



Electric Vehicle Widescale Analysis for Tomorrow's Transportation Solutions

Bryan Roy, Principal Investigator
Energetics, a division of Akimeka, LLC

June 24, 2021

Project ID: ti119



AKIMEKA



Overview

Timeline

Start: October 1, 2019

End: December 31, 2022

~33% Complete

Budget

Total funding	\$3,999,371
DOE share	\$3,999,371
Cost share	\$0
Budget Period 1	\$1,448,567
<i>Expended</i>	\$679,262
Budget Period 2	\$1,518,278
<i>Anticipated</i>	\$1,856,102

Barriers Addressed

- There is no current national database of plugin electric vehicle (PEV) and electric vehicle supply equipment (EVSE) performance.
- PEV and EVSE data includes personal identifiable information (PII) and other sensitive information that must not be disclosed, but PEV and EVSE characteristics are valuable to conduct analysis.

Partners

- **Clean Fuels Ohio**
- Clean Cities (CC) Georgia
- Columbia-Willamette CC
- Dallas-Fort Worth CC
- Denver Metro CC
- Empire CC
- Kansas City Regional CC
- Middle-West Tennessee Clean Fuels
- Palmetto Clean Fuels
- Virginia CC
- **ChargePoint**
- **Sawatch Labs**

Any proposed future work is subject to change based on funding levels



Project Objectives

- Collect, validate, and collate real-world use data and datasets from PEVs and EVSE to inform future research and deployment planning.
 - *Analyze and summarize in Budget Periods (BP) 2 and 3*
- The datasets will encompass approximately 1,600 PEVs and 10,000 charging ports representing heterogeneity vehicle sizes, types, settings, and operating conditions.
 - *35% of target quantity by BP1, 90% by BP2, and 100% by BP3*
- Project data, with all PII removed, will be provided to Department of Energy (DOE) Federally Funded Research and Development Center (FFRDC or “Labs”) for analysis.
 - *Project data will be publicly released in BP3, removing all PII and sensitive information*

VTO Tech Integration Goals

- **National security:** Supports expanded PEV use
- **Economic growth:** Documents real-world performance
- **Affordability for business and consumers:** Provides real-world data on utilization and opportunities to improve
- **Reliability/resiliency:** Shows PEV use in many applications

Impact

- Secured commitments from partners to share data
- Developed PII-free data characterizations
- Transferred initial datasets to DOE Labs

Any proposed future work is subject to change based on funding levels



Project Approach

PARTNER ENGAGEMENT

Sub-recipient/vendors	Clean Fuels Ohio: managing other Clean Cities and securing data partners Sawatch Labs: facilitating PEV telematics installations and data collection ChargePoint: providing supplemental EVSE data
Clean Cities Partners	Secure data partners, assist with data transfer, collect supplemental information
Project Advisory Committee	Providing input on data sources, analysis approach, and result formats

PROGRAM DEVELOPMENT

Data sources	Clean Cities Partners and others identify PEV and EVSE deployments
Data protocols	Develop and document data collection and data protection protocols
Data sharing agreements	Template specifying data protocols along with participant roles and responsibilities
Project Verification Plan	Defined goals for data heterogeneity and key performance indicators

COLLECT EVSE DATA

Historic data	Transfer of past data from data partners starting from 10/1/2019 if available
Current data	Ongoing quarterly transfer of data
Surveys	Supplemental information to validate or augment data

Any proposed future work is subject to change based on funding levels



Project Approach - Continued

COLLECT PEV DATA	
Historic data	Transfer of past data (10/1/2019 to present) from data partners if available
Telematics	Coordinate the installation of telematics devices for PEV fleets and individuals
Current data	Ongoing quarterly transfer of data
Surveys	Supplemental information to validate or augment data
DATA MANAGEMENT	
Data storage environment	Process and approach to collect, store, and process data
PII Anonymization	Establish data characteristics from PII, then remove
Extract, Transform, Load	Ongoing processing of data from combined raw dataset to distributable dataset
DATA ANALYSIS AND REPORTING	
Approach	Parameters, summary statistics, and visualizations used in summaries and reports
Reporting	High-level results and trends
Dissemination	Website, interactive dashboard, published reports

Any proposed future work is subject to change based on funding levels



Milestones

#	BP1 MILESTONE	TYPE	DESCRIPTION
1	PII anonymization process ✓	Technical	Validated PII anonymization process
2	Data verification plan ✓	Technical	Completed final data verification plan
3	Data analysis approach ✓	Technical	Validated data analysis approach
4	Data sharing agreements ✓	Technical	Executed data sharing agreements covering a range of PEVs and EVSE
5	Transfer data ✓	Go/No-Go	First non-PII PEV and EVSE data set transferred to DOE Labs

#	BP2 MILESTONE	TYPE	DESCRIPTION
10A	Transfer data	Technical	Second data set transferred to DOE national labs
10B	Transfer data	Technical	Third data set transferred to DOE national labs
6	Historical EVSE usage data	Technical	Collected all historical EVSE data from partners
7	Historical PEV usage data	Technical	Collected all historical PEV data from partners
8	Telematics devices	Technical	All project telematics devices installed
10C	Transfer data	Technical	Fourth data set transferred to DOE national labs
9	Summary Clean Cities report	Technical	Developed activity summary report of Clean Cities partners
10D	Transfer data	Go/No-Go	Fifth data set transferred to DOE national labs

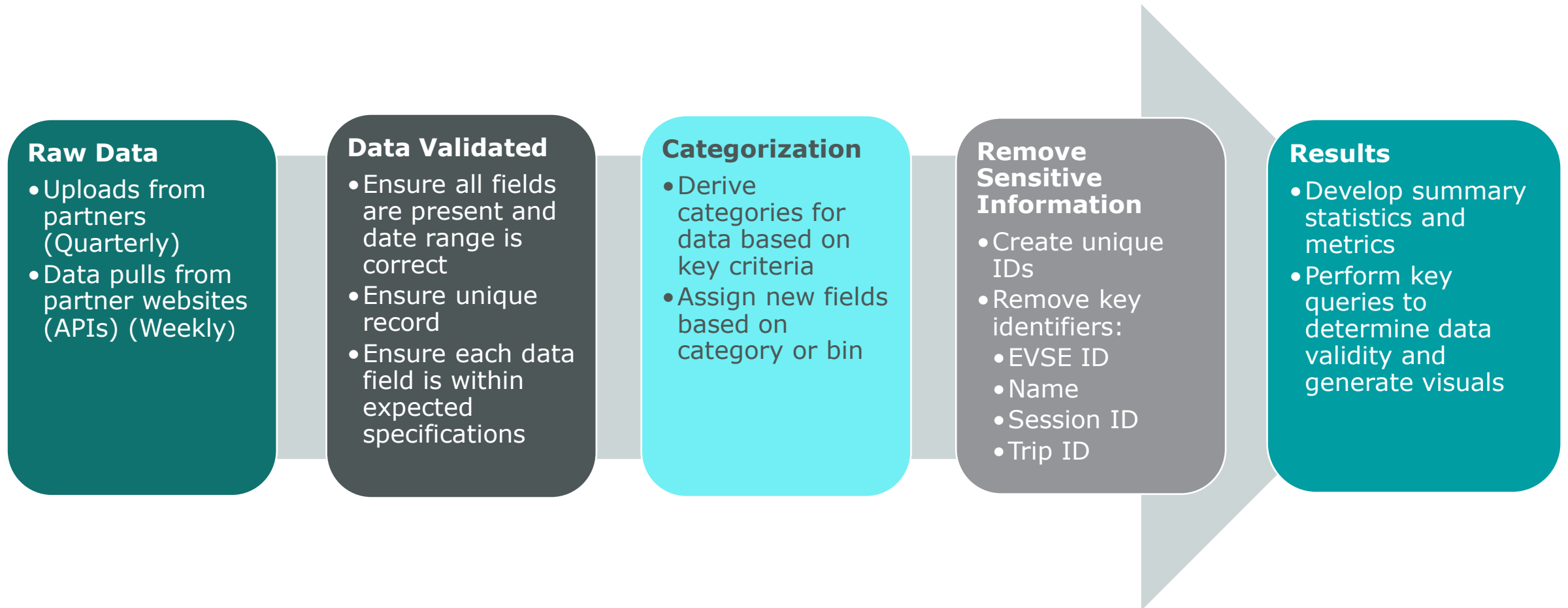
#	BP3 MILESTONE	TYPE	DESCRIPTION
13A	Transfer data	Technical	Sixth data set transferred to DOE national labs
13B	Transfer data	Technical	Seventh data set transferred to DOE national labs
11	Summary of PAC feedback	Technical	Completed summary of PAC feedback on project analysis summaries and reports
13C	Transfer data	Technical	Eighth data set transferred to DOE national labs
12	Fleet and driver survey results	Technical	Completed results summary from fleet and driver surveys
13D	Transfer data	Technical	Ninth data set transferred to DOE national labs
14	Final report published	Technical	Final report published
15	Results dissemination	Technical	Results dissemination completed

Any proposed future work is subject to change based on funding levels



Project Accomplishments and Progress

Data is transformed in several stages to produce the resulting aggregated and anonymized database





Project Accomplishments and Progress

Anonymization is achieved by **limiting resolution** (e.g., truncating zip codes), using **differential values** rather than absolute data (e.g., distance traveled rather than start and end locations), and through **categorization**.

	Characterization	Options
All	Land Use	Urban, Suburban, Rural
	U.S. Region	New England, Middle Atlantic, East North Central, West North Central, South Atlantic, East South Central, West South Central, Mountain, Pacific
EVSE	Access	Private, Limited (Restricted by permit, employees, etc.), Public
	Ownership	Federal Government Owned, Jointly Owned, Local/Municipal Government Owned, Privately Owned State/Provincial Government Owned, Utility Owned
	Payment	Free, For Fee
	Station Type	L2, DCFC
	L2 Venue	Business Office, Multi-use Parking Garage/Lot, Leisure Destination, Retail/Restaurant, Multi-Unit Dwelling, Municipal Building, Medical or Educational Campus, Transit Facility, Hotel, Fleet, Residential
	DCFC Venue	Corridor, Community
Vehicle	User Type	Personal, Public Fleet, Private Fleet
	Ownership	Owned, Leased
	EV Type	PHEV, BEV
	Vehicle Size	Light-Duty, Medium-Duty, Heavy-Duty
	Vehicle Class	1-8
	Operation	Primary, Secondary, Daily use / commuter, As needed / recreational, Car sharing, Ride Hailing, Off-road
	Vehicle Type	Sedan, Minivan, SUV, Pick-up, Truck, Bus, Shuttle Bus, Yard Tractor



Project Accomplishments and Progress

Securing data sharing agreements was challenging due to COVID as PEV fleet and EVSE operators had more pressing activities and individual driver gatherings were restricted.

Region	EXECUTED			LEADS		
	Agreements	EVSE Ports	PEVs	Agreements	EVSE Ports	PEVs
Nationwide	1	6,879	0	2	250	75
New England	3	20	27	2	25	15
Middle Atlantic	4	1,322	23	6	100	800
East North Central	0	0	0	17	850	350
West North Central	2	6	11	9	2,000	10
South Atlantic	2	6	31	32	1,600	575
East South Central	0	0	0	5	175	75
West South Central	4	97	31	17	900	375
Mountain	8	474	69	20	25	475
Pacific	1	300	0	7	1,500	250
Total	25	9,104	192	117	7,375	2,975



Project Accomplishments and Progress

EVSE data quantity is above interim target and meeting several diversity thresholds.

Key Performance Indicator	BP1 Target	BP2 Target	Project Target	As of Q4 2020	Notes
EVSE port data	3,500	9,000	10,000	7,758	Port count
EVSE type thresholds	6 of 8	7 of 8	8 of 8	5 of 8	
• AC Level 2	20%			74%	
• DC Fast Charging	20%			26%	
○ Corridors	5%			~13%	Working on an algorithm to connect to AFDC station list which includes this; anticipate this is >50% of DCFC.
○ Workplace	5%			35%	
○ Multi-unit dwellings	5%			7%	
○ Curbside	5%			TBD	This is not a segregated deployment type by EVSP so will take more investigation to determine
○ Fleets	5%			3%	
○ Transit/Ports/Airports	5%			1%	



Project Accomplishments and Progress

PEV data quantity is below desired interim target, but despite COVID challenges is expected to get back on track in BP2.

Key Performance Indicator	BP1 Target	BP2 Target	Project Target	As of Q4 2020	Notes
PEV data	560	1,440	1,600	76	Significantly impacted by COVID-19
PEV type thresholds	6 of 8	7 of 8	8 of 8	3 of 8	
• Plug-in hybrid	33%			12%	Have not specifically targeted this vehicle type and perhaps less important given the trajectory of the industry
• Battery electric	33%			88%	
○ Personal Use	25%			4%	Delayed roll-out to personal vehicle owners due to COVID-19 concerns
○ Fleet Use	25%			96%	
○ Shared Use	5%			0%	Challenging demographic, have identified a potential fleet
○ Light-duty	25%			100%	
○ Medium-duty	5%			0%	Have some possible fleets, but impacted by Calstart project
○ Heavy-duty	5%			0%	Have some possible fleets, but impacted by Calstart project



Collaboration & Coordination

Project Sponsor
US DOE

Prime Recipient
Akimeka, LLC

FOA Awardee
Calstart

Vendor
Sawatch Labs

Sub-Recipient
Clean Fuels Ohio

Vendor
ChargePoint

Clean Cities Partners

- Columbia-Willamette (OR/WA)
- Dallas-Fort Worth (TX)
- Denver Metro (CO)
- Empire (NY)
- Georgia
- Kansas City Regional (MO/KA)
- Middle-West Tennessee
- Palmetto Clean Fuels (SC)
- Virginia

DOE Lab Partners

- Argonne National Laboratory
- Idaho National Laboratory
- National Renewable Energy Laboratory

Project Advisors

- California Energy Commission
- California Public Utility Commission
- Duquesne Light
- Exelon
- Geotab
- Maryland Energy Administration
- National Associations of State Energy Offices
- National Rural Electric Cooperative Association
- Nissan
- New York State Energy Research and Development Authority
- Proterra
- University of California, Davis

Minimum Interactions

- Monthly DOE updates
- Monthly DOE Lab calls
- Biweekly Team call/email
- Monthly Clean Cities Call
- Quarterly Advisor calls



Overall Impact

Achievements to date

- Secured participation of advisors and held three meetings
- Established website and conducted project outreach to prospective data partners
- Secured 25 data partner agreements and collected data from 7,758 EVSE and 76 PEVs
- Provided initial PEV and EVSE datasets to the Labs

Upcoming

- Additional data partners and data to reach project targets (BP2)
- Online interactive dashboard of summary results (BP2&3)
- Project-level and data partner summary reports (BP2&3)
- Quarterly transfer of updated PEV and EVSE datasets to the Labs (BP2&3)
- In-depth data analysis reports (BP3)
- Public dataset (BP3)

Any proposed future work is subject to change based on funding levels



Transportation

Driving Electrification Through the Power of Data

We currently work with Clean Cities Coalitions, fleets, state/local governments, vehicle manufacturers, utilities, and charging station providers to develop a national data resource on end-user driving and vehicle charging patterns, vehicle performance, and infrastructure. We collect and analyze data to inform planning for:

- All-electric and plug-in hybrid electric vehicles (PHEVs)
- Diverse geographies and climates
- Fast-charging infrastructure (AC level 2 and DC)
- Varied vehicle types (cars, trucks, buses, etc.)
- All types of EV supply sites (curbside, corridors, workplaces, multi-unit dwellings, fleets, transit hubs, ports, airports, etc.)

Project Information

EV WATTS is addressing a growing need for practical information about vehicle electrification. The EV WATTS project team is collecting real-world use data from plug-in electric vehicles (PEVs) and charging stations (also known as EVSE – electric vehicle supply equipment). Researchers then validate, analyze, and summarize the data, which can be used to inform future research, development, and deployment.

If you operate several PEVs or charging stations anywhere in the United States, consider being a project data provider. Read more about this opportunity below and contact us.



Purpose

The U.S. transportation system is moving toward electrification, with PEV adoption on the rise. This trend has created a need for up-to-date national data on this technology. EV WATTS datasets and analysis will be used to improve the understanding of PEV use and performance, specifically charging and driving patterns as well as vehicle and infrastructure performance. This knowledge informs decision making for multiple stakeholders: manufacturers, consumers, charging station hosts, and researchers.

Data

The data collection effort is comprehensive, covering:

- All-electric and plug-in hybrid electric vehicles telematics data
- A variety of vehicle applications: cars, trucks, buses, etc.
- Multiple geographic areas and climates
- AC Level 2 and DC fast charging infrastructure
- Various EVSE sites: corridors, workplace, multi-unit dwellings, curbside, fleets, transit, ports, airports, etc.

Results will be posted to this website in the form of quarterly summary reports throughout 2021 and 2022. At project completion, Energetics will create an anonymized dataset for public use.

Resources

FAQs



Summary

Objective

- Collect, validate, collate, analyze, and summarize real-world use data from 1,600 PEVs and 10,000 EVSE to support research at the DOE Labs and other institutions.

Approach

- Secure data partners, import raw data, remove PII through characterizations, transfer dataset quarterly to DOE Labs, share summary results through an online interactive dashboard, create summary project and data partner reports, and post the fully anonymized dataset at the end of the project.

Collaborations

- Clean Fuels Ohio, nine other Clean Cities Coalitions, Sawatch Labs, ChargePoint, three DOE Labs, 12 advisors, and 25 data partners (at the end of 2020).

Achievements

- Data management and analysis processes established, growing list of secured data partners, and successfully transferred initial dataset to the DOE Labs.

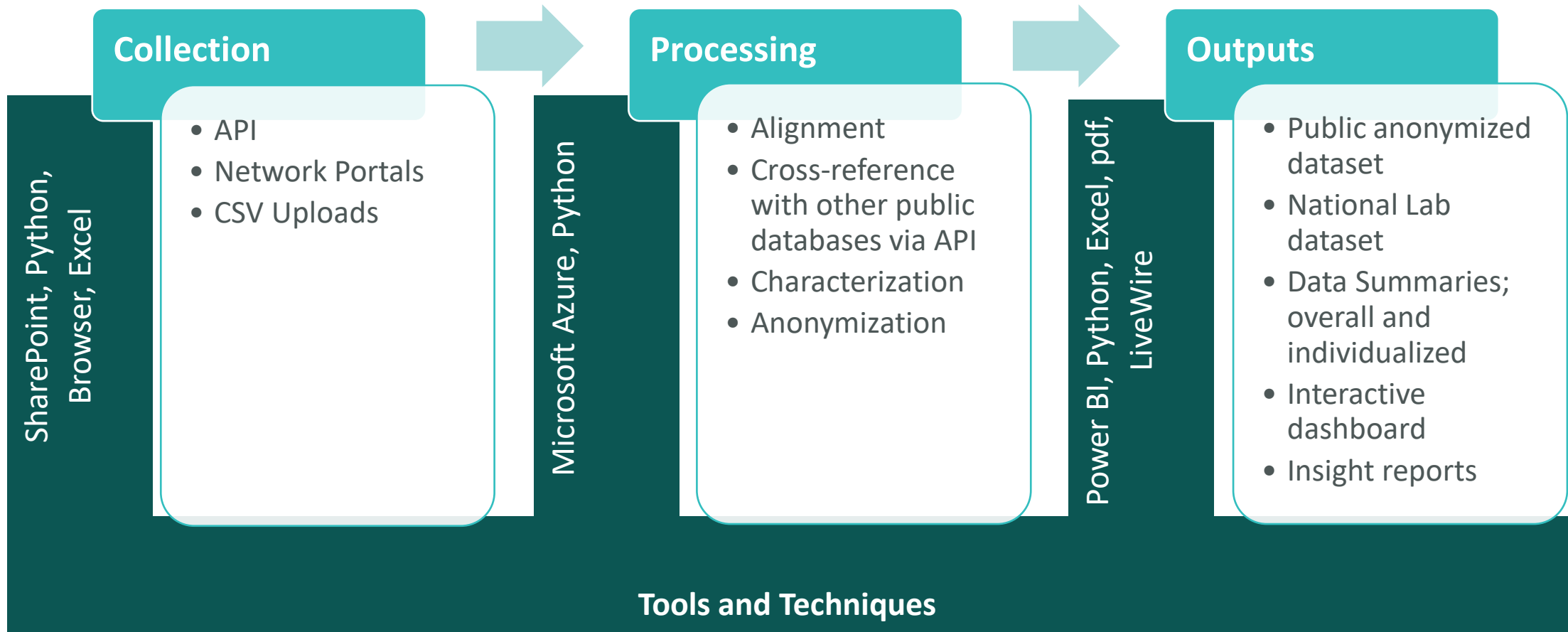


Technical Back-up Slides



Project Accomplishments and Progress

The EV WATTS database is stored as a SQL database on the Azure platform





Project Video



<https://youtu.be/LAx52gRXJDA>