%
Plug-in Hybrid Electric Vehicle	1%
Propane	15%
Methanol	1%
Diesel fuel (B20)	58.69%

Sum of conventional\_fuel\_economy\_city by manufacturer

This donut chart displays the share of conventional fuel economy in the city across different manufacturers. Toyota accounts for 12.3% of the total, followed by Ford at 11.2%.

Manufacturer	Percentage
Ford	10.48%
Toyota	12.3%
Chevrolet	11.2%
GMC	1%
Mercedes-Benz	1%
Lexus	1%

Visualizations Fields Filters

Build visual

Search

Alternative\_Fuel\_Statistics

- access\_code
- city
- Count of access\_code
- country

country\_Hierarchy

- Date\_Hierarchy
- Year
- Quarter
- Month
- Day

Date\_Hierarchy

- ev\_connector\_type
- ev\_network
- ev\_network\_web
- ev\_other\_info
- fuel\_type\_code

Values

Add data fields here

Drill through

Cross-report

Keep all filters

Add drill-through fields here

Update available (click to download)

# Dashboards

Skribble - Power BI Desktop

File Home Insert Modeling View Help

Cut Copy Format painter Paste Get data from workbook hub Data Server Enter Dataverse Recent sources Transform Refresh data New visual Text box Insert More visuals New measure Quick measure Calculations Sensitivity Publish Share

First state by city and fuel\_type\_code

fuel\_type\_code: BD, CNG, EBS, ELEC, HY, LNG, LPG, RD

Count of access\_code and Count of access\_code average per fuel\_type\_code

● Count of access\_code ● Count of access\_code average per fuel\_type\_code

Count of access\_code and Count of access\_code average per fuel\_type\_code by fuel\_type\_code

ELC, DSS, LPG, BD, CNG, RD, LNG, HY

Count of ev\_network and Count of state by Year

● Count of ev\_network ● Count of state

state and ev\_network

ev\_network: 7CHARGE, AMPUP, Blink Network, CHARGELAB, ChargePoint,...

LightDutyDashboard1 AlternateFuelDashboard2

Visualizations Fields

Build visual

Filters

Search

Alternative\_Fuel\_Stat...

- access\_code
- city
- Count of access...
- country

> country Hierarc...

> date\_last\_confir...

> Date Hierarc...

- Year
- Quarter
- Month
- Day

ev\_connector\_t...

ev\_network

ev\_network\_web

ev\_other\_info

fuel\_type\_code

Add data fields here

Drill through

Cross-report

Keep all filters

Add drill-through fields here

Page 2 of 2

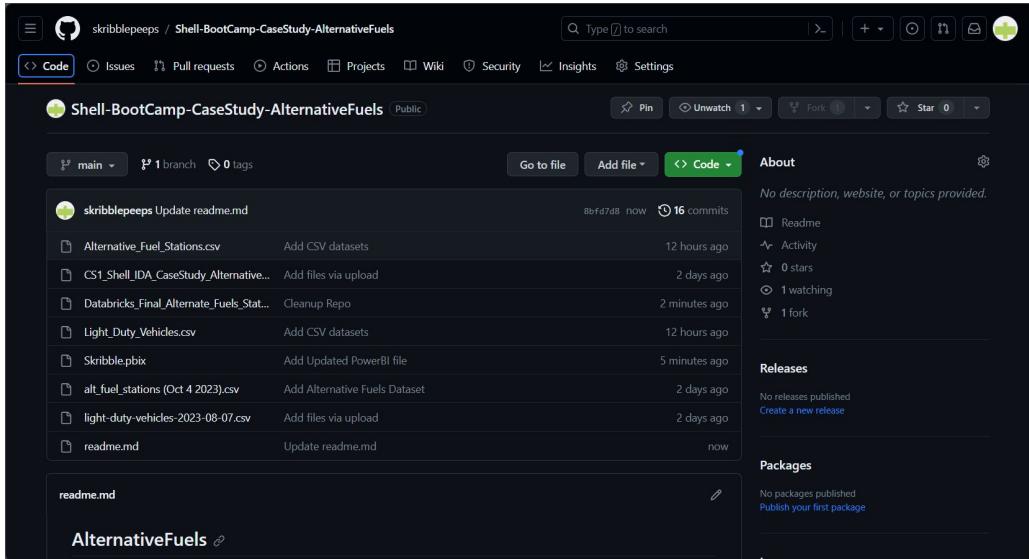
70% Update available (click to download)

10:35 AM 10/6/2023

Windows Taskbar icons: File Explorer, Internet Explorer, Google Chrome, File, Start.

# Github Link

[skibblepeeps/Shell-BootCamp-CaseStudy-AlternativeFuels \(github.com\)](https://github.com/skibblepeeps/Shell-BootCamp-CaseStudy-AlternativeFuels)



# System Demo

Your insights matter! Participate in our brief survey about our CDC top-level resource, and help us enhance your experience.

All pipeline runs > **copy\_data\_pipeline - Activity runs**

Rerun Cancel Refresh Update pipeline List Gantt

Copy data **Succeeded** Copy data1

Copy data **Succeeded** Copy data2

**Activity runs**

Pipeline run ID 75aa8481-a9d5-40fb-afe6-ce00f8ed13fd

All status Monitor in Azure Metrics Export to CSV

Showing 1 - 2 items

Activity name	Activity status	Activity type	Run start	Duration	Integration runtime	User properties
Copy data1	<b>Succeeded</b>	Copy data	10/6/2023, 10:28:18 AM	20s	AutoResolveIntegratio	
Copy data2	<b>Succeeded</b>	Copy data	10/6/2023, 10:28:18 AM	25s	AutoResolveIntegratio	

---

# Q&A



# Challenges & Key Learnings

- **Data Quality and Integrity** - Ensuring that the data is of good quality and accurate was a significant challenge. This included handling missing values, outliers, and anomalies, and removing corrupted data.
- **Tools and Technology Selection** - Choosing the right set of tools and technologies (Azure Storage, Data Factory and DataBricks) was challenging
- **Data Storage and Retrieval** - Deciding on appropriate storage solutions (e.g., databases, data lakes, warehouses) and retrieval mechanisms based on access patterns and performance requirements
- **Establishing the connection between various components** - Integrating the data, and establishing the connection between the various components (Blob storage, ADLS, Databricks and SQL database) was a complex task, as the data was in different formats and structures

# Data Storage and Management

Microsoft Azure Search resources, services, and docs (G+)

Home > Resource groups >

## Create a resource group

Basics Tags Review + create

Resource group - A container that holds related resources for an Azure solution. The resource group can include all the resources for the solution, or only those resources that you want to manage as a group. You decide how you want to allocate resources to resource groups based on what makes the most sense for your organization. [Learn more](#)

**Project details**

Subscription \* npunext-1680261221326

Resource group \* BootCamp-CaseStudy-Skribble

**Resource details**

Region \* (US) East US

[Review + create](#) [< Previous](#) [Next : Tags >](#)

Company name appears here <https://portal.azure.com/#>

# Data Storage and Management

The screenshot shows the Microsoft Azure portal interface for creating a new resource group. The top navigation bar includes the Microsoft Azure logo, a search bar, and various account and settings icons. The current page title is "Create a resource group". The validation status "Validation passed." is displayed in a green bar. The "Review + create" tab is selected, while "Basics" and "Tags" tabs are also present. The "Basics" section displays the following configuration:

Setting	Value
Subscription	npunext-1680261221326
Resource group	BootCamp-CaseStudy-Skribble
Region	East US

The "Tags" section shows "None" listed under the "Tags" heading.

At the bottom of the screen, there are buttons for "Create", "< Previous", "Next >", and "Download a template for automation". A watermark for "Company name appears here" is visible at the bottom left.

# Data Storage and Management

Microsoft Azure Search resources, services, and docs (G+) Shellunext\_1693422718... UNEXT (NPUNEXT.ONMICROSOF...

Home > Storage accounts > Create a storage account ...

Basics Advanced Networking Data protection Encryption Tags Review

**Project details**

Select the subscription in which to create the new storage account. Choose a new or existing resource group to organize and manage your storage account together with other resources.

Subscription \* npunext-1680261221326

Resource group \* BootCamp-CaseStudy-Skribble [Create new](#)

**Instance details**

Storage account name ⓘ \* skribblecasestudy

Region ⓘ \* (US) East US [Deploy to an edge zone](#)

Performance ⓘ \*  Standard: Recommended for most scenarios (general-purpose v2 account)  Premium: Recommended for scenarios that require low latency.

Redundancy ⓘ \* Locally-redundant storage (LRS)

[Review](#) < Previous Next : Advanced > [Give feedback](#)

# Data Storage and Management

Microsoft Azure Search resources, services, and docs (G+) Shellunext\_1693422718...  
UNEXT (NPUNEXT.ONMICROSOFT.COM)

Home > Storage accounts >

## Create a storage account

Basics **Advanced** Networking Data protection Encryption Tags Review

Require secure transfer for REST API operations

Allow enabling anonymous access on individual containers

Enable storage account key access

Default to Azure Active Directory authorization in the Azure portal

Minimum TLS version

Permitted scope for copy operations (preview)

**Hierarchical Namespace**

Hierarchical namespace, complemented by Data Lake Storage Gen2 endpoint, enables file and directory semantics, accelerates big data analytics workloads, and enables access control lists (ACLs) [Learn more](#)

Enable hierarchical namespace

Review < Previous Next : Networking > Give feedback

Company <https://portal.azure.com/#home>

# Data Storage and Management

Microsoft Azure Search resources, services, and docs (G+ /) Shellunext\_1693422718... UNEXT (NPUNEXT.ONMICROSOFT.COM)

Home > skribblecasestudy\_1696485399188 | Overview Deployment

Search Delete Cancel Redeploy Download Refresh

Overview Inputs Outputs Template

>Your deployment is complete

Deployment name: skribblecasestudy\_1696485399188  
Subscription: npunext-1680261221326  
Resource group: BootCamp-CaseStudy-Skribble

Start time: 10/5/2023, 11:26:48 AM Correlation ID: d6e9041c-183d-4f25-a457-59fafc2c5cdf

Deployment details Next steps Go to resource

Give feedback Tell us about your experience with deployment

**Cost Management**  
Get notified to stay within your budget and prevent unexpected charges on your bill.  
[Set up cost alerts >](#)

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**Work with an expert**  
Azure experts are service provider partners who can help manage your assets on Azure and be your first line of support.  
[Find an Azure expert >](#)

# Data Storage and Management

The screenshot shows the Microsoft Azure Storage Accounts interface. The top navigation bar includes the Microsoft Azure logo, a search bar, and various icons for account management. The current path is Home > Storage accounts > skribblecasestudy | Containers > parent.

The main area displays the 'parent' container details:

- Authentication method:** Access key (Switch to Azure AD User Account)
- Location:** parent
- Search blobs by prefix (case-sensitive):** Search bar with a placeholder and a 'Show deleted objects' toggle switch.

A table lists the blobs in the container:

Name	Modified	Access tier	Archive status	Blob type	Size
\$_azuretmpfolder\$					
curated					
raw					
staging					

The left sidebar contains navigation links and settings sections:

- Home
- Storage accounts
- Containers
- parent (Container)
- Overview
- Diagnose and solve problems
- Access Control (IAM)
- Settings**
  - Shared access tokens
  - Manage ACL
  - Access policy
  - Properties
  - Metadata

At the bottom left, there is a placeholder for 'Company name'.

Microsoft Azure Search resources, services, and docs (G+/) 1 ? Shellunext\_1693422718... UNEXT (NPUNEXT.ONMICROSOFT.COM)

Home > Resource groups > BootCamp-CaseStudy-Skribble > Marketplace >

## Create Data Factory

Basics Git configuration Networking Advanced Tags Review + create

One-click to create data factory with sample pipeline and datasets. [Try it](#)

### Project details

Select the subscription to manage deployed resources and costs. Use resource groups like folders to organize and manage all your resources.

Subscription \* npunext-1680261221326

Resource group \* BootCamp-CaseStudy-Skribble [Create new](#)

### Instance details

Name \* Skribble-CaseStudy-DataFactory

Region \* East US

Version \* V2

[Previous](#) [Next](#) [Review + create](#) [Give feedback](#)

Home &gt;



## Microsoft.DataFactory-20231005111333 | Overview



Search

Delete

Cancel

Redeploy

Download

Refresh

Overview

Inputs

Outputs

Template

## Your deployment is complete

Deployment name : Microsoft.DataFactory-20231005111333  
Subscription : npunext-1680261221326  
Resource group : BootCamp-CaseStudy-Skribble

Start time : 10/5/2023, 11:15:47 AM

Correlation ID : e8e700d6-2f53-457a-94fc-fd20e92c4a4e

&gt; Deployment details

▽ Next steps

[Go to resource](#)

Give feedback

[Tell us about your experience with deployment](#)

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[Set up cost alerts >](#)

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[Go to Microsoft Defender for Cloud >](#)

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»

Data Factory

Validate all

Publish all



Auto Save



?



## Factory Resources

 Filter resources by name

### Pipelines

1

● pipeline1

▷ Change Data Capture (preview)

0

▷ Datasets

0

▷ Data flows

0

▷ Power Query

0

pipeline1



### Activities

 Search activities

#### Move and transform

Copy data

Data flow

&gt; Synapse

&gt; Azure Data Explorer

&gt; Azure Function

&gt; Batch Service

&gt; Databricks

&gt; Data Lake Analytics

&gt; General

&gt; HDInsight

&gt; Iteration &amp; conditionals

&gt; Machine Learning

&gt; Power Query

## New dataset

In pipeline activities and data flows, reference a dataset to specify the location and structure of your data within a data store. [Learn more](#)

Select a data store

BLOB

All

Azure

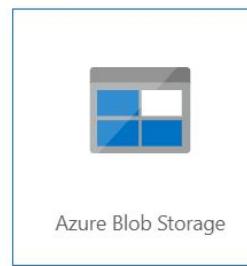
Database

File

Generic protocol

NoSQL

Services and apps



Azure Blob Storage

General

Source

Source dataset \*

 Select... New

Continue

Cancel

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Data Factory

Validate all

Publish all 1

Auto Save

## Factory Resources

Filter resources by name

pipeline1

### Pipelines

pipeline1

Change Data Capture (preview)

Activities

Search activities

#### Move and transform

Copy data

Data flow

Synapse

Azure Data Explorer

Azure Function

Batch Service

Databricks

Data Lake Analytics

General

HDInsight

Iteration &amp; conditionals

Machine Learning

Power Query

General

Source

Source dataset \*

Select...

New

## Select format

Choose the format type of your data



Avro



Binary



DelimitedText



Excel



JSON



ORC



Parquet



XML

Continue

Back

Cancel

Your insights matter! Participate in our [brief survey](#) about our CDC top-level resource, and help us enhance your experience.

Data Factory

Validate all

 Publish all 1

Auto Save

## Factory Resources

Filter resources by name

pipeline1

### Pipelines

pipeline1

Change Data Capture (preview)

### Activities

Search activities

#### Move and transform

Copy data

Data flow

Synapse

Azure Data Explorer

Azure Function

Batch Service

Databricks

Data Lake Analytics

General

HDInsight

Iteration &amp; conditionals

Machine Learning

Power Query

General

Source

Source dataset \*

Select...

+ New

## New linked service

 Azure Blob Storage [Learn more](#)

Name \*

source\_data

Description

Connect via integration runtime \* ⓘ

AutoResolveIntegrationRuntime

Authentication type

Account key

Connection string

Azure Key Vault

Account selection method ⓘ

 From Azure subscription  Enter manually

Azure subscription ⓘ

npunext-1680261221326 (a5e974c6-541a-4d4e-9be2-318d882552c0)

Storage account name \*

skribblecasesudy

Additional connection properties

+ New

Create

Cancel

Test connection





Your insights matter! Participate in our

Data Factory ▾ Val



## Factory Resources

Filter resources by name

### Pipelines

copy\_pipeline

Change Data Capture (previe

Datasets

Data flows

Power Query

## Preview data

Linked service: source\_data

Object: light\_duty\_vehicles.csv

#	Vehicle ID	Fuel ID	Fuel Configuration ID	Manufacturer ID	Category ID	Model	Model Year	Alternative Fuel Economy City	Alternative Fuel Economy Highway
1	13140	45	9	377	27	A3	2023		
2	13139	45	9	377	27	A3 quattro	2023		
3	13141	45	9	377	27	A4 quattro	2023		

> Power Query

Filter by last modified ⓘ  
Start time (UTC)

End time (UTC)

view experience  On

{ } ...

roperties

general Related

name \*

copy\_pipeline

cription

notations

New

Your insights matter! Participate in our [brief survey](#) about our CDC top-level resource, and help us enhance your experience.

Data Factory

Validate all

Publish all 3

Auto Save

## Factory Resources

Filter resources by name



### Pipelines

1

copy\_pipeline

Change Data Capture (preview)

0

### Datasets

2

altfuelstations

lightdutyvehicle

Data flows

0

Power Query

0

copy\_pipeline

lightdutyvehicle

## Activities



Move and transform

Copy data

Data flow

Synapse

Azure Data Explorer

Azure Function

Batch Service

Databricks

Data Lake Analytics

General

HDInsight

Iteration &amp; conditionals

Machine Learning

Power Query

## New dataset

In pipeline activities and data flows, reference a dataset to specify the location and structure of your data within a data store. [Learn more](#)

Select a data store

Search

All

Azure

Database

File

Generic protocol

NoSQL

Services and apps



Azure Blob Storage



Azure Cosmos DB for MongoDB



Azure Cosmos DB for NoSQL



Azure Data Explorer (Kusto)



Azure Data Lake Storage Gen1



Azure Data Lake Storage Gen2

Continue

Cancel

Your insights matter! Participate in our brief survey about our CDC top-level resource, and help us enhance your experience.

Data Factory

Validate all

Publish all 3

Auto Save

## Factory Resources

Filter resources by name

copy\_pipeline

lightdutyvehicle

### Pipelines

copy\_pipeline

Change Data Capture (preview)

### Datasets

altfuelstations

lightdutyvehicle

Data flows

Power Query

## Activities

Search activities

### Move and transform

Copy data

Data flow

&gt; Synapse

&gt; Azure Data Explorer

&gt; Azure Function

&gt; Batch Service

&gt; Databricks

&gt; Data Lake Analytics

&gt; General

&gt; HDInsight

&gt; Iteration &amp; conditionals

&gt; Machine Learning

&gt; Power Query

General

Source

Sink dataset \*

Select...

+ New

## Select format

Choose the format type of your data



Avro



Binary



DelimitedText



JSON



ORC



Parquet

Continue

Back

Cancel

Your insights matter! Participate in our [brief survey](#) about our CDC top-level resource, and help us enhance your experience.

Data Factory

Validate all

Publish all 3

Auto Save

## Factory Resources

Filter resources by name

copy\_pipeline

lightdutyvehicle

### Pipelines

Activities

Validate

copy\_pipeline

Move and transform

V

Change Data Capture (preview)

0

### Datasets

2

altfuelstations

lightdutyvehicle

Data flows

0

Power Query

0

Copy data

Data flow

&gt; Synapse

&gt; Azure Data Explorer

&gt; Azure Function

&gt; Batch Service

&gt; Databricks

&gt; Data Lake Analytics

&gt; General

&gt; HDInsight

&gt; Iteration &amp; conditionals

&gt; Machine Learning

&gt; Power Query

General Source

Sink dataset \*

Select...

+ New

## New linked service

Azure Data Lake Storage Gen2 [Learn more](#)

Name \*

adls

Description

Connect via integration runtime \* ⓘ

AutoResolveIntegrationRuntime

Authentication type

Account key

Account selection method ⓘ

 From Azure subscription  Enter manually

Azure subscription ⓘ

npunext-1680261221326 (a5e974c6-541a-4d4e-9be2-318d882552c0)

Storage account name \*

skribblecasestudy

Test connection ⓘ

 To linked service  To file path

Annotations

Create

Cancel

Test connection

Your insights matter! Participate in our [brief survey](#) about our CDC top-level resource, and help us enhance your experience.

Data Factory

Validate all

Publish all 5

Auto Save

Preview experience

On



## Factory Resources

Filter resources by name

copy\_pipeline

lightdutyvehicle



### Pipelines

copy\_pipeline

Change Data Capture (preview)

### Datasets

adlsaltfuelstations

adlslightdutyvehicle

altfuelstations

lightdutyvehicle

### Data flows

### Power Query

## Activities

Search activities

### Move and transform

Copy data

Data flow

### Synapse

Azure Data Explorer

Azure Function

Batch Service

Databricks

Data Lake Analytics

General

HDInsight

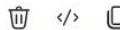
Iteration &amp; conditionals

Machine Learning

Power Query

## Copy data

Copy data1



### General

### Source

### Sink

### Mapping

### Settings

### ...

#### Sink dataset \*

adlslightdutyvehicle



Open



New

Learn more

#### Copy behavior ⓘ

Flatten hierarchy

#### Max concurrent connections ⓘ

## Properties

### General

### Related

Name \*

copy\_pipeline

### Description

### Annotations

+ New



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» Data Factory ▼ Validate all ↑ Publishing 5 Auto Save

## Factory Resources

Filter resources by name  +

▲ Pipelines 1

copy\_pipeline

▷ Change Data Capture (preview) 0

▲ Datasets 4

adlsaltfuelstations

adslightdutyvehicle

altfuelstations

lightdutyvehicle

▷ Data flows 0

▷ Power Query 0

copy\_pipeline

Activities

Search activities

Move and transform

Copy data

Data flow

Synapse

Azure Data Explorer

Azure Function

Batch Service

Databricks

Data Lake Analytics

General

HDInsight

Iteration & conditionals

Machine Learning

Power Query

lightdutyvehicle

Validate ✓

Debug ▷

Add trigger ⚡

Copy data

Copy  
alt fuel stations d...

Copy data

Copy  
light duty vehicle...

Publishing

Deploying changes to the factory



Parameters Variables Settings Output

+ New

Properties

General Related

Name \*

copy\_pipeline

Description

Annotations

+ New



Data Factory

Validate all

Publish all 1

Auto Save

Preview experience

On



## Factory Resources



1

Filter resources by name

copy\_pipeline

altfuelstations

lightdutyvehicle

## Pipelines

1

copy\_pipeline

Change Data Capture (preview)

0

## Datasets

4

adlsaltfuelstations

adlslightdutyvehicle

altfuelstations

lightdutyvehicle

Data flows

0

Power Query

0

copy\_pipeline

altfuelstations

lightdutyvehicle

✓ Validate ✓ Validate copy runtime ➡ Debug ⚡ Add trigger

General Source Sink Mapping Settings User properties

<input type="checkbox"/>	Engine Type	abc String	→	Engine Type	abc UTF8	<a href="#">+</a>
<input type="checkbox"/>	Engine Size	abc String	→	Engine Size	abc UTF8	<a href="#">+</a>
<input type="checkbox"/>	Engine Cylinder Count	abc String	→	Engine Cylinder Count	abc UTF8	<a href="#">+</a>
<input type="checkbox"/>	Engine/Motor(s) Desc...	abc String	→	Engine_Motor Descrip...	UTF8	<a href="#">+</a>
<input type="checkbox"/>	Manufacturer	abc String	→	Manufacturer	abc UTF8	<a href="#">+</a>
<input type="checkbox"/>	Manufacturer URL	abc String	→	Manufacturer URL	abc UTF8	<a href="#">+</a>
<input type="checkbox"/>	Category	abc String	→	Category	abc UTF8	<a href="#">+</a>
<input type="checkbox"/>	Fuel Code	abc String	→	Fuel Code	abc UTF8	<a href="#">+</a>
<input type="checkbox"/>	Fuel	abc String	→	Fuel	abc UTF8	<a href="#">+</a>
<input type="checkbox"/>	Fuel Configuration Na...	abc String	→	Fuel Configuration Na...	abc UTF8	<a href="#">+</a>
<input type="checkbox"/>	Electric-Only Range	abc String	→	Electric_Only Range	UTF8	<a href="#">+</a>
<input type="checkbox"/>	PHEV Total Range	abc String	→	PHEV Total Range	abc UTF8	<a href="#">+</a>
<input type="checkbox"/>	PHEV Type	abc String	→	PHEV Type	abc UTF8	<a href="#">+</a>
<input type="checkbox"/>	Notes	abc String	→	Notes	abc UTF8	<a href="#">+</a>
<input type="checkbox"/>	Drivetrain	abc String	→	Drivetrain	abc UTF8	<a href="#">+</a>

Your insights matter! Participate in our [brief survey](#) about our CDC top-level resource, and help us enhance your experience.

X

All pipeline runs > **copy\_data\_pipeline - Activity runs**

Rerun Cancel Refresh Update pipeline List Gantt

Copy data **Copy data1**

Copy data **Copy data2**

**Activity runs**

Pipeline run ID 75aa8481-a9d5-40fb-afe6-ce00f8ed13fd

All status ▾ Monitor in Azure Metrics ▾ Export to CSV ▾

Showing 1 - 2 items

Activity name ↑	Activity status ↑	Activity type ↑	Run start ↑	Duration ↑	Integration runtime	User properties:
Copy data1	✓ Succeeded	Copy data	10/6/2023, 10:28:18 AM	20s	AutoResolveIntegrati	
Copy data2	✓ Succeeded	Copy data	10/6/2023, 10:28:18 AM	25s	AutoResolveIntegrati	

# Data Ingestion and Transformation

SQL queries executed in Azure

DataBricks to find

- The state with the most number of alternate fuel stations
- The most used alternative fuel-based vehicle
- The economy based on Drivetrain, Category and Car manufacturer
- The Economy according to fuel type
- The number of stations selling biodiesel state wise

```
Cmd 21
1 # Creating a temporary table from the DataFrame
2 fuels_df.createOrReplaceTempView("Alternative_Fuels")
3
4 State_With_Most_Alternative_Fuel_Station = spark.sql("""
5     SELECT state, COUNT(*) as station_count
6     FROM Alternative_Fuels
7     GROUP BY state
8     ORDER BY station_count DESC
9     LIMIT 1
10    """)
11
12 State_With_Most_Alternative_Fuel_Station.show()

▶ (2) Spark Jobs
▶ [State_With_Most_Alternative_Fuel_Station: pyspark.sql.dataframe.DataFrame = [state: string, station_count: long]
+-----+
|state|station_count|
+---+---+
| CA | 18838 |
+---+---+


1 Most_Used_Alternative_Fuel_Based_Vehicle = spark.sql("""
2     SELECT fuel_type_code, COUNT(*) as station_count
3     FROM Alternative_Fuels
4     GROUP BY fuel_type_code
5     ORDER BY station_count DESC
6     LIMIT 1
7    """)
8
9 Most_Used_Alternative_Fuel_Based_Vehicle.show()

▶ (2) Spark Jobs
▶ [Most_Used_Alternative_Fuel_Based_Vehicle: pyspark.sql.dataframe.DataFrame = [fuel_type_code: string, station_count: long]
+-----+
|fuel_type_code|station_count|
+---+---+
| ELEC | 66043 |
+---+---+
```

```
fuels_df.write.mode("overwrite").saveAsTable("Alternative_Fuels")
light_vehicles_df.write.mode("overwrite").saveAsTable("LightDuty_vehicles")
```

```
%sql
select * from Alternative_Fuels;
```

```
# Creating a temporary table from the DataFrame
fuels_df.createOrReplaceTempView("Alternative_Fuels")
```

```
State_With_Most_Alternative_Fuel_Station = spark.sql("""
    ... SELECT state, COUNT(*) as station_count
    ... FROM Alternative_Fuels
    ... GROUP BY state
    ... ORDER BY station_count DESC
    ... LIMIT 1
""")
```

```
State_With_Most_Alternative_Fuel_Station.show()
```

state	station_count



```
1 # Creating a temporary table from the DataFrame
2 fuels_df.createOrReplaceTempView("Alternative_Fuels")
3
4 State_With_Most_Alternative_Fuel_Station = spark.sql("""
5     SELECT state, COUNT(*) as station_count
6     FROM Alternative_Fuels
7     GROUP BY state
8     ORDER BY station_count DESC
9     LIMIT 1
10""")
11
12 State_With_Most_Alternative_Fuel_Station.show()
```

## ▶ (2) Spark Jobs

▶ [ ] State\_With\_Most\_Alternative\_Fuel\_Station: pyspark.sql.dataframe.DataFrame = [state: string, station\_count: long]

```
+-----+
|state|station_count|
+-----+
|   CA|        18838|
+-----+
```

```
1 Most_Used_Alternative_Fuel_Based_Vehicle = spark.sql("""  
2     SELECT fuel_type_code, COUNT(*) as station_count  
3     FROM Alternative_Fuels  
4     GROUP BY fuel_type_code  
5     ORDER BY station_count DESC  
6     LIMIT 1  
7 """)  
8  
9 Most_Used_Alternative_Fuel_Based_Vehicle.show()
```

▶ (2) Spark Jobs

▶ 📄 Most\_Used\_Alternative\_Fuel\_Based\_Vehicle: pyspark.sql.dataframe.DataFrame = [fuel\_type\_code: string, station\_count: long]

```
+-----+-----+  
|fuel_type_code|station_count|  
+-----+-----+  
|          ELEC|        66043|  
+-----+-----+
```

```
1 economy_DCM = spark.sql("""  
2     SELECT drivetrain, category, manufacturer,  
3             AVG(alternative_fuel_economy_combined) as avg_alternative_fuel_economy  
4     FROM LightDuty_vehicles  
5     GROUP BY drivetrain, category, manufacturer  
6     ORDER BY avg_alternative_fuel_economy DESC  
7 """)  
8  
9 economy_DCM.show()
```

▶ (2) Spark Jobs

▶ 📈 economy\_DCM: pyspark.sql.dataframe.DataFrame = [drivetrain: string, category: string ... 2 more fields]

drivetrain	category	manufacturer	avg_alternative_fuel_economy
RWD	Sedan/Wagon	Tesla	137.0
RWD	Sedan/Wagon	Hyundai	135.0
AWD	Sedan/Wagon	Tesla	120.0
FWD	SUV	Hyundai	120.0
FWD	Sedan/Wagon	Chevrolet	117.5
RWD	Sedan/Wagon	Kia	117.0
FWD	Sedan/Wagon	Kia	113.0
AWD	Sedan/Wagon	Lucid	111.0
FWD	Sedan/Wagon	Mini	110.0
FWD	Sedan/Wagon	Nissan	107.0
RWD	SUV	Volkswagen	107.0

```
1 economy_Acc_Fuel_Type = spark.sql("""  
2     SELECT fuel_type_code,  
3             AVG(alternative_fuel_economy_highway) as avg_fuel_economy_highway,  
4             AVG(alternative_fuel_economy_city) as avg_fuel_economy_city  
5     FROM LightDuty_vehicles  
6     GROUP BY fuel_type_code  
7     ORDER BY fuel_type_code  
8 """)  
9  
10    economy_Acc_Fuel_Type.show()
```

► (2) Spark Jobs

► economy\_Acc\_Fuel\_Type: pyspark.sql.dataframe.DataFrame = [fuel\_type\_code: string, avg\_fuel\_economy\_highway: double ... 1 more field]

fuel_type_code	avg_fuel_economy_highway	avg_fuel_economy_city
NULL	160.80428134556576	121.25983146067416
BD	34.666666666666664	23.0
CNG	18.976691729323306	14.266165413533834
CNG_GSLN	NULL	NULL
E85_GSLN	17.500604594921402	12.587167070217918
ELEC	86.6152205823529	91.91611111111112
H2	60.25	64.25
HYBR	34.71232876712329	34.282758620689656
LPG	14.0	11.052631578947368
LPG_GSLN	NULL	NULL
M85_GSLN	19.0	14.0
PHEV	68.874	87.32275862068965

```
1 trend_of_buying_biodiesel = spark.sql("""select count(fuel_type_code) as num_of_stations_selling_biodiesel,  
2 state from Alternative_fuels where fuel_type_code="BD" group by state""")  
3 trend_of_buying_biodiesel.show()
```

## ▶ (2) Spark Jobs

▶ 📈 trend\_of\_buying\_biodiesel: pyspark.sql.dataframe.DataFrame = [num\_of\_stations\_selling\_biodiesel: long, state: string]

num_of_stations_selling_biodiesel	state
76	AZ
33	SC
274	MN
5	NJ
9	DC
30	OR
7	VA
1	RI
2	NH
8	MI
2	NV
46	CA
1	CT
14	NE
108	NC
2	VT
25	MD
2	HI

```
1   fuels_df.write.save("/mnt/input/parent/curated")
```

▶ (6) Spark Jobs

Command took 4.72 seconds -- by shellunext\_1693422718303@npunext.onmicrosoft.com at 06/10/2023, 10:25:20 on Shellunext's Personal Compute Cluster

Cmd 28

```
1   light_vehicles_df.write.save("/mnt/input/parent/curated")
```

■ AnalysisException: Cannot write to already existent path dbfs:/mnt/input/parent/curated without setting OVERWRITE = 'true'.

Command took 0.28 seconds -- by shellunext\_1693422718303@npunext.onmicrosoft.com at 06/10/2023, 10:25:29 on Shellunext's Personal Compute Cluster

Cmd 29

```
1   %fs ls /mnt/input/parent/curated
```

```
2
```

Table ▾ +

New result table: OFF ▾

	path	name
1	dbfs:/mnt/input/parent/curated/_delta_log/	_delta_log/
2	dbfs:/mnt/input/parent/curated/part-00000-981aa7ac-f29a-499d-abf7-83db48d735ab-c000.snappy.parquet	part-00000-981aa7ac-f29a-499d-abf7-
3	dbfs:/mnt/input/parent/curated/part-00001-a6a15c47-b4c7-476a-9df4-5bdcb240119b-c000.snappy.parquet	part-00001-a6a15c47-b4c7-476a-9df4
4	dbfs:/mnt/input/parent/curated/part-00002-05fd2ec1-7e23-4552-9456-bd20b6d473f0-c000.snappy.parquet	part-00002-05fd2ec1-7e23-4552-9456
5	dbfs:/mnt/input/parent/curated/part-00003-9fe17f38-cc1e-40d6-a311-a219624a9fc6-c000.snappy.parquet	part-00003-9fe17f38-cc1e-40d6-a311-

↓ 5 rows | 0.61 seconds runtime

Refreshed 28 minutes ago

# Data Visualization and Business Scope

The screenshot shows the Microsoft Power BI Desktop application window. The title bar reads "Untitled - Power BI Desktop" and the URL is "https://wai.nuvepro.com/guacamole/#/client/aS0wMTM0N2FiMWxEyMmI4NmE3MwBjAG51dmVs...". The ribbon menu is visible with the "Home" tab selected. The main canvas area displays the message "Build visuals with your data" and "Select or drag fields from the Fields pane onto the report canvas." A cursor is hovering over a small icon on the canvas. To the right, the "Visualizations" pane shows various chart and report icons, and the "Fields" pane lists fields like "Alternative\_Fuel\_Stations" and "Light\_Duty\_Vehicles". The bottom status bar shows "Page 1 of 1", "80%", "Update available (click to download)", the date "10/5/2023", and the time "9:05 PM". The taskbar at the bottom includes icons for File Explorer, Task View, Edge, and File Explorer.

Skribble - Power BI Desktop

File Home Insert Modeling View Help Format Data / Drill

Cut Copy Format painter Paste

Get data workbook hub Data Server Enter data Dataverse Recent sources

Transform Refresh data New visual Text box More visuals

New measure Quick Sensitivity Publish

Measure Sensitivity Share

Count of category by fuel

Fuel Type	Count of Category
Hybrid Electric	~950
Ethanol (E85)	~400
Electric	~400
CNG-Compressed Natural Gas	~100
Biodiesel (B20)	~100
Propane	~50
CNG-Bi-fuel	~20
Hydrogen Fuel Cell	~10
Propane-E85-fuel	~10
Methanol	~10

Sum of alternative\_fuel\_economy\_highway by fuel

Fuel Type	Percentage
Electric	53.66%
Ethanol (E85)	14.33%
Biodiesel (B20)	12.3%
Hydrogen Fuel Cell	~4%
Propane	~3%
Methanol	~2%
CNG-Compressed Natural Gas	~1%
CNG-Bi-fuel	~1%
Hybrid Electric	~1%
Propane-E85-fuel	~1%

Sum of conventional\_fuel\_economy\_city by manufacturer

Manufacturer	Percentage
Ford	12.3%
Toyota	11.2%
Chevrolet	~8%
GMC	~6%
Mercedes-Benz	~4%
Lexus	~3%
Nissan	~3%
Honda	~2%
BMW	~2%
Subaru	~1%
Audi	~1%
Porsche	~1%
Mazda	~1%
Volvo	~1%
Land Rover	~1%
Jeep	~1%
Lincoln	~1%
BMW	~1%
BMW	~1%

Visualizations Fields

Build visual

Filters

Search

Alternative\_Fuel\_Stat...  
Light\_Duty\_Vehicles

- alternative\_fuel...
- alternative\_fuel...
- alternative\_fuel...
- alternative\_fuel...
- category
- category\_id
- conventional\_f...
- conventional\_f...
- drivetrain
- engine\_type
- fuel
- fuel\_code
- fuel\_configurat...
- fuel\_configurat...

X-axis

Y-axis

Legend

Add data fields here

Page 1 of 2

LightDutyDashBoard1 AlternateFuelDashBoard2 +

10:40 AM 10/6/2023

Dashboard i-01 Home \*CS1\_Sht raw - Mi Alternati skribble Skribble Team ski notepad Lumen skribble +

https://wai.nuvepro.com/guacamole/#/client/aS0wMTM0N2FiMWExMmI4NmE3MwBjAG51... Search Sign in

### Scribble - Power BI Desktop

**Home** Insert Modeling View Help Format Data / Drill

Cut Copy Format painter Paste Get data workbook hub Data SQL Server Enter Dataverse Recent sources Transform Refresh data New visual Text box More visuals New measure Quick measure Sensitivity Publish

Clipboard Count of category by fuel

category	Count of category
Hybrid Electric	~950
Ethanol (E85)	~850
Electric	~750
Plug-in Hybrid Electric	~650
CNG Compressed Natural Gas	~550
Diesel (B20)	~450
Propane	~350
CNG-Gasoline	~250
Hydrogen Fuel Cell	~150
Propane-Diesel	~100
Methanol	~50

Sum of alternative\_fuel\_economy\_highway by fuel

fuel	Sum of alternative_fuel_economy_highway
Ethanol (B85)	55.69%
Propane	15.35%
Methanol	12.3%
Diesel (B20)	10.48%
Biodiesel (B20)	~2.08%
Hydrogen Fuel Cell	~3.4%
Electric	~3.4%
Hybrid Electric	~3.4%
CNG Compressed Natural Gas	~3.4%
Plug-in Hybrid Electric	~3.4%
Propane	~3.4%
CNG-Gasoline	~3.4%
Hydrogen Fuel Cell	~3.4%
Propane-Diesel	~3.4%
Methanol	~3.4%

Sum of conventional\_fuel\_economy\_highway by manufacturer

manufacturer	Sum of conventional_fuel_economy_highway
Ford	12.3%
Toyota	11.2%
Chevrolet	10.48%
GMC	10.48%
Mercedes-Benz	~3.4%
Lexus	~3.4%
Honda	~3.4%

Visualizations Fields

Build visual

Filters

Search

Alternative\_Fuel\_St...  
Light\_Duty\_Vehicles

- alternative\_fuel...
- alternative\_fuel...
- alternative\_fuel...
- alternative\_fuel...
- category
- category\_id
- conventional\_f...
- conventional\_f...
- drivetrain
- engine\_type
- fuel**
- fuel\_code
- fuel\_configurat...
- fuel\_configurat...

Legend

fuel

Values

Sum of alternative\_fu...

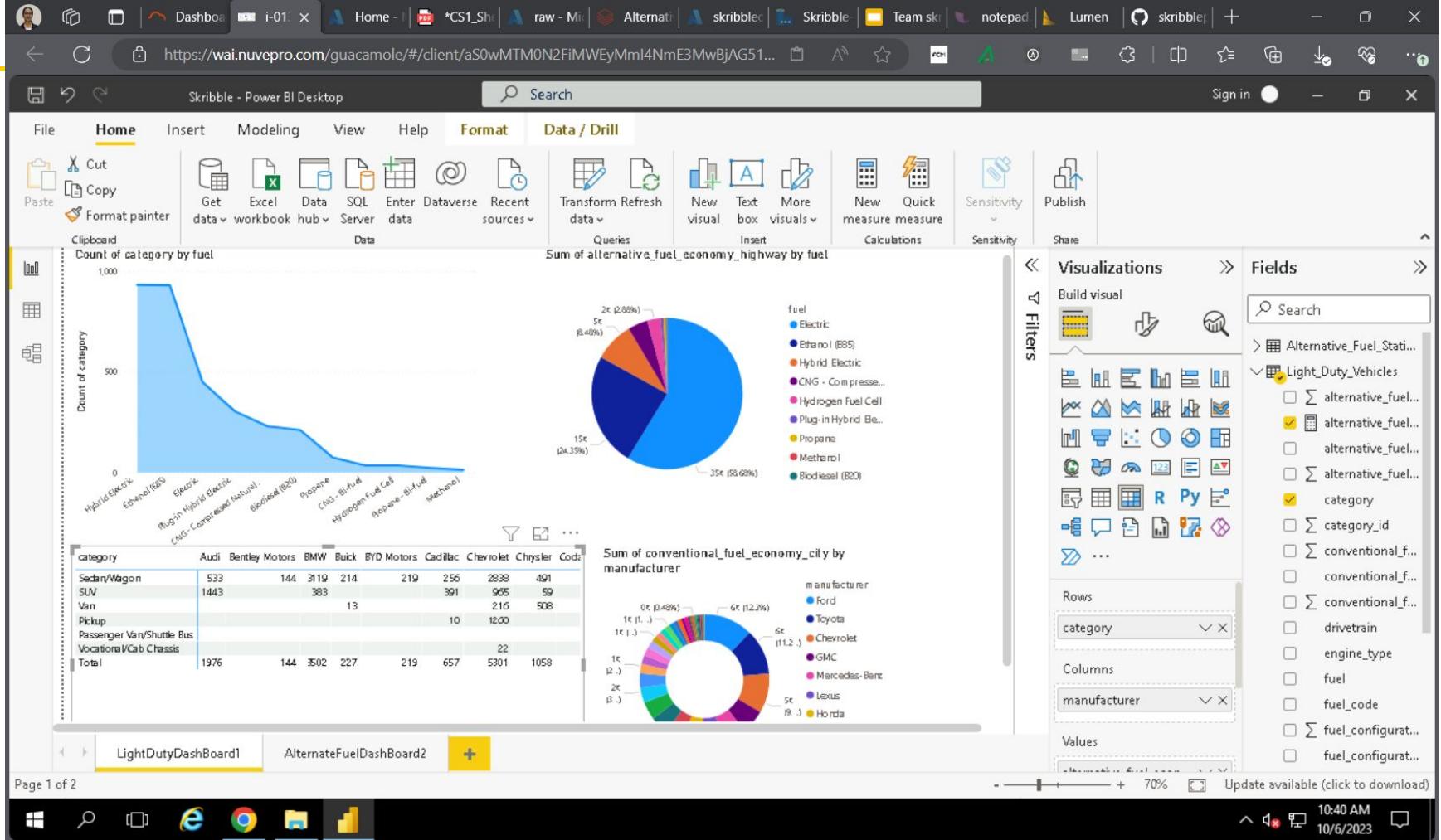
Details

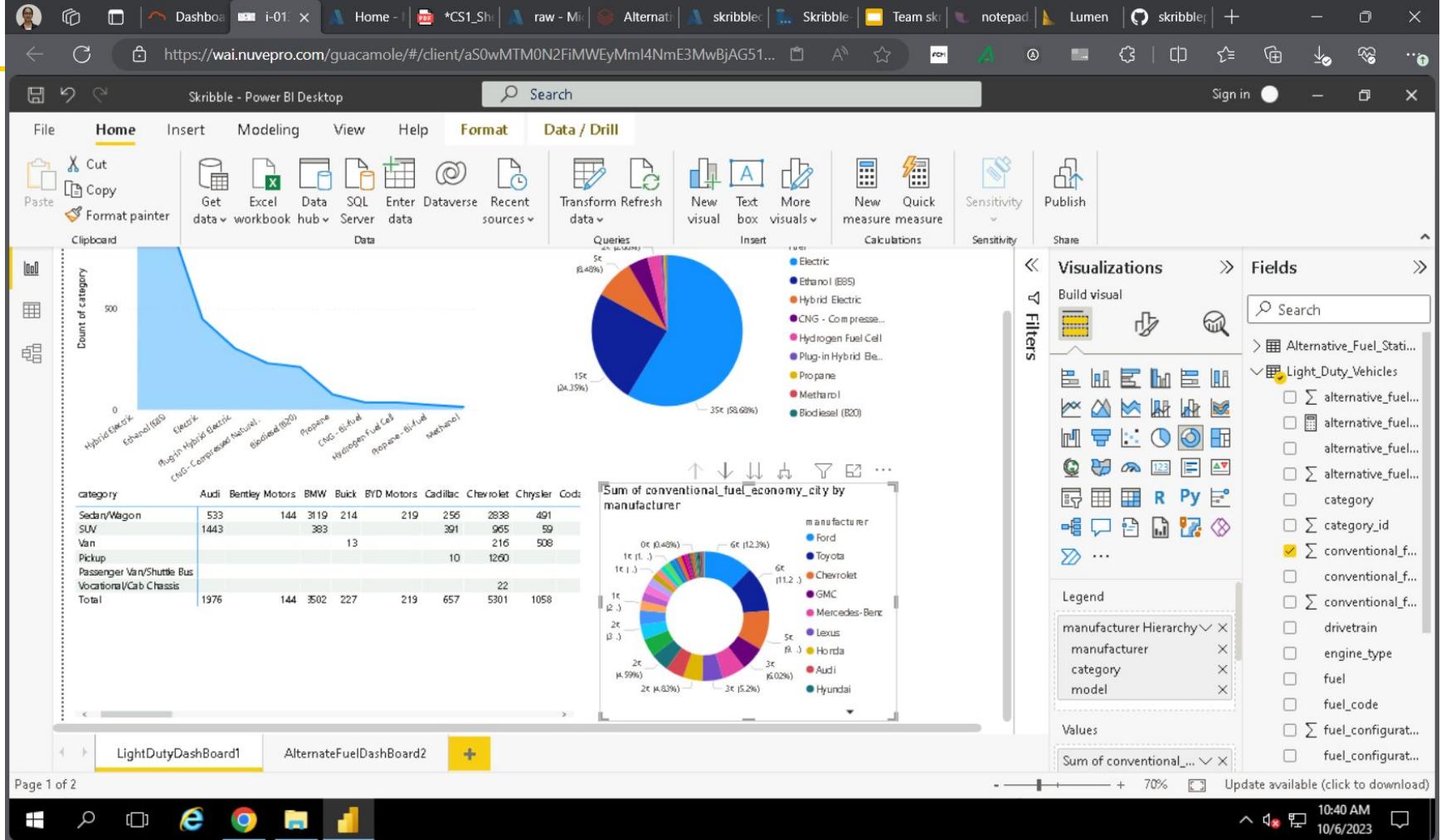
Add data fields here

Page 1 of 2 LightDutyDashBoard1 AlternateFuelDashBoard2 +

10:39 AM 10/6/2023

Windows Start Taskbar Icons





Untitled - Power BI Desktop

Search

File Home Insert Modeling View Help Format Data / Drill Table tools Measure tools

Name: alternative\_fuel\_ec...  
Home table: Light\_Duty\_Vehicles

\$% Format: Whole number  
Data category: Uncategorized

New measure Quick measure

Measure tools

Structure:

```
1 alternative_fuel_economy_city max per manufacturer =  
2 MAXX(  
3 | KEEPFILTERS(VALUES('Light_Duty_Vehicles'[manufacturer])),  
4 | CALCULATE(SUM('Light_Duty_Vehicles'[alternative_fuel_economy_city]))  
5 )
```

Formatting:

Properties:

Calculations:

Visualizations:

Build visual:

Fields:

Count of category

Sum of alternative\_fuel\_economy\_city and alternative\_fuel\_economy\_city max per manufacturer by category

Legend:

- category: Sedan/Wagon, SUV, Van, Pickup, Passenger Van/Shuttle/Van/Chassis, Vocational/Cab Chassis
- manufacturer: (various manufacturers listed)

Filters on this visual:

- alternative\_fuel\_economy... is (All)
- category is (All)
- manufacturer is (All)
- Sum of alternative\_fuel... is (All)

Add data fields here

Filters on this page:

Values:

- Sum of alternative\_fu...
- alternative\_fuel\_econ...

Dashboard:

- Dashboard1
- Dashboard2

Page 1 of 2

70%

Update available (click to download)

9:34 PM  
10/5/2023

21:35  
05/10/2023

Dashboard i-01 Home \*CS1\_Sht raw - Mic Alternat skribble Skribble Team skr notepad Lumen skribble

https://wai.nuvepro.com/guacamole/#/client/aS0wMTM0N2FiMWEyMml4NmE3MwBjAG51...

Skribble - Power BI Desktop

File Home Insert Modeling View Help Format Data / Drill

Cut Copy Format painter Paste Get data workbook hub Data Server Enter data Dataverse Recent sources Transform Refresh data New visual Text box More visuals Insert New measure Quick Sensitivity Publish Calculations Sensitivity Share

Filters Visualizations Fields

Search

Count of access\_code and Count of access\_code average perfuel\_type\_code by fuel\_type\_code

First state by city and fuel\_type\_code

fuel\_type\_code ● BD ● CNG ● IBS ● ELECT ● HY ● LNG ● LPG ● RD

Count of access\_code ● Count of access\_code average per fuel\_type\_code

Count of access\_code and Count of access\_code average perfuel\_type\_code by fuel\_type\_code

First state by city and fuel\_type\_code

fuel\_type\_code ● BD ● CNG ● IBS ● ELECT ● HY ● LNG ● LPG ● RD

Count of access\_code ● Count of access\_code average per fuel\_type\_code

Count of ev\_network and Count of state by Year

Count of ev\_network ● Count of state

state and ev\_network

ev\_network ● 7CHARGE ● AMPUP ● Blink Network ● CHARGE LAB ● ChargePoint...

LightDutyDashBoard1 AlternateFuelDashBoard2 +

Page 2 of 2

70% Update available (click to download)

10:41 AM 10/6/2023

Filters

Search

Filters on this visual

city is (All)

country is (All)

First state is (All)

fuel\_type\_code is (All)

state is (All)

Add data fields here

Visualizations

Build visual

Fields

Search

Alternative\_Fuel\_Stat...

access\_code

city

Count of acces...

country

> country Hierarc...

date\_last\_config...

Date Hierarc...

Year

Quarter

Month

Day

ev\_connector\_t...

ev\_network

ev\_network\_web

ev\_other\_info

fuel\_type\_code

Location

country Hierarchy

country

state

city

Legend

fuel\_type\_code

https://wai.nuvepro.com/guacamole/#/client/aS0wMTM0N2FiMWEyMml4NmE3MwBjAG51...

# Skribble - Power BI Desktop

Search

Sign in

## Home

Cut, Copy, Format painter, Paste, Clipboard

### Data

Get data, workbook hub, Data, SQL Server, Data source, Recent sources, Transform Refresh data, New visual, Text box, More visuals, Insert, Calculations, Sensitivity, Publish

### Queries

### Insert

### Format

### Data / Drill

#### First state by city and fuel\_type\_code

fuel\_type\_code: BD, CNG, EBS, ELEC, HY, LNG, LPG, RD

#### Count of access\_code and Count of access\_code average per fuel\_type\_code by fuel\_type\_code

Count of access\_code: 607, Count of access\_code average per fuel\_type\_code: 607.00

#### Count of ev\_network and Count of state by Year

Count of ev\_network: 7CHARGE, AMPUP, Blink Network, CHARGE LAB, ChargePoint,...

#### state and ev\_network

ev\_network: 7CHARGE, AMPUP, Blink Network, CHARGE LAB, ChargePoint,...

Page 2 of 2

LightDutyDashboard1, AlternateFuelDashboard2

Filters

Build visual

Visualizations

Fields

Search

Alternative\_Fuel\_Stat...

- access\_code
- city
- Count of acces...
- country

> country Hierarc...

- Date last config...
- Date Hierarc...
- Year
- Quarter
- Month
- Day

ev\_connector\_t...

- ev\_network
- ev\_network\_web
- ev\_other\_info

fuel\_type\_code

X-axis: fuel\_type\_code

Y-axis: Count of access\_code

Legend: RD, ELEC, EBS, LNG, LPG, CNG, BD, HY

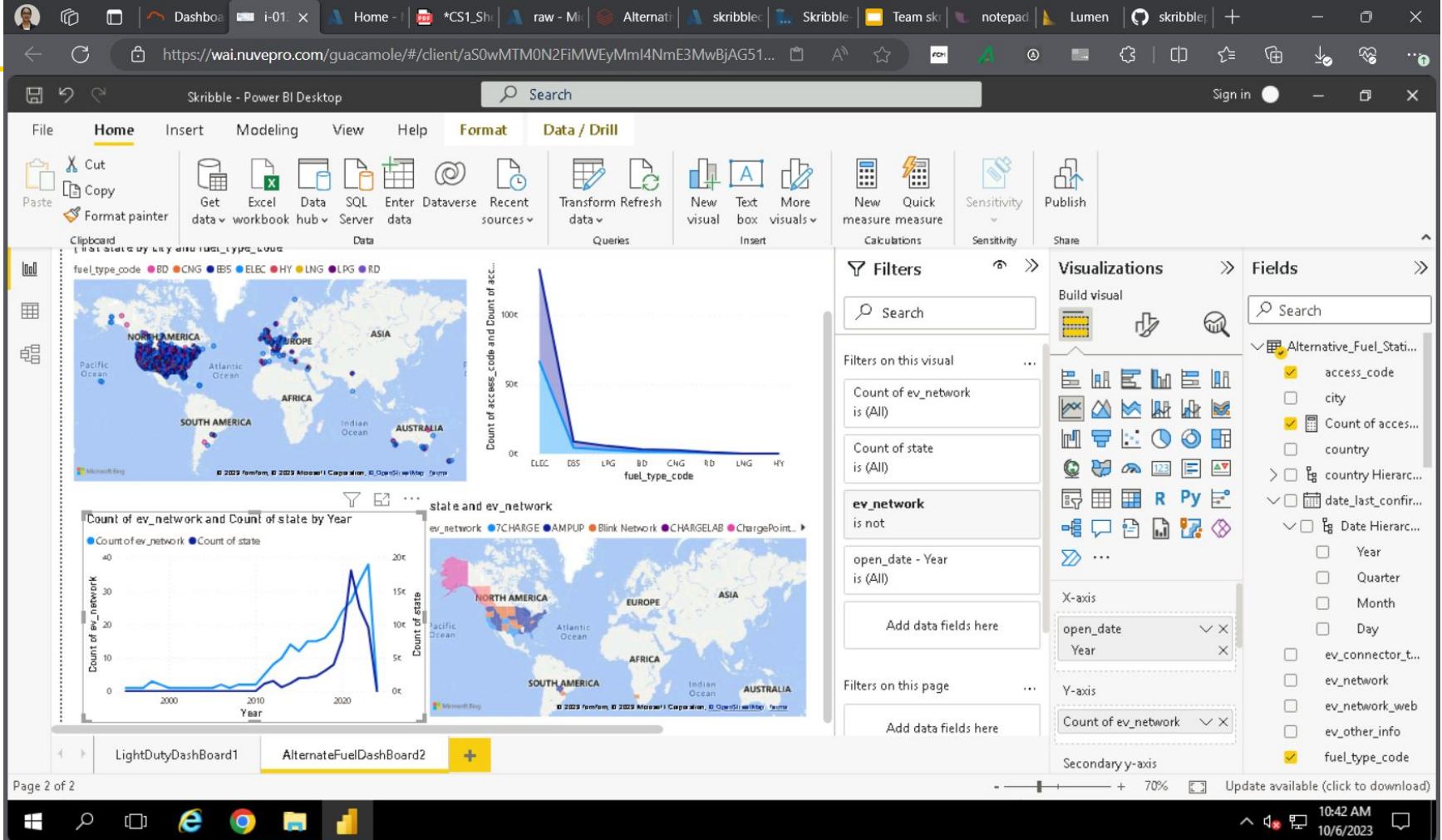
70% 10:41 AM 10/6/2023

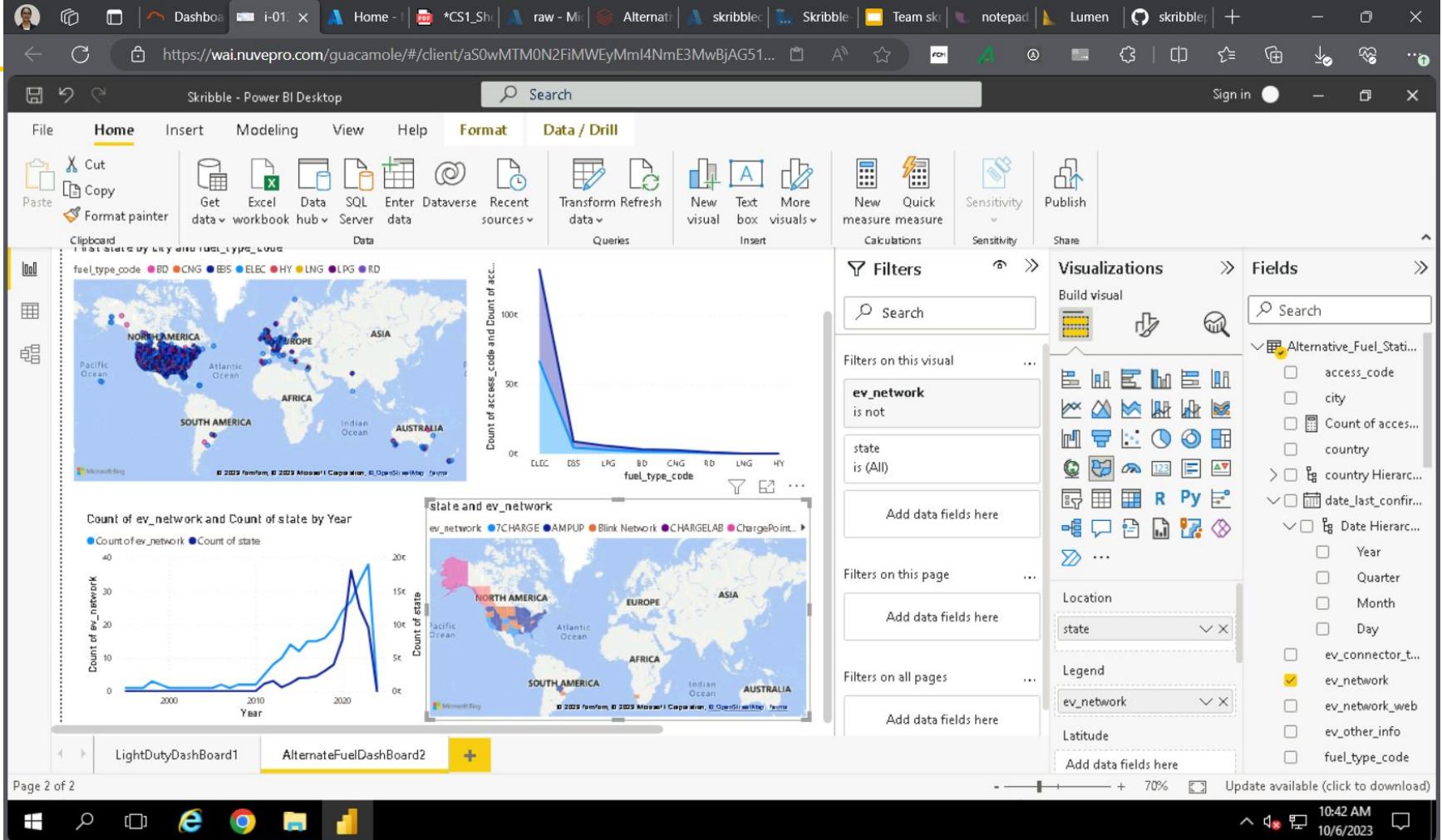
Update available (click to download)

10:41 AM 10/6/2023

10:41 06/10/2023

21





Skribble - Power BI Desktop

File Home Insert Modeling View Help Format Data / Drill Table tools Measure tools

Name: Count of access\_code... Format: General Data category: Uncategorized

Home table: Alternative\_Fuel\_St... \$ % Auto

New measure Quick measure

Structure:

```

1 Count of access_code average per fuel_type_code =
2 AVERAGEX(
3   FILTER(VALUES('Alternative_Fuel_Stations'[fuel_type_code])),
4   CALCULATE(COUNTA('Alternative_Fuel_Stations'[access_code]))
    
```

Formatting Properties Calculations

Visualizations Fields

Build visual

Search:

Count of access\_code is (All)

Count of access\_code a... is (All)

fuel\_type\_code is (All)

Add data fields here

Y-axis

Count of access\_code

Count of access\_code...

Legend

Add data fields here

Filters on this visual

Count of access\_code is (All)

Count of access\_code a... is (All)

fuel\_type\_code is (All)

Add data fields here

Filters on this page

Add data fields here

Filters on all names

Add data fields here

Month Day ev\_connector\_t... ev\_network ev\_network\_web ev\_other\_info fuel\_type\_code id latitude longitude open\_date Date Hierarc... Year Quarter Month Day state

Count of ev\_network and Count of state by Year

Count of ev\_network Count of state

state and ev\_network

Page 2 of 2

9:52 AM 10/6/2023

